# Contents

## EEXERCISE MEDICINE AND EUROPEAN UNION

**Dr. Vincenzo Costigliola**
President,
European Medical Association
Bruxelles, Belgium
*Email: Vincenzo@emanet.org*

- Smoking, alcohol abuse, unhealthy diet activity Cancer Cardiovascular diseases, obesity, chronic respiratory diseases, diabetes, mental health, a relatively small group of health conditions is responsible for a large part of the disease burden in Europe.

- The European Region is the most affected by non-communicable diseases (NCDs), and their growth cause 86% of deaths and 77% of the disease burden in the WHO European Region

- These disorders are largely preventable and are linked by common risk factors A more equitable share of the benefits from effective interventions would bring significant health and economic gain to all Member States.

- The exercise and physical activity, evaluated in many scientific studies, is important for prevention and treatment of the many chronic diseases.

**Recommendations**

- Include physical exercise in treatment plans.
- Include exercise in primary and secondary prevention of diseases.
- Include physical exercise in teaching goals and plans for medical students.
- Create broad awareness that exercise is indeed medicine.
- Makes “level of physical activity” a standard vital sign question in each patient visit.
- Helps physicians and other health care providers to become consistently effective in counseling and referring patients as to their physical activity needs
- Lead to policy changes in public and private sectors that support physical activity counseling and referrals in clinical settings.
- Produce an expectation among the public and patients that their health care providers should and will ask about and prescribe exercise.
- Encourages physicians and other health care providers to be physically active themselves to act as an example.

**BREASTFEEDING AND NON-COMMUNICABLE DISEASES (NCDS) PREVENTION**

**Dr. Wang Shu-Fang**
PhD, RN, CNM, IBCLC, CBD;
President
Chinese Lactation Consultant Association
*Email: taiwanbbking@gmail.com*

*"Among both men and women, most deaths globally are due to non-communicable conditions"--The global burden of disease, 2016 update, WHO.*

## 1. The trends and facts of NCDs

The fact is out of every 10 deaths, 6 are due to non-communicable conditions, 3 to

Communicable, reproductive or nutritional conditions and 1 is due to injuries.

- What are the main NCDs? – WHO. Prevention of non-communicable diseases: a global perspective. There are heart disease and stroke; diabetes; cancer; chronic respiratory disease.
- Risk factors of NCDs: They include tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol. Therefore, NCDs are so called lifestyle diseases, and

"Lifestyle diseases" are caused by "behaviors."

- NCD deaths as a proportion of all deaths -WHO Global Health Estimates 2015.
- The death rate of NCDs was the highest of all diseases.
- The proportion of people who die prematurely from NCDs is highest in poorest countries.
- NCDs are not a "rich country" problem.
- NCDs are a global political priority
- NCDs are included in the 2030 Agenda for Sustainable Development


## 2. Global NCD Action Plan 2013-2020

❖ **WHO provided the guidance to practice the Global NCD Action Plan 2013-2020.**

Vision: A world free of the avoidable burden of NCDs

Goal: To reduce the preventable and avoidable burden of morbidity, mortality and disability due to NCDs by means of multi-sectoral collaboration and cooperation at national, regional and global levels. (For more details link to http://www.who.int/nmh/events/ncd_action_plan/en/)

❖ **Best buys for Diet and physical activity include:** Reduce salt intake; Replace trans fats with polyunsaturated fats; Implement public awareness programmes on diet and physical activity; Promote and protect breastfeeding.

## 3. Breastfeeding and NCDs

❖ World Breastfeeding Week (**1-7 AUGUST**): 2018-BREASTFEEDING: Foundation of Life. In a world filled with inequality, crises and poverty, breastfeeding is the foundation of lifelong good health for babies and mothers.

❖ **What are the health advantages of breastfeeding?**

The simple act of breastfeeding has numerous health advantages to both mothers and their babies: in terms of NCD prevention. The WHO recommends early initiation of breastfeeding (within the first hour of birth) and exclusive breastfeeding (no water, other fluids or foods) for 6 months, followed by continued breastfeeding for 2 years or more with appropriate addition of complementary foods.

❖ **Breastfeeding Impacts for the breastfed baby/child**

a) Short-Term Health Benefits: Fewer ear & respiratory infections; Fewer gastrointestinal disorders; Lower risk of Sudden Infant Death Syndrome
b) Long-Term Health Benefits: Improved growth and development; Higher IQ; Lower risk of childhood cancer (leukemia with longer duration); Improved cardiovascular disease through life; Lower risk of Type 1 and Type 2 diabetes; Lower risk of obesity(Decreased prevalence of overweight/obesity – 10% reduction); and Lower adults' blood pressure, serum cholesterol, and type-2 diabetes.

❖ **Health benefits for breastfeeding mothers:**

a) Short-Term Benefits: Faster recovery from pregnancy and childbirth; Faster loss of pregnancy weight (especially for exclusively breastfed for 6 months); Greater sleep at night!

b) Long-Term Benefits: Lower risk of breast cancer(especially for premeno-pausal breast cancers); Lower risk of ovarian cancer; Lower risk of Type 2 diabetes (This could be due to improving glucose hormones); Lower blood pressure; Lower risk of cardiovascular disease past menopause.

❖ **Breastfeeding and Obesity**

a) NCDs…Obese: It is estimated that breastfeeding reduces 10% of the risk of overweight and obesity as compared to formula feeding. Acta Paediatr. 2015; 104(467):3-13. [1]

b) Reviews & Meta-analysis on Breastfeeding and Obesity:

- There are 61 studies included in the meta-analysis; Odds ratio = 0.87, 95% CI (0.85-0.89) for reduced risk of later obesity associated with breastfeeding compared to formula feeding. Owen et al., Pediatrics, 2005; 115(5):1367-77. [2]
- There are 9 studies that met the inclusion criteria, Odds Ratio = 0.78, 95%CI (0.71, 0.85) on the protective effect of breastfeeding for obesity, and the dose response effect was found. Arenz et al., Int J Obes Relat Metab Disord, 2004; 28(10):1247-56. [3]

c) Support for the Evidence on Breastfeeding and Obesity: Harder et al., Am J Epidemiol. 2005; 162(5):397-403. [4] There are 17 studies included.

- Secular trends: Trend for increased breastfeeding is opposite that for obesity
- Dose Response: Some studies find this effects, others do not
- Plausible mechanisms: Changes in leptin production and sensitivity; Lower energy and protein intake in breastfed infants; Insulin response to feeding; higher in formula fed infants; Differences in the feeding relationship; self-regulation of energy intake; Changing composition of human milk during feedings.

d) Contradictory Study on Breastfeeding and Obesity:

Martin R et al., JAMA Pediatr 2017; 171(7):e170698 [5] The results give no comfort to promoters of breastfeeding because there was no reduction in BMI or obesity rates in the intervention group, either in the earlier years or at 16 years old.

e) WHO Commission on Ending Childhood Obesity

Overweight children are also likely to become obese adults. Overweight and Obesity are risk factors for cardiovascular disease, diabetes and some cancers in later life.-WHO, 2017

**4. Global Strategy on Diet, Physical Activity and Health**

Regular physical activity is proven to help prevent and treat NCDs. It also helps prevent hypertension, overweight and obesity and can improve mental health, quality of life and well-being. Yet, much of the world is becoming less active. WHO has developed a new global action plan to help countries scale up policy actions to promote physical activity. A key feature of this new plan is its call for a ''systems-based'' approach where effective implementation will require bold leadership combined with cross-government and multisector partnerships at all levels to achieve a coordinated, whole-of-system response.

Retrieved from http://www.who.int/ncds/prevention/physical-activity/gappa

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# EXERCISE AND AVIATION MEDICINE

**Amei Farina Abdul Rashid**,
Institute of Aviation Medicine, RMAF KL
*Email: amei.farina@ipptudm.com*

**Mohammad Razin Kamarulzaman**,
Malaysia Airlines Berhad
*Email: mohammadrazin.kamarulzaman@malaysiaairlines.com*

Aviation Medicine is a medical specialty which combines aspects of preventive, occupational, environmental and clinical medicine with the physiology and psychology of man in flight. It is concerned with the health and safety of those who fly, both crews and passengers, as well as the selection and performance of those who hold aviation licenses (ICAO, 2018).

In essence, Aviation Medicine practitioners look into the healthcare of the aviation industry workforce from the fighter pilot to the baggage handler on the ramp and in the case of commercial airlines, to a certain extend the well-being of the passengers. From the aircrew's perspective, they have to be fit and healthy and not be under the influence of any substances that may cause sudden incapacitation. To ensure that the aircrew health is meeting the standards, aircrew are subjected to rigorous medical examinations on entry and periodically until they reach the current retirement age of 65 years old.

Exercise plays a big role in the fitness of the workforce. For the commercial and military aircrew, it keeps them fit and healthy to face the challenges of long duty days, mental and physical workload, circadian rhythm disruption as well as fatigue. In addition, the military fighter aircrew needs to be fit and healthy to counter the effects of the g-force while flying the aerobatic manoeuvres. They are thought to have good body physique and are aided by human centrifuge training to ensure they are enabling to counter and sustain against the g-force. The air crew are also trained in the altitude chamber to indoctrinate them on the effects of the gas laws on the body physiology – mainly Boyle's law effects of gas expansion on closed cavities and Dalton's law of effects of hypoxia.

The aviation system also relies on the ground crew to ensure the smooth running of the operations. The engineering and maintenance crew works are subjected to heavy lifting, working in awkward posture and are subjected to fatigue. The ramp agents or baggage

handlers carry between 2-3 tons of bags and cargo per flight and manual lifting is highly used. They ramp personnel need to be well toned to ensure musculo-skeletal injuries can be minimized.

In summary, the aviation industry workforce, be it military or commercial need to be fit and healthy to ensure their well-being and to prevent injuries in one of the safest industry in the world.

# GLOBAL NCD TARGET- REDUCE PHYSICAL INACTIVITY

**Dr Temo K Waqanivalu**
MBBS (Fiji) MPH (Israel) DipFLM (Aus) FFPH (UK)
Program Officer, Surveillance and Population Based Prevention Unit, Prevention of NCD Department, WHO HQ, Geneva
*Email: waqanivalut@who.int*

## Background

Heart disease and stroke, cancers, diabetes, and chronic respiratory diseases and other noncommunicable diseases (NCDs) cause tens of millions of deaths per year, the majority of which occur during the most productive years of life. NCDs reduce economic output and prevent people around the world from living lives of health and wellbeing. Creating the conditions that favour sustainable development means taking action to prevent and control NCDs now.

Nine global NCD targets provide a vision for progress by 2025. The WHO Global NCD Action Plan 2013-2020 and other resources provide a roadmap of policies and interventions to realise this vision. When implemented, they will put countries on track to meet the commitments made on NCDs at the United Nations General Assembly in 2011 and 2014, and in the 2030 Agenda for Sustainable Development, including target 3.4 to reduce premature NCD deaths.

## Global Target

A 10% relative reduction in the prevalence of insufficient physical activity by 2025.

## Fast Facts

- One in four adults and more than 80% of the adolescent population around the world are not physically active enough.
- Insufficient physical activity is one of the 10 leading risk factors for global deaths, causing 3.2 million deaths each year.
- Urbanization, fear of violence, high-density traffic, and pollution can discourage people from becoming more physically active.
- Adults should engage in at least 150 minutes of physical activity per week.
- Children and adolescents aged 5-17 need at least 60 minutes of physical activity every day to improve and maintain physical and mental health.

**Priority Actions**

Meeting this target is possible. Shifts in physical activity patterns, including changes in transportation methods and modes of work, have led to an increase in physical inactivity levels globally. The WHO Global Strategy on Diet, Physical Activity and Health and the WHO Global NCD Action Plan 2013-2020 provide guidance for attaining the physical inactivity target. Partnerships between government and civil society will be key to supporting policy implementation. Focusing on the following policy measures will help achieve this target:

- Adopt and implement national guidelines on physical activity for health.
- Conduct evidence-informed campaigns through mass and social media, at the national and community level, to inform and motivate adults and young people about the benefits of physical activity and other healthy behaviours.
- Develop policy measures in cooperation with relevant sectors to promote physical activity through activities of daily living, including through "active transport," recreation, leisure and sport.
- Promote community involvement in local actions aimed at increasing physical activity.
- Create surveillance systems that evaluate actions aimed at increasing physical activity, so as to contribute to an evidence base of effective and cost-effective actions.

# SAFETY AND EXERCISE

**Prof. István Berkes MD.**
University of Physical Education
Budapest, Hungary
*Email: berkesdr@gmail.com*

The key to successfully fighting against the non-communicable diseases is to increase the safety of various exercise programs. As the evidence-based results of physical activity have been increasingly wider accepted more and more people are pursuing an active lifestyle. However, due to adverse events that occur during physical activity, many people are afraid of exercise. Therefore, one of the most important tasks for all health care providers is to ensure the safety of exercise programs.

After studying current scientific literature it can be stated that „the benefits of physical activity far outweigh the negative consequences associated with physical activity" (3.). However, exercising has some common adverse events as well, and it is important to be aware of potential side effects to avoid and prevent any negative results.

The physical activity-related adverse events include musculoskeletal injuries, cardiac hearth diseases, heat injuries, infectious diseases and others. This lecture focuses on the prevention of musculosceletal injuries and cardiac hearth diseases.

Musculoskeletal injuries are the most common type of physical-activity associated adverse events that may be acute or overuse injuries. Distinguishing these two types of injuries is absolutely important due to their different prevention, management and prognosis.

Unfortunately, activity-related musculoskeletal injuries cannot be eliminated completely, but most of them can be prevented.

The factors that increase susceptibility to these adverse events are diverse, and include intrinsic and extrinsic risk factors. **Figures 1 & 2.**


**Figure 1**


**Figure 2**

The elimination of intrinsic risk factors supports the prevention of overuse injuries, and the elimination of the external risk factors helps prevent acute injuries.

Sudden adverse cardiac events may result in severe outcomes (e.g., sudden death, myocardial infarction). „During periods of vigorous physical activity all individuals, even regularly active individuals, are at higher risk of sudden adverse cardiac events (e.g., sudden

death, myocardial infarction) than during periods when they are less active. However, active people are at less risk than inactive people both during activity and during inactivity. When the risks during activity and at rest are averaged over the whole day, active people have a lower risk"(2.).

The preventive management of sudden adverse cardiac events includes risk assessment, pre-exercise screening, and well-designed exercise programs. Risk assessment is a useful tool for the estimation of total cardiovascular risk.

Current recommendations for physical activity suggests that „asymptomatic men and women who plan sensible increases in light to moderate physical activity do not need to consult a health care provider before doing so" (1.). There is no evidence based data that the incidence of activity-related cardiovascular adverse events could be reduced by a medical consultation. Preexercise-screening with a medical professional and diagnostic exercise testing for cardiovascular diseases are useful when clinically indicated but are not recommended for universal screening to enhance the safety of exercise" (1., 2., 3.,).

There is, however, full agreement with the safety of small increases in light to moderate activity, and it is recommended that "previously inactive" men aged 40 years and older, women age 50 years and older, and people who have chronic disease or risk factors for chronic disease should consult a physician before starting a vigorous activity program (1.).

It is the responsibility of the health care provider to recommend a comfortable level of effort, initially, and increasing the frequency and duration of activities only after allowing adequate time for adaptation to each new level of activity to minimize the risk of activity-related adverse effects.

Health care providers should assess the physical activity level in any subject (how many days and minutes per day are spent on average doing physical activity at moderate or vigorous intensity). They should warn against inactivity and help incorporate physical activity to daily life. Subjects should be advised on appropriate types of activities and ways of progressing and should be helped in setting personal goals to achieve and maintain the benefits (1., 2.).

Educating people about symptoms and prevention of musculoskeletal injuries and cardiovascular diseases and gradual progression of exercise intensity and volume may reduce the risks of physical-activity associated adverse events.

Nutrition significantly influences the risk of musculoskeletal injuries, cardiovascular and other chronic diseases. Following the rules for a healthy diet is absolute necessary during physical activity. Still a number of gaps exist concerning safety and exercise. To answer them is one of the most important duty of our Society.

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# EXERCISE AS A FORM OF ACTIVE REHABILITATION

**SuFen Yew, PKT, BCN,**
President MPA, President ACPT, Vice President MyCAHP, Vice Chair AWP-WCPT,
Physiotherapist, Certified Manual Lymphatic Therapist
*Email: suyew58@yahoo.com*

There exist confusion trying to differentiate between physical activities and exercise. According to American College of Lifestyle Medicine physical activity is define as any bodily movement produced by skeletal muscles that result in an expenditure of energy. Exercise is the subset of physical activity and is activity that is planned or structured which involves repetitive bodily movement done to improve or maintain one or more of the components of physical fitness.

Active Rehabilitation is the process where a specialized movement program is designed to help improve and regain full function following injury, disease or disorder. It involves restoring flexibility, mobility, stability, balance, strength, endurance and power achieved through a structured program of exercise and training prescribed for the patient done by the patient

Exercise is a complex molecular, cellular and systemic physiological stimulus. With every single session of exercise, skeletal muscles, heart, lungs, brain, vascular tissue, bone, liver and other systems will experience some form of "stress". This eustress can leave lasting effects; the magnitude of the effect depends largely on the intensity and duration of exercise done.

Prescribing exercises for rehabilitation involves several short long -term goals like reducing and relieving pain, maintain or improve flexibility, mobility, strength, re-establish neuromuscular control and maintain or increase levels of cardiovascular, respiratory fitness.

Universally exercise is prescribed for various rehabilitations as treatment, prevention or promotion of health and wellness. Prescribing exercise should not be a cookbook approach and using it as recipes is strongly discouraged because every individual client is special and different.

"Exercise as medicine - evidence for prescribing exercise as therapy in 26 different chronic diseases" is a review of up to date evidence-based basis for prescribing exercise as medicine in the treatment of 26 different diseases ranging from psychiatric diseases, neurological disorders , NCDS to cancer. What more evidence is needed!

Active Rehabilitation is the cornerstone for complications as a result of immobilization, unloading, injury, inactivity, chronic health conditions, disorders and aging. Lower limb large muscles lose approximately 8.4% of its mass and 22.9 % of its strength after 14 days of immobilization. Even healthy retirement-age people with 10 days of bed rest lost approximately 2.2 pounds of weight from their lower extremities compared to less than 1.1 pounds of weight loss in young adults after 28 days of bed rest. Loss of skeletal muscle mass is greatest in Type I fibers, in response to the above complications. There is no pharmaceutical option available so exercises remain effective stimuli to combat inactivity-induced muscle losses. Exercises include active exercises and strength training such as weights, resistance and repetitions.

Motor nerves too become less efficient in recruiting and stimulating individual fibers within a given motor unit post injury, prolonged bed rest or immobilization. Neuromuscular efficiency is the ability of the neuromuscular system to properly recruit agonists, synergists, stabilizers, neutralizers and antagonists to act concentrically, eccentrically and isometrically in the entire kinetic chain in all three planes of motion. Flexibility training exercises – mobility, agility and stretching exercises enhances optimum neuromuscular efficiency and function.

Disuse and without stress induce ligaments weakness and bone loss. High frequency, short duration endurance exercises positively enhance collagen hypertrophy. Multi-component exercises of strength and resistance exercises, aerobic, high impact and weight-bearing training and exercise against gravity have been shown to reverse disuse osteoporosis. Whole-body vibration (WBV) in combination with exercise is evidenced to increase bone mass.

Joints and proprioception are equally not spared. Loss of joints normal compression leads to decreased lubrication, cartilage deprived of nutrition, subsequently causing degeneration. Continuous movement and joint exercise stimulates synovial production and weight bearing exercises help to retard loss of articular cartilage. Without intact proprioception the muscles, tendons and ligaments are constantly second-guessing the position of the joint sand limb around the injured area. Balance exercises, strength exercises and plyometric teaches the body to control, enhance joint sense for better control and prevent of recurrent injuries. In a nut shell, exercise is a powerful catalyst to improve and maintain bone and muscle mass, ligaments, blood vessels, tendons and nerves and joints in musculoskeletal rehabilitation.

Exercise has been acknowledged as the mainstay in rehabilitation of cardio-respiratory disease and disorders. Resting heart rate increases approximately 1/2 beat per minute each day of complete bed rest. Stroke volume, maximum oxygen uptake and vital capacity decrease concurrently. Chronic cardio-respiratory disorders presents with impairments and secondary morbidities, such as weakness, deconditioning, dysfunction of peripheral and respiratory muscles. Exercise-training modality most suitable are walking, upper extremity exercise, respiratory muscles strengthening exercises, aquatic exercise and active chest manual therapy. Respiratory Muscle Training (RMT) consists of a series of specific exercises, to increase strength and endurance of the respiratory muscles and therefore improve respiration.

Exercise is greatly recommended in cardiac rehabilitation program as exercises have a protective mechanism for the heart and vascular system. It is evidenced to slow down cardiopulmonary atherosclerosis as shear stress on artery walls during exercise results in improved endothelial functions besides enhanced release of nitric oxide. It decreases serum triglycerides, increase high density lipoprotein cholesterol. Exercise promotes decrease in blood pressure and has anti-inflammatory effect associated with increased risk of CHD. Endurance exercise reduced myocardial ischemia in advance CHD by decreasing RPP and myocardial O2 demand. Improvement in insulin sensitivity and glucose homeostasis also indirectly address NCDs. A new study published in the American Journal of Transplantation; high-intensity exercise help stable heart transplant patients reach higher levels of exercise capacity, and gain better control of their blood pressure than moderate intensity exercise.

Exercise is food for the brain; has been proven to facilitate neuroplasticity of certain brain structures. Exercise in neuro rehab is capable of **neurogenesis**, especially in the hippocampus and cerebral ventricles, and **exercise stimulates this growth**. Exercise increases *the* brain's 'baseline activity' which stimulates cellular growth. *It sets into motion an interactive cascade of growth factor that has the net effect of stimulating plasticity, enhancing cognitive function and stimulating neurogenesis according to* Wilcox, 2009.

*Will we reach a point where <u>NOT</u> prescribing physical activity should be considered patient neglect?*

# EXERCISE AND ENDOCRINOLOGY

**Dr. Gunavathy Muthusamy**
Internal Medicine Specialist & Endocrinologist,
Hospital Shah Alam,
Malaysia
*Email: haravin20@gmail.com*

Physical activity exerts an important influence on the endocrine system, modulating synthesis and secretion of several hormones. Almost every organ and system in the body a affected by physical activity and exercise, mainly through the endocrine and the neuroendocrine systems.

As the body transitions from a resting to an active state, the rate of metabolism must increase to provide the necessary energy. This requires the coordinated integration of many physiological and biochemical systems. Such integration is possible only if all of the involved tissues, organs, and systems can efficiently communicate. Although the nervous system is responsible for much of this communication, fine-tuning the physiological responses to any disturbance in homeostasis is primarily the responsibility of the endocrine system.

The endocrine system is defined as all tissues or glands that secrete hormones, and once these hormones are secreted into the blood, they act as signals throughout the body. Hormones are involved in most physiological processes, so their actions are relevant to many aspects of exercise and sport.

Hormones are categorized as two basic types steroid and non-steroid hormones. The steroid types are cortisol, aldosterone testosterone, estrogen and progesterone. The non-steroid hormones are thyroxine and triiodothyronine, epinephrine, nor-epinephrine, insulin, glucagon and pituitary hormones.

Effects of exercise on hormonal secretions are varied. It affects the metabolic rate, the blood sugar, blood flow and exerts psychological effects. Exercise, particularly heavy weightlifting, stimulates the release of luteinizing hormone from the anterior pituitary gland, and luteinizing hormone triggers testosterone production. Exercise that involves intense bursts of energy also stimulates the release of thyroxine from the thyroid gland. Exercise can help control or reduce weight because testosterone and thyroxine speed up metabolism.

Insulin is a hormone that regulates glucose/ blood sugar, by transporting it to muscles and tissues that use glucose for energy. Excessive insulin in the blood reduces the sensitivity to insulin and glucose stays in the blood when insulin sensitivity goes down, and this leads to diabetes. Exercise might increase insulin sensitivity by reducing blood concentrations of insulin. Blood insulin levels begin decreasing after 10 minutes of aerobic exercise, and weight training might increase sensitivity to insulin at rest and theses reduces the reliance on insulin injections for type 2 diabetics.

The adrenal medulla releases epinephrine during exercise and increases epinephrine levels at higher exercise intensities. Epinephrine increases the amount of blood pumped by the heart. Epinephrine also enhances the ability to use muscles during exercise by dilating the blood vessels, which lets the muscles get more oxygen-rich blood. Thyroxine secretions during exercise increase the amount of blood in the body by about 30 percent, and these secretions might remain elevated for around five hours

The effects of exercise on the endocrine system might positively affect the mental state. Exercise-induced testosterone might increase confidence and libido. Conversely, low testosterone levels might inhibit motivation, self-confidence, concentration and memory.

During exercise, the pituitary gland releases human growth hormone, which stimulates the body to increase bone, muscle and tissue production.

When one starts exercising, the thyroid gland sends out hormones that regulate the body's temperature, heart rate and blood pressure. It also regulates the alertness and focus that are needed to work at a high intensity. The adrenal gland secretes cortisol and aldosterone, and both these hormones regulate blood pressure, glucose, acts as an anti-inflammatory agent, regulates hydration levels, the speed of the heart and the strength of contractions. It also turns stored carbohydrates into energy.

One of the important aspects of exercise that we cannot ignore is its role in obesity, pre diabetes and management of other metabolic conditions.

Obesity is a complex mal-relationship between energy intake and expenditure that results in a homeostasis that is resistant to change. Obesity clearly has negative health implications that are well documented in consensus literature. Likewise, correction of body weight reduces the incidence and severity of comorbid diseases. A key aspect to this end is a significant amount of physical activity that is appropriately supervised and quantified.

Many physicians never broach this subject with their patients because of time limitations or comfort-level constraints. This is unfortunate because a physician's recommendations and proper guidance at the point of care are important predictors of patient participation in exercise.

# MOOD STATES AND HORMONAL RESPONSES TO MODERATE AND HIGH EXERCISE INTENSITIES AMONG INACTIVE MALE STUDENTS: THE FUNCTIONS OF EXERCISE HABIT STRENGTH

**Dr. Hairul Anuar Hashim**
Exercise and Sport Science Programme,
School of Health Sciences,
Universiti Sains Malaysia,
16150 Kubang Kerian, Kelantan,
Malaysia.
*Email: hairulkb@usm.my*

## INTRODUCTION

The association between physical activity (PA), exercise, and health outcomes is well-established. Exercise is widely regarded as an effective tool to maintain optimum physical health. Participation in regular physical activity and exercise in an appropriate intensity, frequency, duration and modes of exercise provide numerous benefits to individuals (Garber et al., 2011). For instance, it contributes to lower blood pressure, improved lipoprotein profiles, decreased heart rate, enhanced insulin sensitivity, increase exercise threshold and play important roles in weight management (Penedo & Dahn, 2005). In addition to the aforementioned benefits, exercise is also widely known to promote psychological wellbeing such as reduced depression, anxiety, as well as improving mood states. Mood is pervasive in individuals' daily life. It affects individuals' psychological well-being, alter behavior patterns, and tend to influence physical health (Cohen & Rodriguez, 1995). In order to promote mood enhancement, mode of exercise and exercise intensity are important factor to take into consideration. However, it is reported that the most consistent benefits appear to be associated with moderate intensity exercise in promoting a greater mood improvement (Berger & Motl, 2001).

## MATERIAL AND METHODS

Twenty four male athletes were recruited to participate in this study. The participants aged between 19 - 25 years old (Mean= 22.4; SD= 1.7). Participants' mood states were measured using Brunel Mood Scale (BRUMS; Terry et al., 2003). It consists of six dimensions of mood including anger, confusion, depression, fatigue, tension, and vigour. Responses were attached to a 5-point like scale. Exercise habit strength was measured using an 18-item Exercise Habit Strength Questionnaire (Grove, Zillich, & Medic, 2014). This measure consists of four subscales (Automaticity, Negative Consequences, Stimulus Cue,

and Patterned Action) representing the process associated with habitual behavior using a six-point Likert scale. Perception of physical exertion was measured using Borg RPE scale (Borg, 1998). It measures the degree of heaviness and strain experience in physical work as estimated according to a specific rating method. It measures participant's subjective rating on their strain experience on the following scale: 6 (No exertion), 7 (Very very light), 8-9 (Very light), 10-11(Fairly light), 12-13 (*Somewhat hard*), 14-15 (*hard*), 16-17 (*Very hard*), 18-19 (*Very, very hard*) and 20 (*Maximal exertion*). Furthermore, Blood samples (4ml) were analyzed for cortisol, adrenaline, noradrenaline and ß-endorphins using a commercial available test kits by using ELISA method. Heart rates were monitored using Polar Heart Rate monitor.

**PROCEDURES**

Approval to conduct the study was obtained from the Human Research and Ethics Committee, University Sains Malaysia. On the experimental day, participants were randomly performed two experimental trials (moderate and vigorous intensity exercises) in two different sessions with a break of 6-8 days. Prior to the trial, participants performed sub-maximal (VO2), maximal oxygen uptake ($VO_{2max}$) and measure of exercise habit strength. Mood states were measured before and after exercise bout. Heart rate and rating of perceived exertion (RPE) were recorded every 5 minutes of running time. Blood sample were taken at baseline, after 5 minutes of warmed-up and the end of 30 minutes exercise. Data were analysed using SPSS Version 22. Descriptive statistics, Repeated Measure ANOVA and Mixed Factorial ANOVA was used to analyse the data.

**RESULTS**

Twenty four male athletes participated in this study, their characteristics (Mean ± SD) were (Age= 22.4±1.7 yr, Height=169.6± 6.6m, Weight=64.9±8.8kg, Body Mass Index (BMI) = 22.4± 2.7kg.m$^{-2}$ and $V0_2$max of 46.1± 5.1ml.kg.min$^{-1}$). Heart rate and rating of perceived exertion (RPE) were selected as variables in order to monitor the running intensity in this study. Repeated measures ANOVA (for comparison between trial) revealed a significant difference in the heart rate (F= 69.727; df= 4.439; *p*= 0.000) and RPE (F= 20.971; df= 2.496; *p*= 0.000).

For hormonal responses, a significant (F= 6.091; df= 3.410; *p*= 0.001) different in the cortisol between trial. Similarly result was obtained from noradrenaline (F=16.126; df= 2.862*; p*= 0.000) and adrenaline (F= 8.724; df= 2.438; *p*= 0.001) when comparing between trials. In contrast, ß-endorphin revealed a non-significant (F= 1.392; df= 3.190; *p*= 0.253) different.

For mood states, the result revealed a significant (F= 6.860; df= 2.125; *p*= 0.002) trial effect for anger and vigor (F=4.368; df=2.057; *p*= 0.017) only.

The results of Mixed Factorial ANOVA revealed no significant interactions in any of the measured parameters across the testing sessions.

## DISCUSSION

The aim of this study was to examine the roles of exercise habit in moderating exercise-induced mood states among males' athletes. The findings revealed a significant increase in heart rate and RPE value in both moderate and vigorous exercise intensities mainly in vigorous intensity. As exercise started, the sympathetic nervous system and the adrenal glands release adrenaline, which further stimulates the increases of heart rates. During exercise, active muscles require more oxygen compare to resting muscles. Increase oxygen consumption (VO2) due to increase demand by the active muscle is directly related to the heart's contractile rate.

Increased heart rate and muscle fatigue are associated with more intense perceptions of exertion (Eston, 2002). Exercise habit strength did not moderate heart rate response and RPE in both exercise intensities. However, despite the nonsignificant difference observed in this parameter, the descriptive statistics shows a pattern in an expected direction. Interestingly, participants with strong exercise habit displayed a lower heart rate and RPE values in both exercise intensities. It is speculated that participants with strong exercise habit may be habituated to the exercise and tend to perceive a much lower exertion.

The patterns of cortisol level across trials showed that participants with strong exercise habit tend to reflect in lower cortisol concentration. Moreover, the patterns showed that individuals with strong habit to exercise secrete more adrenaline and noradrenaline following exercise intensities.

Exercise with appropriate intensity and durations not only beneficial to physiological but it affects psychological such as mood enhancement. Increase in vigour was seen during running in moderate intensity exercise. As a conclusion, the results showed

that levels of vigor improved with reduced levels of confusion, fatigue, and total negative mood especially in moderate intensity exercise. At this point, increase in vigour and decrease in the negative factors were indicate a general improvement of the participants' mood state (Rokka et al., 2011).

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# EXERCISE AND ELDERLY

**Dr. Dusan Hamar**
Faculty of Physical Education and Sport
Comenius University
Bratislava
Slovakia
*Email: dusan.hamar@fsport.uniba.sk*

Population aging is a typical demographic characteristic in majority of developed countries. Increasing portion of elderlies and retired people, aggravated by the higher incidence of diseases and namely disabilities, poses demands on the health and social security system and affects, but overall economy. Taking efficient care of eldering population is considered one of the major challenges of modern society.

Though the principal mechanism of aging remains unknown, current literature provides solid description of age related changes as well as their impact on daily life and wellbeing. Among them, the most relevant are the morphological and functional changes of cardiorespiratory and neuromuscular system.

Though a mild linear loss has been described for various measures already from the third decade, more accelerated decline of cardiorespiratory function starts after the age of 60. However, in spite of age related deterioration, if not affected by a disease, cardiorespiratory functions remain adequate to support the muscle mass requirements of oxygen even in novenarians. Thus, despite the diminishing of endurance exercise capacity with age, the ability to sustain an intensity of aerobic exercise, required by activities of daily living, remains preserved until very old age.

Concerning the muscular functions, studies demonstrate that strength decreases by approximately 1.5 % per year in the sixth and seventh decade. Thereafter the loss is further accelerated, reaching about 3 % annually. Even more pronounced (almost twice as much) is the loss of power, a parameter reflecting the capability to generate force at given velocity, i.e. while performing dynamic movement.

The loss of strength and muscular power is largely brought about by deteriorating of neuro-regulatory functions and namely by loss of muscle mass. This is due to shrinking of muscle fibers (atrophy) and their partial loss, or both. It is namely deterioration of type II muscle fibers, which negatively affects muscular power. Histological analyses also revealed that loss of muscular function is due to structural changes in mitochondria and their displacement from contracting machinery of the muscle cell.

It is worth mentioning that a significant loss of muscle mass and strength occuring from sixth decade of life is usually more pronounced in women. This can be particularly problematic because the loss starts from already lower muscle mass.

Strength and muscular power are important in maintaining functional abilities to allow performing activities of daily living such as carrying groceries, getting out of a chair, taking out the trash, climbing stairs, etc. Therefore, severe deterioration in muscle functions may dramatically impair basic daily activities. If decreased below a critical level (called disability threshold) subjects lose the ability to take care of themselves and become dependent on nursing care.

Traditionally, it was a decrease in cardiorespiratory function with subsequent limitation of endurance type activities, which have been considered a crucial factor limiting quality of life. However, recent data indicate that limitation is to be ascribed to a deterioration of muscles and a resulting lack of strength. Lack of strength is also a key factor responsible for dramatically increasing incidence of falling and related injuries in elderly population.

Ageing also brings about a steady decrease of cognitive function.

Characteristic for senior years is not only potentially debilitating deterioration of organ functions, but also higher incidence of chronical maladies, namely ischemic heart disease, type 2 diabetes mellitus, cancer and osteoarthrosis. They do not only decrease life expectancy, but further contribute to the functional loss with negative effect on quality of life.

Though diet and environmental factors have an important impact on the process of ageing, a plethora of studies indicate that a key anti-ageing tool is physical exercise.

Positive effect were traditionally ascribed to endurance aerobic exercise. Among their recognized benefits are namely increase in circulation efficiency and capacity of transporting of oxygen. This happens by means of mechanisms such as increasing blood volume, stroke volume, extraction of oxygen in muscles and improved endothelial function leading to better distribution of blood while exercise and increased absolute number of red blood cells. Improved cardiorespiratory function complemented by increased activity of aerobic enzymes in mitochondria leads to higher capability of using oxygen to produce energy for muscle work. Together with decrease of sensitivity of ergo-receptors in muscles they enable to tolerate exercise of higher intensity for a given period of time.

Level of physical fitness does not only affects quality of life, but as shown by longitudinal analyses, it is also strongest predictor of mortality. This applies not only to general population, but even more to patients suffering from chronical cardiac and metabolic diseases. So the exercise induced increase in physical fitness may be considered as an important factor for the enhancement of life expectancy.

In addition to improved tolerance to exercise, regular aerobic activities have numerous additional health related effects, e.g. mild decrease of blood pressure, better tolerance to stress, improving blood lipid spectrum and endothelial function. As a result, aerobic exercise can reduce the risk of death due to cardiovascular problems. Not to be forgotten are the psychological effects, namely lowering the incidence of depression, increasing cognitive capacity and enhancing psychosocial functioning outcomes. There is also solid evidence that aerobic activities reduce risk for diabetes through increasing sensitivity of insulin receptors. In addition, high-impact aerobic activities, such as jogging, walking or rope skipping, may also stimulate bone growth, as well as reduce the risk of osteoporosis.

Contrary to aerobic activities, resistance exercise has not been traditionally considered to have a significant health promoting effects. However, evidence accumulated over recent 30 years show beneficial effect across every age group of seniors and even those suffering from chronic illnesses. Some of the most noteworthy benefits include diminished age-related declines in muscle mass, strength, muscular power and improvement of proprioceptive function. Though at the first sight improvement of strength and power may not appear as a health related benefit, in elderly it is an important and highly desirable effect. Tasks of daily living are becoming easier to perform, velocity of walking increases with positive effect on spontaneous physical activity. Augmented strength and power improve control of balance with resulting decrease of risk of falling. Positive effect on muscle mass is highly desirable for subjects with pronounced muscle catabolism due to various, namely oncological diseases. Resistance training is in fact the only effective means to counteract negative effect of androgen deprivation therapy aggravating muscle wasting in patients with prostate cancer. Another positive result of increased muscle mass is the rise of resting metabolic rate with a positive effect on the energy balance and body weight control. There is also solid evidence that resistance training improves sensitivity of insulin receptors. Resulting positive effects on glycaemia help in prevention and treatment of type 2 diabetes mellitus. Enhancement of bowel function leads up to 50 % shorter transport of digested food through gut, namely colon, an effect which is supposed to prevent common

gastrointestinal problems as obstipation, diverticulosis, haemorrhoids and last, but not least colon cancer.

Scientific literature provides strong evidence to conclude that a combination of both aerobic and strength exercise is not only a powerful tool for the prevention and treatment of chronic diseases, but also a powerful anti-aging modality, which not only fosters life expectancy, but more importantly, adds life to years.

# EXERCISE AND THE HEART

**Dr. Oteh Maskon**
Clinical Associate Professor in Medicine
Faculty of Medicine
Universiti Kebangsaan Malaysia
*Email: omaskon@gmail.com*

Exercise induces changes in heart rate, cardiac output, blood pressure, and pulmonary ventilation mediated by increased sympathetic drive. Knowledge on this haemon-dynamic and physiological changes during exercise are applied in the stress-based cardiac test, cardiopulmonary testing and related, as well rehabilitation of patients who are diagnosed with cardiovascular diseases. Understanding the physiologic and haemon-dynamic changes induced by exercise allow us to have greater insight in exercise prescription, or screening subjects who may be at risk of sudden death during high endurance exercise.

The cardiovascular benefits of exercise are established, known to reduce blood pressure and lipid, improve glucose control and reduction in coronary events. These benefits are seen with moderate amount of exercise.

Among athletes, structural, electrical, peripheral and functional changes in the heart as adaptation process to exercise may lead to some abnormal finding mimicking cardiomyopathy, ability to differentiate between the two conditions are required.

However, athletes (with otherwise normal heart) who regularly involved in chronic high intensity exercise may be prone to long term cardiac complications - mediated via increased biomarkers, atrial stretch, increased oxidative stress and myocardial fibrosis.

# EXERCISE PROTOCOLS

**Associate. Prof Daniela Lucini,**
Exercise Medicine,
University of Milan,
Italy.
*Email: daniela.lucini@unimi.it*

There are multiple approaches in order to foster an active life and in general to promote lifestyle modifications, characterized by differences in required levels of expertise of the involved professionals, lengths of allotted time, employed protocols, operational context, clinical and psychological characteristics of subjects and specific preventive goals. As a result, efficacy varies considerably across different approaches to intervention[1].

The programs that appeared to be most effective, particularly in secondary prevention, are characterized by multifactorial interventions and are designed for individuals or groups according to specific characteristics and needs. Furthermore, successful programs often include computer/technology based interventions. Simple counselling about healthy behaviour yields limited or no results. Conversely intensive behavioural approaches, which are based on cognitive behavioural strategies (CBS), careful patient assessment, prescription of exercise together with prescription of healthy nutrition and smoking cessation, have been shown to be most effective. These approaches require multidisciplinary expertise to be included in the program. This is often guaranteed by the involvement of several different healthcare professionals (specialists, general practitioners, psychologists, dieticians, exercise physiologists) which are required to work in truly collaborative and goal oriented teams in order to get positive results. On the contrary, simple referral to other healthcare professionals without joint responsibility often results in a time consuming, expensive and rather ineffective approach. Notably this strategy is frequently present in clinical contexts outside research programs, representing paradoxically a barrier to a successful result. Other important barriers reported by patients regard the financial burdens and time investments, i.e. conditions woefully characterizing intensive lifestyle modification programs (multiple encounters with different experts, educational sessions, assisted training sessions, etc, that are not always covered by social security system or insurance). These elements should be minimized as much as possible in order to design realistic and efficacious exercise programs.

A multidisciplinary approach is an essential component of these interventions in order to be able to address all the clinical, psychological and technical aspects needed to help patients to be more active and to improve behaviour. In particular, the following types of expertise are required:

- Conventional medical expertise is needed to adequately assess patients, know medical implications of the disease and of its treatment and to tailor nutrition and exercise prescription to patients' needs and characteristics

- Psychological expertise is needed to motivate and help patients to change behaviour and/or to manage possible psychological issues resulting from a major disease

- Technical expertise is needed in order to prescribe exercise, nutrition or for smoking cessation programs, to educate patients and to help them overcome practical barriers.

Focusing on exercise, it is essential that the patient/subject may exercise her/himself in a safe environmental possibly followed by expert trainers. The ideal protocol would combine periods in which the subject becomes more active in everyday life (reduction of sedentariness) with periods in which a precise exercise protocol is followed possibly with the supervision and help of expert trainers. Hence the importance to have exercise physiologists with a specific training in translating exercise prescription into everyday practice, to design specific practical protocol tailored to subject's need, to adapt them to the changing (possible improved) subject's training level.

The collaboration between physicians (well trained in lifestyle changes programs, particularly in exercise prescription) with exercise physiologists (well trained in exercise medicine approaches) may be of paramount importance in order to help patients/subjects to include exercise in day lifestyle.

Briefly a protocol which may be useful in order to drive a patient/subject towards an active life may consider:

- Subject's assessment (clinical conditions and lifestyle habits) in order to define health status, clinical characteristics, areas of improvements and possible contraindications to exercise. These information will constitute the base on which define

- Setting of clinical goal/goals that need to be reached by exercise programs

- Exercise prescription that requires the clear definition of modality, intensity, frequency, duration and progression of exercise. Of particular importance is the definition of the intensity of exercise
- Exercise practice in safe environments following exercise physiologists indications

In conclusion, exercise medicine represents today an important tool to prevent/treat a lot of chronic non communicable diseases and to foster wellbeing in everyone. The most efficacious protocols are those that are tailored on subject's characteristics/needs and which considers a multidisciplinary approach where physicians and exercise physiologists work together.

## EXERCISE AND NUTRITION
## WEST MEETS EAST: FITNESS OR TOTAL HEALTH?

**Dr. Zsuzsanna Fajcsák-Simon**
*Email: fajcsakz@gmail.com*

Obesity and diabetes further rising in Asian countries. Malaysia is titled to be the "fattest" country in Asia. Malaysia is the country where food is available 24/7, any hours of the day. The multi-cultural country offers diversity of cousine, where "eating is a culture".

Exercise is a major important factor for health. Going to the gym however became a fashion for most. Looking at the gym ads, losing weight and body shaping made its position to become rather a part of the fashion industry. Weight loss products are also a multibillion dollar industry promising the "to look good", and match the pictures of the fitness magazines. The looking good factor makes the illusion of feeling better and being healthy. Fitness programs such as boot camps became extreme and participation is hardly screened for these types of activities, resulting in more harm than benefit. Despite of the booming fitness industry, and their effort to produce "the look good", had no impact to cease or slow down the growth rate of obesity and diabetes.

With the rising health issues we must take a look at if "fashion" fitness, and exercise alone or the obsessive consumption of slimming products and taking part in slimming cosmetic services make sense. It seems that this fitness industry it failed to bring the health result expected on large scale.

On another note, the fitness equipment for home use seems to have 90 day functionality before they become the most expensive clothes hangers. Exercise is largely viewed as something painful, and dragged to be involved in for long term. People burn out, get bored, lose interest and eventually give up. Fall back to old habit patterns of long screen time and eating.

Exercise alone counts to about 20% of the result for weight loss. If one engages in exercise without changing food intake and taking the necessary nutritional supplement, the lost weight will stagnate. Eventually one loses interest in exercise as it doesn't to deliver further result.

There are several low carbohydrate diets producing promising result for reducing obesity and diabetes. These are ketogenic diet, intermittent fasting and low Glycaemic index-load. We will discuss each of these diets with their benefits and recommendations.

What do we see the problem is? By my professional point of view, the focus and the scope is off. If the mind-set is not set for health. Food is not consumed out of nourishment but control. The modality of exercise is not set for enjoyment, if being active is not a lifestyle choice, but a self-punishment, - exercise won't work, and won't delivert he expected result esp long term. Exercise and the weight loss products are used as tools to expect a loss in weight and subsequently a rise in one's self esteem. This is at least the promise of the marketing and the hidden message behind the ads. Looking better to fit better socially or to belong somewhere where one feels valued.

Number one factor for making any program work is, the change in the mind set, change in the focus. One must engage in cleaning out the underlying emotional and mental factors. The person shall move health and wellness to the highest value in their mind and with that all activities chosen will be healthy. Healthy emotional and mental fitness is the base to create the long term health and physical fitness. It will make sense, why to eat healthy, why to take certain necessary nutritional supplements and be active as much as possible. The by-product of all these are weight loss, and the maintained loss, for good. East meet West now in the approach of resolving health issues, which are all conditioned behaviour, or lifestyle originated.

Rising above the physical matter, the physical fitness of the West, must include specific mind set fitness, to change, to create sustained change in lifestyle. Exercise and nutrition, must start at the level of mental emotional drivers. One must change what food means to them, and stop using food for self-love. Food is fuel. The goal is to find happiness in "existence" and create abundance-mentality, good-will and loving kindness via meditation practice of the East. Once this foundation is reached, no longer will the individual miss things and fulfil those gaps with food. When the person feels "good enough", he/she will have enough and and craving stops.

Whatever way one starts to engage in change, one will end up covering all aspect to reach total health and total fitness. One may start with exercise; another person may start changing nutrition or another starts meditation for resolving emotional factors to live mindful. The end result is engaging in all exercise, nutrition and living mindful; to create the behavioural change, to live truly happy.

Taking the total health approach further Dr Emoto's and Dr Pollack's work on discovering water crystals and the 4th phase of water – respectively, made sense total health.

Our body supposed to be 70% water, however with age body water content declines till 55% in older aged individuals. Dehydration is a major issue today causing illness and decline in one well-being. So if anything happens to body water quantity of quality, our health will be affected.

Water molecules form water crystals when the water is in positive loving environment. This is also true for the water contained by the human body. When we are in loving, accepting environment we feel good. This would be the natural healthy state of our body water, resulting in health. These water crystals however disappear when the water is in negative environment created by such thoughts, words and action. Negative emotional environment, therefore is the number one causing factor for health to decline.

The only one time where negativity serves our health when our body become negatively charged. The negative charge makes the blood slightly alkaline and keeps immunity strong. Dr Pollack further explains that the water in the human body is not $H_2O$, but so called structured water, which is $H_3O_2$. This is the water which is negatively charged, it stores energy like a battery, it is alkaline and it forms the crystal figures.

Our body can make these hydrogen rich water, as 98% of the water in the body is in this form. The level of structured water in the body is in linear relationship with health. The higher the structured water content, the higher the quality of health.

Structured water is formed by different lifestyle factors which includes plant based diet, specific vitamin and mineral supplements, specific exercises and light exposure. Moreover, our inner detoxification resulting in inner peace forms structured water.

This presentation wills demonstrate and help to accept and make sense, that doesn't matter where one begins to take steps towards health, one must look at health, as a continuum and a journey with different steps. Steps, which are practiced and taken a lifetime.

Once stepping on this road, the feeling better and happier factor, will give the inner inspiration to keep going and live mindfully, happily, actively and healthy in the NOW. Surprisingly one finds to lose weight and become healthy as by-products of all.

# EXERCISE ONCOLOGY IN PROSTATE CANCER: A UROLOGIST'S POINT OF VIEW

**Dr. Goh Eng Hong**
Urology, Nephrology & Men's Health
Prince Court Medical Centre.
*Email: bobby.goh@hotmail.com*

In an age whereby the life expectancy has increased it is expected that the society would see a landscape of ageing population. Therefore, aged-associated diseases such as prostate cancer unsurprisingly are gradually becoming more common encounter. Unfortunately, crippling consequences are prevalent, whether directly resulting from the disease or due to the treatment received. It is a substantial burden to the society and hence clearly a responsibility for the healthcare sector to seek solutions to improve the outcome, not only to increase survival, but also to address the issues of adverse effect due to treatment and the quality of life.

Pelvis is an area with specialized vital functions such as micturition, sexual function and defecation. Any treatment therefore potentially could lead to debilitating dysfunctional state, causing much agony to the patient. Additionally, the affected elderly population largely has various existing medical morbidities plaguing their health hence poorer functional reserve. These patients also commonly face the social issues of isolation, loneliness, poor support, and financial constraint and therefore impaired coping strategy. The treatment modalities for prostate cancer are numerous and rapidly evolving, ranging from mere monitoring to invasive types such as surgery. Although this seems to provide more alternatives for the patients, they may develop anxiety instead as the patients find it hard to make mutual agreement with their care givers and keep questioning the validities of their choices. One of the recognized reasons for patient to opt out of active surveillance and proceed for treatment despite having low risk and absence of disease progression is in fact anxiety during the monitoring period. In tandem with improved management, the patients apparently enjoy longer longevity but at the same time, have to endure more debilitating side effects. It is a question hence whether there is quality of life in a setting of prolonged survival.

In all likelihood, these thorny issues aforementioned could be addressed by exercise medicine, as evidenced by the abundant results from the literatures. Exercise and physical activities generally are regarded as tools in managing metabolic diseases. Evidences are gaining attention that exercise is also beneficial in the disease progression of cancer,

ranging from prevention to palliation, whether physiologically or mentally. Hart et al mentioned this nicely, “Exercise is a provocative medicine, known for its preventive, complimentary and rehabilitative role in the management of cancer.” (1) There have been guidelines suggesting the necessary amount of exercise required to achieve the desirable end results. (2, 3) In the context of exercise advantage on malignant diseases, why is prostate cancer an excellent example? This malignancy represents more than a classic case of cancer. Not only there are the conventional treatment options such as surgery, radiotherapy, and chemotherapy, it also is a disease of the elderly, affecting the critical pelvic functions, as well as necessitating metabolic consideration due to the hormonal treatment. In order to fully utilize the benefit of exercise, the exercise physicians need to be constantly updated with the rapidly changing perspective of prostate cancer management. In addition, providing exercise medicine in the form of multidisciplinary approach is also crucial as it allow a better formulated regime for the particular patients. As a matter of fact, the participation of patient in the decision making process in an era of patient-centered care should be encouraged to improve compliance. Despite the gainful greatness of physical activities, the adherence rates somehow are known to be disappointingly low. (4, 5, 6, 7, 8,
9) Clearly there is a need for further venture to better understand this undesirable situation.

What may have allowed this to happen? Healthcare sector first and foremost partly is to be blamed. Exercise medicine is an uncharted territory for many clinicians as it is not yet a widely known mainstream practice and certainly there is lacking in confidence and expertise to provide the treatment. (10) In addition, evidence of the exercise benefits maybe perceived to be deficient. (3, 10) Clinicians likewise, may have different outlook towards exercise compared to the patients. An example being the reluctance of the primary clinicians to discuss exercise during the point of diagnosis as it was felt that additional information may not be well received by the patients. Contrary to that belief, patients actually are more appreciative of the advices, probably because this is the time in which the patients are absolutely willing to make changes in their life. (10) In terms of infrastructure, inadequate facilities requiring patients to travel a distance definitely is a hindrance towards participation. (8) Certainly we cannot forget also that the treatment for prostate cancer could result in protracted adverse effect, resulting in exhaustion to the patients, making even a trivial activity a daunting task. Being overwhelmingly consumed with the sequelae of treatment whether financially, physically or mentally, there may be little room left for the patient to be motivated to progress further into other treatment such as exercise despite knowing its perk and essential. On the other hand, exercise maybe poorly informed or

understood among the patients causing underutilization as a result. (10) In this regard, the patients may not have the confidence to perform the physical duties and be wearily occupied with the worry and fear of getting injury. (11)

Implementation of appropriate strategies unquestionably could ascertain exercise medicine to be properly exploited. Most importantly in this aspect is educating and creating awareness among the physicians and the public about the advantages of physical activities not just towards metabolic diseases but also cancers. Of course, exercise facilities that are provided sufficiently and conveniently should expect better patient adherence rate. Additionally, the regimes preferably to be tailor-made for each patient. (3) It appeared that spousal involvement is a key facilitating factor in enhancing the acceptability of exercise among the patients. (11) At the same time, much consideration fundamentally is needed to ensure safety features to be thoroughly applied. (2,3) Even if exercise is difficult to be attained the patients are encouraged to avoid no activities at all. (3) As a matter of fact, the patients could realize even some simple daily activity at home is equivalently regarded as exercise. (2, 6) Alternatively, there are also other comparable effective physical exercises such as Qigong or Tai chi. (12)

It is hoped that via this conference, physicians of various disciplines are able to understand each specialty better. Undeniably there would be a better opportunity to expose the public clearer the benefit of exercise and also to develop improved exercise regimens that are more meaningful to the patients.

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# EXERCISE AND BEHAVIOURAL CHANGES

**Dr. Lim Boon Hooi**
University of Malaya
Kuala Lumpur,
Malaysia
*Email: lboonhooi62@gmail.com*

## Introduction

Exercise is an integral component in the management of many chronic, lifestyle-related diseases. Studies demonstrated that exercise is medicine and necessary for health (American College of Sports Medicine, 2014; Dishman et al., 2013; Lavie et al., 2013; Ross et al., 2016). Despite the well-known benefits of physical activity for health in non-communicable diseases (NCDs) patients, they tend to have a low level of physical activity and are less physically active than the general population (Osborn, Nazareth, & King, 2007). Understanding the factors that are associated with physical activity in NCD patients will provide important information for the design of interventions to increase physical activity in this population. A critical examination of psychological theories and models help to explain and predict exercise behaviour (Wankel, 1997). Such theoretical models such as Health Belief Model (Strecher &Rozen tak, 1997), Social-Ecological Model (Stokols, 1992, 1996), Theory of Reasoned Action (Fishbein & Ajzen, 1975), Theory of Planned Behaviour (Ajzen,1985), Transtheoretical Model (Prochaska & DiClemente,1983) etc. have studied the exercise behaviour and its effective factors (Taylor et al., 2006). Hence, in order to facilitate greater understanding of the relevant literature, this paper will be described these theories and models related to exercise and behavioural changes.

## Health Belief Model

The Health Belief Model (HBM) is one of the most frequently used models in explaining health behaviours (Painter, Borba, Hynes, Mays, & Glanz, 2008). It has identified five health beliefs that are linked to practicing health-related behaviours: (a) perceived susceptibility to the health threat, (b) perceived severity of the health threat, (c) perceived benefits and barriers related to the behaviour, (d) cues to action, and (e) self-efficacy. It has been shown that people with a higher level of self-efficacy are more likely to perform physical activity (Ferrier, Dunlop, & Blanchard, 2010; Mo, Blake, & Batt, 2011). A meta-analysis also revealed that interventions that used vicarious experiences and feedback on past or others' performance produced significantly higher levels of physical activity self-efficacy (Ashford, Edmunds, & French, 2010). Despite its broad applications in

various health behaviours, it is important to point out that culture is fundamental to health and plays an important role in explaining health behaviour (Kreuter, Lukwago, Bucholtz, Clark, & Sanders-Thompson, 2003).

**Social-Ecological Model**

The social-ecological model provides a framework that illustrates the complex network of factors that affect behaviour choices through the interaction between individuals and the environment (Stokols, 1992, 1996). The individual and his/her knowledge, skills, and attitudes are at the centre of the model. Layers of the model emanate from the individual to levels of the environment. The model postulates that human behaviour is influenced by multiple factors that occur at various levels of influence: intrapersonal, interpersonal, community, institutional, and policy (Sallis et al., 2006; Stokols, 2000). The social-ecological model has been applied in a variety of settings to identify key elements for success and to guide efforts to promote physical activity including community-based physical activity interventions (Haggis, Sims-Gould, Winters, Gutteridge, & McKay, 2013), work related active commuting (Bopp, Kaczynski, & Campbell, 2013), and physical education (Lounsbery et al., 2013). Li and Rukavina (2012) applied the model as a theoretical framework to drive efforts to promote inclusion of overweight or obese students in physical education classes.

**Theory of Reasoned Action**

Theory of Reasoned Action (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 2005). The Theory of Reasoned Action posits that behaviour is a function of behavioural intentions that are, in turn, a function of **attitudes** and subjective norms (Figure 1).

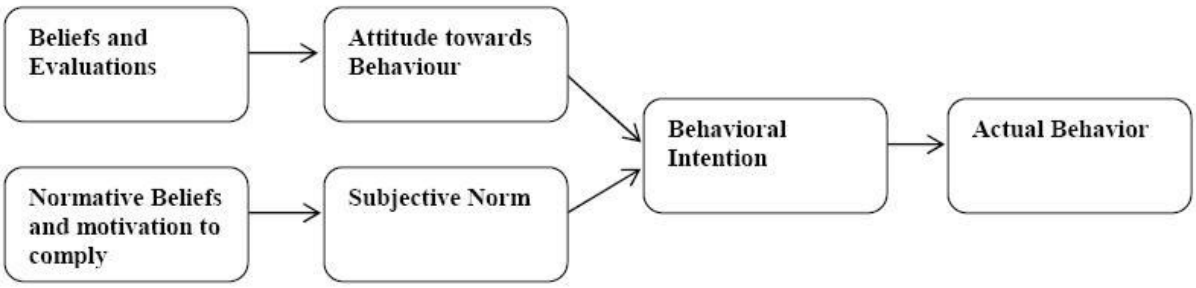


Figure 1: Theory of Reasoned Action (Fishbein & Ajzen, 1975)

**Theory of Planned Behaviour**

Theory of Planned Behaviour (Ajzen, 1991; Ajzen & Fisbein, 1980, 2005). The theory of Planned Behaviour took the components of the Theory of Reasoned Action, but added **perceived behavioural control** as an additional factor predicting both behavioural intentions and behaviour (Figure 2).

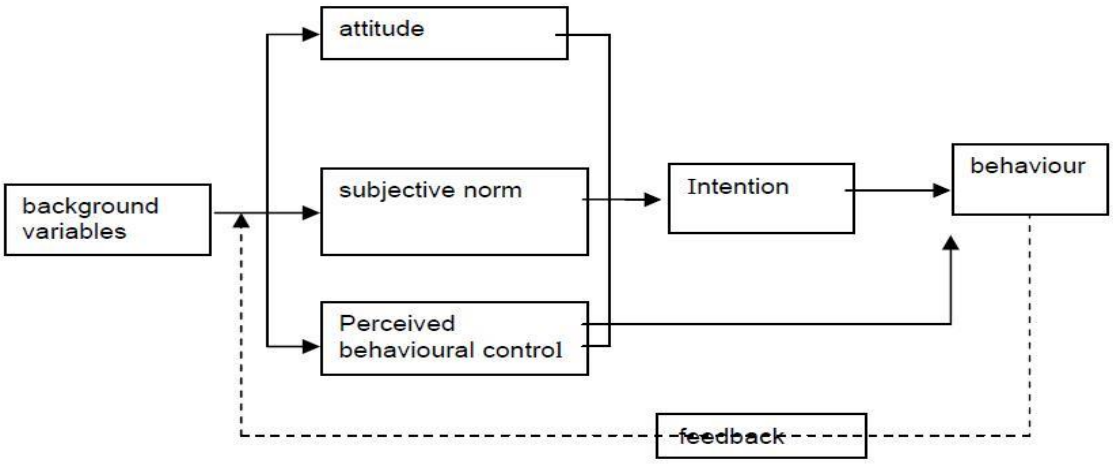


Figure 2: Theory of Planned Behaviour (Ajzen, 1991)

**Reasoned Action Approach**

The reasoned action approach encompasses all of the components proposed by Theory of Reasoned Action and Theory of Planned Behaviour models (e.g., attitudes toward the behaviour, subjective norms, perceived behavioural control, and intentions), while also including additional factors such as ***actual control,*** defined as skills, abilities, and environmental factors that influence one's ability to enact a target behaviour (Figure 3).

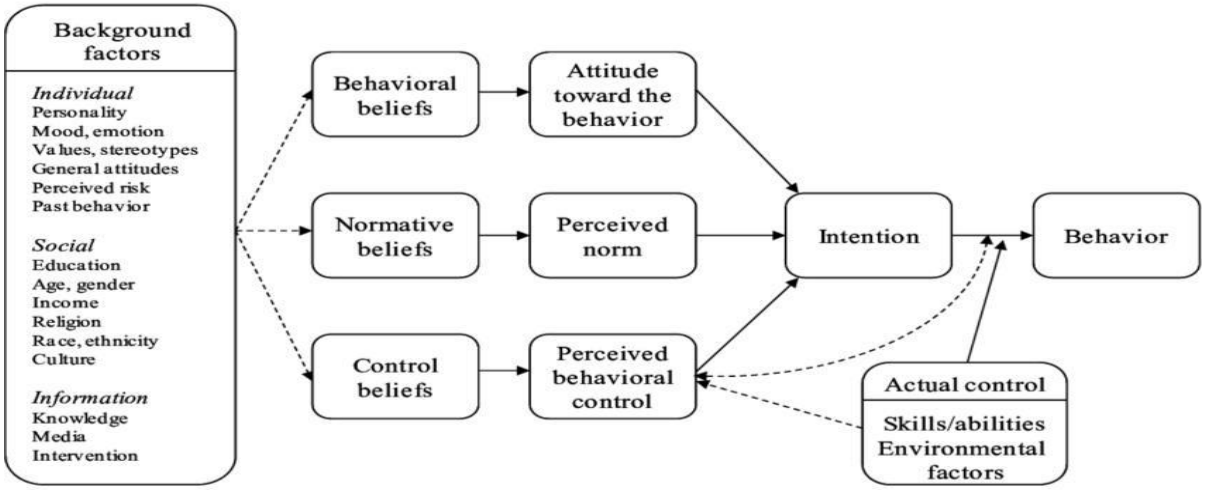


Figure 3: Reasoned Action Approach (Fishbein & Ajzen, 2010)

**Transtheoretical Model**

The Transtheoretical Model of Behaviour Change (TTM), created by Prochaska and DiClemente (1983), is one of the more popular theories used to describe behavioural change in exercise. The TTM is a model of **intentional change** that focuses on the decision-making abilities of the individual rather than the social and biological influences on behaviour as other approaches tried (Velicer, Prochaska, Fava, Norman, & Redding, 1998; Scholl, 2002). The critical assumptions of the TTM and main constructs which include the stages of change, processes of change, self-efficacy, and decisional balance (Patten, Vollman, & Thurston, 2000; Prochaska & Velicer, 1997; Velicer et al., 1998; Scholl, 2002). The temporal dimension of the theory proposes that a person may progress through **five** stages (precontemplation stage; contemplation; preparation; action; maintenance) of change when trying to modify their behaviours (Prochaska & DiClemente, 1983; Prochaska et al., 1992; Prochaska & Velicer, 1997). In the TTM, behaviour change is treated as **dynamic**, rather than an "all or nothing" phenomenon. This distinction is considered one of the theory's strengths (Marshall & Biddle, 2001).

**Integrated Behaviour Change (IBC) Model**

An Integrated Behaviour Change (IBC) Model (Hagger & Chatzisarantis, 2014) that incorporates the very latest thinking on the psychological influences on behaviour change and apply it to physical activity behaviour. A key hypothesis of the IBC model is that the belief-based constructs from the theory of planned behaviour and intentions will mediate the effects of autonomous motivation from the self-determination theory on actual physical activity behaviour.

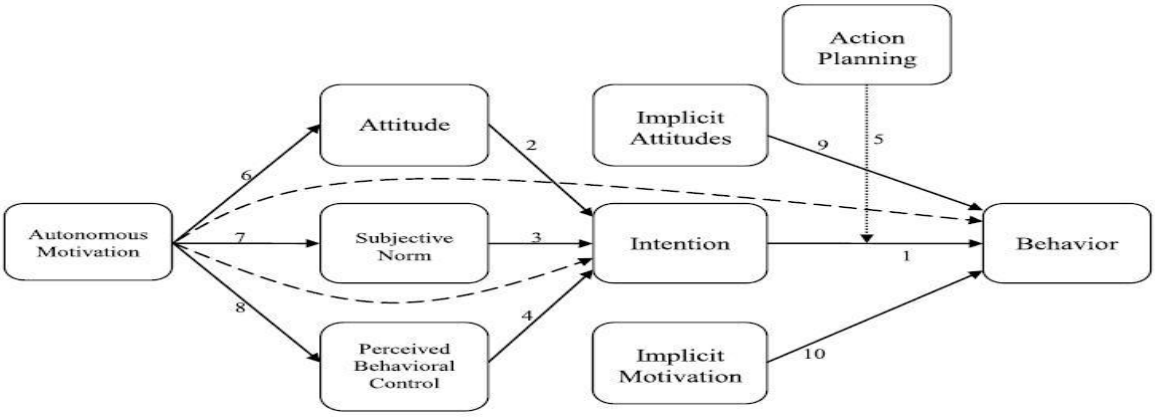


Figure 4: Integrated Behavioural Change (IBC) Model (Hagger & Chatzisarantis, 2014)

# EFFECTS & MECHANISMS OF EXERCISE ON CANCER PREVENTION

**Associate Prof. Hanson Huang Sen-Fang** Secretary General, Clinical Exercise Physiology Society, Taiwan, ROC Faculty, Director, Center for Physical Education Teaching, College of Liberal Arts & Basic Education, Tzu Chi University, Hualien, Taiwan No. 701, Zhongyang Rd., Sec. 3, Hualien Taiwan, ROC Tel +886-3-8565301ext.1220, Fax +886-3-8462920, *Email: hanson@gms.tcu.edu.tw*

## Cancer facts

Cancer is the second leading cause of death globally, and was responsible for 8.8 million deaths in 2015, nearly 1 in 6 deaths is due to cancer. The number of new cases is expected to rise by about 70% over the next 2 decades. Physical inactivity is one of main risk factors of cancer. One third of deaths from cancer are due to the 5 leading behavioural and dietary risks such as high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco use, and alcohol use (WHO, 2017).

## Effect of physical activity and fitness on cancer prevention

Epidemiological researches confirmed increased physical activity (PA) and regular exercise lowered risks of breast, colon, lung, prostate, oesophageal, liver, kidney, stomach cancer of the cardia (top portion of the stomach), endometrial, myeloid leukaemia, myeloma, head and neck, rectal, bladder, total 13 cancers (Moore et al., 2016). Prospective studies revealed that 50 MET-h/week recreational PA reduced the overall cancer mortality by 35%, compared with no recreational PA. Approximate 2% reduction in cancer mortality for every 1 MET-h/week increase below 7.5 MET-h/week occurred and a 1% reduction in cancer mortality by every 10 MET-h/week over 7.5 MET-h/week in general population (Li et al., 2016). Increased PA subsequently improved cardiorespiratory fitness (CRF). The improved CRF also has been shown as an indicator of the reduced cancer mortality. Compared to the least fit group (< 5.0 METs), subjects with moderate to high CRF exhibited 26–46% reduced risks of cancer mortality (Vainshelboim et al., 2017). Systematic review study results demonstrated CRF, independent of adiposity, strongly and inversely associated with total cancer mortality, evidenced that cardiorespiratory fitness plays a role as predictor of cancer mortality (Schmid & Leitzmann, 2015).

**Magic post-exercise serum on cancer prevention:**

The magic post-exercise serum may be the potential antidote mediated physical activity on cancer prevention. Animal model experiment showed that post-exercise serum inhibited human mammary cancer cell proliferation and induced apoptosis of these cells, compared with pre-exercise serum (Hojman et al., 2011). Human model study also revealed similar results of the effect of post-exercise serum on male prostate cancer cells (Rundqvist et al., 2013). Cancer survivor trial also demonstrated the similar post-exercise serum effects on breast cancer cells (Dethlefsen et al., 2016). Recently, post-exercise serum effect had been extended to lung cancer trial. Serum collected from young men after an acute high intensity interval training exercise (6×1min+6×1min) resulted in significant inhibition of lung cancer cell survival and proliferation in vitro compared to cells treated with serum taken pre-exercise, and led to significant inhibition of phosphorylation/activation of Akt, mTOR, p70 S6K, and Erk1/2 levels in cancer cell (Kurgan et al., 2017). In line with the results derived from the effects of post-exercise serum, review paper reported that certain myokines such as calprotectin, osteonectin or secreted protein acidic and rich in cysteine (SPARC), oncostatin and irisin in post-exercise serum may potentially involve in mediating cancer cell apoptosis and inhibiting tumour development (Huang et al., 2017). And, circulating-miRNA expression such as c-miR-133, c-miR-221/22, c-miR126 and c-let-7 derived from muscle or other organs after acute exercise also have been suggested have roles on cancer prevention (Dufresne et al., 2018).

**Other proposed mechanisms:**

Typical mechanisms of physical activity on cancer prevention such as lowered insulin and estrogen, and growth factors associated with cancer development and progression (breast, colon), prevented obesity and insulin resistance, reduced inflammation, improving immune system function, altered the metabolism of bile acids, decreased exposure time of the gastrointestinal tract to suspected carcinogens had been proposed (National Cancer Institute, 2017). Detailed pathways of mobilizing NK cells into circulation by β-adrenergic signaling and catecholamines, and these cells affected by muscle-derived myokines (IL-6, IL-7, IL-5), exercise-dependent hyperthermia, as well as intratumoral vascularization and perfusion, subsequently inducing the regulation, redistribution, and activation of mobilized NK cells had been demonstrated (Idorn & Hojman 2016). Direct biochemical changes related to exercise such as cell growth regulators, protein involved in DNA damage repair,

androgen receptors coactivators, regulators of apoptosis and cell cycle arrest, hormonal systems, immune systems components, inflammations, oxidative stress and antioxidant pathways, and indirect biological benefits related to exercise such as sunlight exposure, weight loss and mood change also had been classified (Thomas, Kenfield & Jimenez, 2016). Exercise-dependent regulation of the tumour microenvironment which includes changes in metabolisms, decreased PI3K signaling, lactate, and monocarboxylate transporter 1; immune regulation such as increased T cell content, NK cell and decreased tumour-associated macrophage; and angiogenesis, increased oxygen delivery, vessel maturity and pericyte coverage had been also reported (Koelwyn et al., 2017). Based on observed evidences, those acute physiological responses such as the acute exercise sessions leading to physical changes (increased blood flow, shear stress on the vascular bed, temperature increases, sympathetic activation) and endocrine (release of catecholamines and exercise hormones, myokine secretion) regulation that results in increased tumor perfusion, oxygen delivery, intratumoral metabolic stress, cellular damage, and ROS production create signaling pathways that prevent metastasis. And, the chronic training adaptations comprising systemic alterations with improved immune function, reduced systemic inflammation, and improved metabolic health, as well as intratumoral changes in the form of enhanced blood perfusion, immunogenic profile, and immune cell infiltration mainly decrease the risk factors of cancer initiation and development. These speculations have been suggested recently (Hojman et al., 2018). Lastly, physical activity on lowered cancer risk and progression through muscle-derived or other organs-derived circulating miRNA (c-miRNA) after acute or chronic PA such as c-miR-133, c-miR-221/22, c-miR126 and c-let-7 modulation have been hypothesized recently as well (Dufresne et al., 2018).

**Summary**

Epidemiological evidences confirmed the effects of the increased PA and improved CRF lowered cancer morality in a nonlinear dose-response manner. Certain exerkines or myokines in acute post-exercise serum acutely confer inhibition and suppression of cancer proliferation or induction of cancer cell apoptosis. Improved systemic metabolic, immune, vascular, endocrinal and other physiological functions resulted from chronic adaptation to regular exercise or increased PA mainly reduce risk factors of developing cancer. These are two major potentially plausible mechanism perspectives of exercise on cancer prevention.

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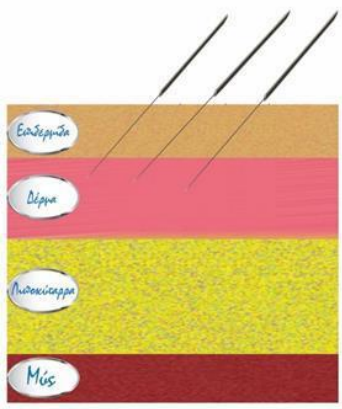
## NATURAL LIFTING WITH EXERCISE OF ELASTIC FIBERS

**Dr. Sotirios Tsioumas, MD**
Mc Aesthetic Medicine,
Lecturer at the University of Camerino,
Rome, Italy.
*Email: S_tsioumas@hotmail.com*

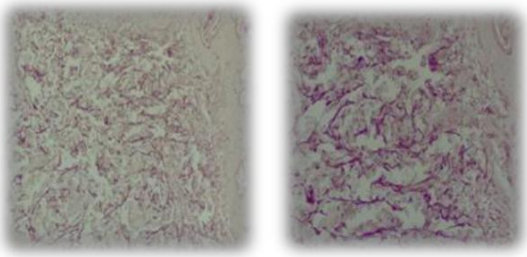
How we act on the skin:




With **Needle shaping technique,** applied by acupuncture needles and a **Device of Galvanic current set at high voltage and limited current,**

We achieve shaping, tightening and regenerating the elastic fibers

- ✓ The liquids are removed osmotically through deprivation of saline-mediated currents, to prevent unraveling of the fibers and collagen
- ✓ Differentiation of the orientation of elastic fibers; from horizontal to vertical with possible mild thickening (youth-triangle)



Soft Surgery Histological (University of Athens)

**It is a microscopic autotransplantation of tissue for traction > Autologous Threads**

**With this microsurgical technique we achieve facial Improvement immediately after and we perform Natural Lifting of face & body:**

- Reform of lips, chin, cheekbones and wrinkles without stuffing and drugs
- Increase lip volume, cheekbone

- Treat depressed scars
- Correction of nasolabial grooves, marionette lines, frontal wrinkles
- Lifting and filling of the sulcus and the tip of the nose
- Asymmetrical facial correction from facial paralysis

In addition, Needle Shaping technique and the usage of **Device with fractional waves** are indicated for **local lipolysis**.

So, we achieve to intervene in problematic areas such as eye bags, double chin, face contour and in areas with local fat as well.

**Results**

- Are beautiful and obvious immediately after, from the first moment
- Are long lasting
- People do not lose their characteristic
- There are no edemas, swelling, suture points, etching
- With needle shaping we can all find our former youth naturally, without injecting any kind of material or drug

**Protocol**

- Needle shaping – off 4-6 main sessions with results in a year and a half
- Each main session has a repetitive one after 15 days (free of charge), resulting in a total if 8-12 sessions in a year and a half
- Many needles where the problem exists

**Contradictions NONE**

# PHYSICAL ACTIVITY AND WELLBEING

**Associate Prof. Hanson Huang Sen-Fang** Secretary General, Clinical Exercise Physiology Society, Taiwan, ROC Faculty, Director, Center for Physical Education Teaching, College of Liberal Arts & Basic Education, Tzu Chi University, Hualien, Taiwan No. 701, Zhongyang Rd., Sec. 3, Hualien Taiwan, ROC Tel +886-3-8565301ext.1220, Fax +886-3-8462920, *Email: hanson@gms.tcu.edu.tw*

## Physical activity, cardiorespiratory fitness and all-cause mortality

Increased physical activity (PA) and improved cardiorespiratory fitness (CRF) benefit the reduced morality. Prospective studies shown the greatest survival effects occurred at a dose of approximately 5 times or 3-12 times of the current physical activity minimum (150min/week) recommendation (Arem et al., 2015; Loprinzi, 2015). Review studies also shown that physical activity benefit existed at high levels of total physical activity (≥8000 MET-min/week) and major gains occurred at lower levels of activity, up to 3000-4000 MET-min/week (Kyu et al., 2016), but appeared to reach a threshold at around 6000MET-minutes/week (Zhou et al., 2017). Cohort studies confirmed that increase in CRF led to the decreased nonfatal myocardial infarction, nonfatal stroke, nonfatal heart failure, atrial fibrillation events, cancer mortality and all-cause mortality (Hussain et al., 2018; Khan et al., 2017; Vainshelboim et al., 2017).

## Physical activity and epigenetic modifications

The reduced risk of all-causes mortality derived from increased PA/exercise and CRF likely mediated by epigenetic modifications and altered gene expressions. Epigenetic modifications are heritable alterations and not due to changes in the structure and sequence of nucleotides. Epigenetic modifications on cellular and physiological phenotypic traits potentially result from external, environmental or/and behaviour factors. Molecular and biological studies revealed that epigenetic mechanisms such as DNA methylation, histone modifications and microRNA expression are involved in exercise-induced chronically physiological adaptation (Goto et al., 2015), which includes skeletal muscle and cardiac remodeling, endothelial function, NK-cell activation, adipose tissue, pancreatic islets and liver functions (Davegårdh et al., 2018; Soci et al., 2017; Zimmer et al., 2016), and the exercise-associated health benefits, such as blood lipid and glucose control, left ventricular hypertrophy, psychological resilience and neurogenesis, the prevention of premature aging.

And it is even hypothesized that sperm and oocyte, and in utero epigenetic changes influences embryogenesis and affects the developmental origins of health and disease in the offspring. Conversely, physical inactivity-related epigenetic modifications are linked to detrimental health outcomes (Denham, 2018).

**Physical activity and telomere length**

Possibly, one of most significant exercise-associated health benefits linked with epigenetic modifications is exercise-maintained telomere length. Telomeres are regions of repetitive DNA at the end of human chromosomes, which protect the end of the chromosome from damage. Telomere shortening has negative effects on health conditions and been linked to many health issues including aging and cancer (Li, 2018). Human leukocyte telomere length is positively associated with high physical activity (Cherkas et al., 2008) and $VO_2$max (LaRocca et al., 2010). Most active subjects even biologically younger by 9-10 years compared with inactive subjects according to leukocyte telomere length measurement (Cherkas et al., 2008; Tucker, 2017). It seems that PA alters telomere length needs chronically regular participation. Regular PA for at least 10 years is necessary to achieve a sustained effect on relative leukocyte telomere length (Saßenroth et al., 2015). Exercise potentially contributes to the telomere protection through the mechanisms of increasing telomerase activity, decreasing inflammation and oxidative stress, and mobilizing stem cells (Arsenis et al., 2017).

**Physical activity and overall well-being**

Exercise benefits physical health, also benefits psychological health, quality of life and overall wellbeing. Positive events improve quality of life and may minimize the impact of negative life events. A dearth of positive events is also associated with increased psychiatric symptoms. Behavioral activation theory suggests the occurrence of one positive event increases the likelihood of engaging in subsequent positive events (Hopko, Lejuez, & Robertson, 2006). Not only those were “active” versus “inactive” were less likely to have suicidal ideation (Vancampfort et al., 2018), exercise also creates a positive cascade, increases positive social and achievement events experienced on the same day and positive social events on the following day, and consequently increasing physical exercise and the occurrence of positive events is central to well-being promotion (Young et al., 2018). Previous systematical review study also evidenced leisure time physical activity/exercise as

an effective way of promoting positive affect, life satisfaction and subjective well-being (Wiese et al., 2017).

**Summary**

Increased PA/exercise and improved CRF reduced risk of all-causes mortality likely are mediated by epigenetic modifications and altered gene expression, and subsequent telomere protection, physiological and psychological health. Eventually, increased PA/exercise and improved CRF enhance life quality and positive life satisfaction, and have been evidenced as a costless and effective way of promoting overall well-being.

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# COMBATTING SEDENTARY BEHAVIOURS AND EXERCISE INSUFFICIENCY- A SINGAPOREAN PERSPECTIVE

**Professor Dr. Michael Chia**, PPA, PPS
National Institute of Education
Nanyang Technological University
Singapore
*Email: michael.chia@nie.edu.sg*

## Case examples of combating sedentary living and physical inactivity National Initiatives

Singapore adopts a whole-of-nation approach in promoting healthy lifestyles- encouraging a physically active and sporting pursuits at all ages, pursued either, at age-groups levels or as familial units. Organized under the auspices of Active SG of Sport Singapore, the physical activities are multi-faceted. These are targeted at stay-at-home caregivers and retirees (e.g. daily sessions of exercise or learn to play sport), families with young children and grandparents (e.g. weekend and school holiday programs), youth (e.g. learn to play schemes to sport academies), and young adults (e.g. indoor and outdoor fitness sessions, martial arts). A segment of the Active SG's work is also devoted to encouraging inclusive participation where the physically disabled can learn and participate in appropriate exercise and play a sport. More information is available at https://www.myactivesg.com/programmes.

## National Steps Challenge

This is an annual event organized by the Health Promotion Board of the Ministry of Health that is open to all citizens and permanent residents of Singapore, where each participant collects, without charge, a pedometer upon sign up. Over a period of six months, participants earn points for accumulating targeted daily number of steps (e.g. 5000, 7500, 10 000 or more). Attractive prizes are available as part of a six-tier level of total step accumulation and accomplishment. The first two series of the National Steps Challenge attracted 156 000 and more than 350 000 participants with several significant milestones achieved. More information is available at https://www.hpb.gov.sg/article/national-steps-challenge-season-two. In the following segment, some case examples of completed and on-going research that target reducing sedentary behaviors at work and in school from the NIE Singapore are presented.

**Office-based research**

Office Sitting Made Less Sedentary – A Future-forward Approach to Reducing Sedentary Behaviours at Work

Excessive sitting is detrimentally associated with major lifestyle diseases. Attempts at intervening the prolonged sitting time at work offer possibilities for a healthier lifestyle. The aim of the study was to evaluate the impact of using a seat-cycle (S-C) compared to the office-chair (O-C) in reducing prolonged sitting in the office. Twenty-one (mean age = 48±12.4 years) office workers (10 men and 11 women; mean BMI = 24.1±4.6 kg/m²) volunteered to participate in an 11-week crossover design study. Participants were assigned randomly to two groups- each started with different conditions: the office-chair (O-C) or the seatcycle (S-C) intervention for 4 weeks with a 2-week 'washout' period in-between before switching over. Self-reported sleep quality, lower back pain, daytime sleepiness and several anthropometric measurements were obtained under the two conditions. Participants spent on average 5.79±1.51 hours sitting in the office, and used the seat-cycle for an average of 22.8 minutes daily at work. Significant improvements ($p<0.05$) were noted in a pre-to-post setting for resting systolic blood pressure (124.9±12.57 mmHg vs 120.5±13.56 mmHg); sleepiness ratings between 1300–1400 hours (1.91±0.71 vs 1.56±0.57); lower back pain score (0.95±1.02 vs 0.57±0.68) and sleep quality (4.81±2.16 vs 3.38±2.04) after the S-C intervention. The use of the S-C provides deskbound workers a potential way to interrupt prolonged sitting at work and support for such interventions at the workplace is encouraged.

**Conference-based research**

Use of a Just-In-Time prompt to interrupt prolonged sitting at two international conferences

The 'just-in-time' prompt (Prolonged sitting is hazardous to health. Be free not to sit throughout this presentation) were used in two separate conferences—one focused on health and the other on language. Ten oral presentation sessions were assigned randomly to the experimental group (EXPT, with the JIT prompt) and ten oral presentation sessions to the control group (CON, without the JIT prompt). In both conferences, the proportion of the attendees who stood up (i.e. did not sit) during the oral presentations in the EXPT conditions

was less than 10%. The main finding was that the use of the JIT prompt to discourage prolonged sitting at the health conference where attendees were likely to be knowledgeable about the dangers of prolonged sitting was ineffective (EXPT vs CON conditions, $p>0.05$; ES=0.69) compared to conference attendees at a language conference (EXPT vs CON conditions, $p<0.05$, ES=1.14).

**School-based initiatives**

As children and youth spend a great deal of time in school on a daily basis, school-based programmes that promote more active forms of learning offer strong potential to form good habits when young. Additionally as young people reap the benefits of leading a more physical active lifestyle through what they learn and experience through quality physical education lessons, they may help influence the home environment as a positive sort of intergenerational learning.

**PRIDE for PLAY**

This programme piloted in a number of primary and secondary schools was recognized by the World Leisure Organization with a highly commended award in an international innovation contest worldwide for having a positive health impact in the community in 2010.

PRIDE for PLAY is a school-based intervention programme, which allows primary schools to capitalize on children's innate proclivity for play on a daily basis. Play is a fundamental antidote to a youth lifestyle that is increasing sedentary even though many useful things are accomplished while being still. Daily play provides a much need balance between being physically active and being physically still. The innovative programme extracts three minutes from other timetabled subject lessons in the lower primary levels (10 periods per day) and aggregates it to form an embedded 30-minutes play session that is incorporated as a daily activity. The benefits of daily play include the natural development and nurturance of social emotional learning outcomes and values inculcation such as team work, racial integration, social and cultural sensitivity, negotiation, responsibility, coping with winning and losing, confidence and resilience. Research data on PRIDE for PLAY, distilled over a two-year-period show increased daily physical activity, improved teacher-pupil bonding and understanding, improved school ethos, increased concentration and less disruptive pupil behavior in class, no increased incidence of injuries and no decline in academic performance. Feedback from the stakeholders- pupils, parents, teachers and

school leaders – were all praise for PRIDE for PLAY for its innovativeness, authenticity, simplicity, feasibility, efficacy, scalability and low cost. While PRIDE for PLAY holds great promise, follow-on data among schoolchildren in Singapore show that even when a 40-week physical activity intervention during school increased step-count within school by up to 15%, this did not alter total accumulated step count. This, in essence meant that it was extremely difficult to alter sedentary behaviors with exercise interventions. Human exposure to sedentary lifestyle at school and outside of school is likely to be entrenched even more.

**Research in progress**

High-intensity-interval-training makes a hit on student learning, fitness and health in primary and secondary schools students in Singapore

The purpose of the research is to examine the acute and chronic effects 18 sessions of high intensity interval training (HIIT) on student learning, fitness and health. This is an on-going study. HIIT for the intervention group takes the form of thrice a week 3x20s maximal running sprints, interspersed with an active recovery interval of 60s. The research employs a counterbalanced crossover design, over a period of two 10-week blocks that is interspersed with a 1-month school break (washout period). With institutional ethics approval for the study, participants are aged 9-10 years (primary school pupils), and 14-15 years (secondary school students). Participants are randomized to the HIIT Intervention Group and the Control Wait-list Group. Acute measurements of alertness (Epworth Sleepiness Scale), mood (Short Mood and Feelings Questionnaire) and verbal memory recall (Rey Verbal Auditory Learning Test), are administered 15 minutes for the HIIT intervention group and to the Control Wait-list group after the thrice weekly session Subject-specific tests for mathematics, language, science are administered to both groups in a similar manner. Habitual physical activity, (5-day pedometer-assessed); height-weight and waist circumference; quality of life (PEDsQL) and a timed 50m sprint-run, are conducted for all participants in a pre-to-post research study in Weeks 1-2 and 9-10. Data will analyzed statistically in a pre-to-post manner, as will differences between key variables between the HIIT Intervention and Control wait-list group. The group order will be reversed following a wash-out period of 1-month and the study is repeated using a cross-over design i.e. the Wait-list Group becomes the HIIT Intervention Group and vice versa. The test measurements are repeated as in the previous 10-week cycle. Results are instructive in that HIIT may not only serve as a timesaving means of breaking up sedentary time in school,

improve the conditions for learning, fitness and health.

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# EXERCISE AND NUTRITION IN THE PREVENTION OF OXIDATIVE STRESS

**Associate Prof. Dr. Chee Keong Chen,**
Exercise and Sports Science Programme,
School of Health Sciences,
Universiti Sains Malaysia,
16150 Kubang Kerian, Kelantan,
Malaysia.
*Email: ckchen@usm.my*

Free radicals are defined as any chemical species containing one or more unpaired electrons that are capable of independent existence (Halliwell & Gutteridge, 1999). Most free radicals that occur in vivo either originate from reactive oxygen species or reactive nitrogen species. Examples of free radicals include superoxide, hydroxyl peroxyl, and hydroperoxyl (Yu, 1994; Gutteridge, 1995). Reactive nitrogen species include nitric oxide and nitrogen dioxide (Cooper et al., 2002). Normally, the human body also produces reactive oxygen species during resting state, but at levels well within the capacity of the body's antioxidant defence system. These free radicals are naturally neutralized by antioxidant defence system in the body which consist of enzymes such as superoxide dismutase, glutathione peroxidase, catalase, and numerous non-enzymatic antioxidants, including vitamins A, E, and C, glutathione, ubiquinone, and flavonoids (Criswell et al., 1993; Goldfarb, 1993; Dekkers et al., 1996).

When the presence of reactive oxygen species is in excess of the available antioxidant buffering capacity, this condition leads to oxidative stress (Jenkins, 1988; Sen, 1995; Alessio et al., 1998).These reactive oxygen species can damage proteins, lipids and DNA, altering the organism's structure and function (Aruoma et al., 1991; Roberts and Hubel, 2004). Because of this reason, the increased reactive oxygen species has been implicated in the pathophysiology of a wide range of human diseases such as cancer, diabetes, and neurological diseases (Xie & Huang, 2003; Valko et al., 2006; Reddy et al., 2009). Studies on the effects of antioxidant supplementation in ameliorating the prevalence of these diseases have been equivocal.

Some of the studies that have indicated the beneficial effects on health have used various types of antioxidants. For instance, data from the Women's Health Study, which included almost 40,000 healthy women has shown that vitamin E was associated with reduced deaths from cardiovascular causes and also reduced major cardiovascular events in a subgroup of women aged 65 or older (Lee et al., 2005). Gifkins et al. (2012) reported that

there was a decreased risk for endometrial cancer in healthy individuals following the intake of total phenolic from foods. Several studies have also indicated that antioxidant supplementation lead to a significant increase in the endogenous antioxidant enzymes. Giray et al. (2003) has demonstrated that vitamin E supplementation (600mg.day$^{-1}$) for 14 weeks resulted in a significant increase in glutathione peroxidase and superoxide dismutase activities. Similarly, it was shown that supplementation of vitamin C (500mg.day$^{-1}$) for 8 weeks increased the antioxidant status in healthy individuals (Khassaf et al., 2003). Healthy adults who were undergoing intense physical training had improved plasma antioxidant activity following supplementation of purple grape juice (10mL.kg$^{-1}$.day$^{-1}$) for 28 days (Toscano et al., 2017). Melatonin supplementation (20mg.day$^{-1}$) for 2 weeks increased glutathione peroxidase and superoxide dismutase activities in high intensity trained athletes (Ortiz-Franco et al., 2017). Damirchi et al. (2015) also reported that 14 days of garlic extract supplementation increases salivary antioxidant of superoxide dismutase and catalase in young male athletes.

Performing regular exercise has been reported to elicit an up-regulation of antioxidant markers. According to Fernando et al. (1999), total plasma antioxidant capacity was 25 % higher in sportsman than in controls. He and his colleagues have shown that there was an increase in plasma superoxide dismutase activity, antioxidant levels and α-tocopherol in soccer players under regular training. In a recent study, Nordic walking for 6 weeks with individually customized intensity improved the blood antioxidant defence system among previously sedentary women (Cebula et al., 2017). Goon et al. (2009) found that performing 12 months of Tai Chi exercise in sedentary volunteers significantly reduced plasma oxidative stress markers at post-exercise, while antioxidant marker of SOD increased significantly. Similarly, Wadiah et al. (2015) have reported that combined aerobic dance exercise (3 sessions per week) and consumption of chocolate malt drink (45g.day$^{-1}$) for 8 weeks resulted in increased superoxide dismutase activity among 44 healthy females. Thus, there is substantial evidence in the literature indicating that different types of exercise and antioxidant supplementation increase the antioxidant capacity of healthy individuals and athletes. The enhanced antioxidant status is generally associated with improved health status by alleviating oxidative stress and hence may prevent certain diseases.

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# FACTORS ASSOCIATED WITH METABOLICALLY HEALTHY OBESITY: ROLE OF PHYSICAL FITNESS

**Dr. Aldhoon Hainerová**
Department of Children and Adolescents,
Faculty Hospital Královské Vinohrady,
Third Faculty of Medicine,
Charles University,
Prague, Czech Republic
*Email: ihainer@hotmail.com*

Obesity has become a major public health issue worldwide. The prevalence of both adult and childhood obesity has significantly increased. There is, however, evidence that in some children populations the prevalence of overweight and obesity is plateauing (1). Obesity is widely associated with increased risks of cardiovascular and metabolic morbidity and premature mortality. Metabolic syndrome, a clustering of abdominal obesity, dyslipidemia, hypertension and disorders of glucose metabolism, are diagnosed in obese individuals, including youths.

Some individuals despite being obese do not present with cardio-metabolic disorders. Therefore, over the past years a phenomenon known as metabolically healthy obesity (MHO) has been used to describe a condition in which individuals are free of cardio-metabolic complications. Different criteria for both the adults and children have been used to categorize MHO. MHO is usually defined as the absence of disturbed metabolic profile or as the preservation of insulin sensitivity.

The prevalence of MHO widely differs dependent on the definition used but usually is from 3.3 to 40.0 % among obese adults and is higher in children and adolescents (up to 68.0 %). In our study of 702 obese adolescents, the prevalence of MHO was 52.6 % in girls and 42.9 % in boys (2). Not only the definition but also ethnicity, age and gender play an important role in the occurrence of MHO. In addition to insulin sensitivity, MHO is characterized by favorable body fat distribution, less pronounced pro-inflammatory state, smaller adipocytes, less macrophages in adipose tissue, absence of fatty infiltration of the liver and skeletal muscle and favorable hormonal profile and genetic background (2). Lifestyle and environmental factors, including diet and physical activity, have a direct effect on body fat stores as well as on cardio-metabolic health. An excessive energy intake with sedentary and low physical activity leads to a positive energy balance resulting in an increased fat mass accumulation.

Several studies, including ours, tried to identify determinants and molecular mechanisms of MHO. Based on our study of boys matched for age, body weight, and body height and body mass index but differed in metabolic health status, we concluded that increased cardio-metabolic risk was related to an earlier onset and a longer duration of obesity (3). Diet including its quantity, composition, pattern and quality in relation to MHO has been widely studied but with rather inconsistent results (4).

Almost thirty years ago, pioneering studies of Steven N. Blair et al. demonstrated that better cardiorespiratory fitness was associated with decreased all-cause mortality in both genders (5). Later on, it was recognized that higher level of cardiorespiratory fitness (CRF) is also independently associated with reduced cardiovascular morbidity and mortality. Additionally, individuals with higher CRF present healthier metabolic profile (6). The prevalence of metabolic syndrome was ten times less common in individuals with higher CRF than in those with low CRF (7). Importance of "fitness vs. fatness" was thoroughly reviewed (8). A large Aerobic Center Longitudinal Study of 43 265 enrolled adults showed a clear association of better CRF with MHO phenotype in both genders (9). Further studies demonstrated that even a short-term intervention based on CRF improvement led to a change of metabolically risky phenotype to MHO and to a decrease of risk factors characterizing metabolic syndrome (10). Metabolic health may be influenced by characteristics of skeletal muscles, such as type of muscle fibers and muscle strength. For example, higher insulin sensitivity was noted in overweight and obese women with higher muscle strength evaluated by dynamometry (11). In contrast to adults, Demmer et al. reported that cardio-metabolic risks associated with central adiposity were only partially ameliorated by fitness in adolescents (12).

It is necessary to take into account that individuals with MHO represent non-homogenous group of patients. There are some individuals that are comparable to metabolically healthy normal weight individuals. On the other hand, some patients may possess other obesity-related risks unrevealed by regular clinical examination. Therefore, it should be kept in mind that even MHO may be a transitory condition. The lecture will discuss current knowledge related to MHO with a particular focus on CRF.

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# COMBATING EPIDEMICS OF METABOLIC SYNDROME, GUT DYSBIOSIS, CVD AND CANCER: CONTRIBUTION OF EXERCISE MEDICINE IN THE CONTEXT OF PREDICTIVE, PREVENTIVE AND PERSONALIZED MEDICINE AS THE MEDICINE OF FUTURE

**Dr. Rostyslav Bubnov**

[1]European Association for Predictive, Preventive and Personalised Medicine, http://www.epmanet.eu/ Brussels, Belgium; [2]Zabolotny Institute of Microbiology and Virology, National Academy of Sciences of Ukraine, Kyiv, Ukraine; [3]Clinical hospital "Pheophania" of State Affairs Department, Kyiv, Ukraine.

*Email: rostbubnov@gmail.com*

**Keywords:** Exercise medicine; Predictive, preventive and personalized medicine; metabolic syndrome; CVD; cancer; microbiome; diet; probiotics; ultrasound; CAREN

## Introduction

Health is the result of genetic / epigenetic background, environment (like food, microbiome) and behavior (like physical activity, habits) factors. *Metabolic syndrome* (MetS) includes the development of visceral obesity (increasing waist circumference) plus any 2 of criteria of a violation of metabolism: cardiovascular diseases (CVD), liver disease, hypertension, dyslipidemia, hyperglycemia and insulin resistance and is a large global challenge [1]. Obesity evokes chronic inflammation and combined with MetS is a risk for cancer development. Global epidemics of obesity and CVD those that constitute MetS has been observed during last decades (WHO, 2009, 2016); in this context the role of *Exercise medicine (EM*) is crucial part of the preventive and treatment programs.

***Moderate evidence supports the role of EM to reverse MetS.*** Regular physical activity is essential for people to maintain a balance between the numbers of consumed and used calories and can reduce the risk of developing cardiovascular disease, type-2 diabetes, dementia and some cancers by at least 30%. Exercise decreases inflammation, levels of lipid peroxidation and therefore can improve fitness, increase leanness and reduce obesity and is associated with favorable changes in risk factors for MetS, CVD and diabetes [2]. Professional sports lead to decreasing levels of inflammatory cytokines and increasing microbial diversity. Specific accumulation of metabolites in muscles and in organism tissues was noted, also related to hypoxia and focused physical exertion can be a predictive marker and a target for microbiota associated interventions. Exercises can reduce age-related intramuscular fat accumulation in trunk muscle followed by muscle dysregulation and imbalance [2].

***Evidence is rigorous indicating that exercises can be effective for prevention number of cancers (NIH)*** [3].

Exercise medicine can prevent obesity and decrease risks of 13 different types of cancer (breast, colon, endometrial, etc). Additionally physical activity may improve cancer-specific outcomes (recurrence, progression, and survival) and reduce the risks of several cancers (like prostate cancer) through mechanisms, obesity-independent. Effectiveness of **EM** to prevent cancer can be explained by a number of biological effects on the body, namely: preventing obesity and the development of insulin resistance; lowering the levels of hormones, such as insulin and estrogen, and of certain growth factors; reducing inflammation and modulating immune system function; reducing the time of food passage through the gut; altering the metabolism of bile acids, suspected as carcinogens (for colon cancer) [3].

However, current evidence regarding lifestyle-related diseases is underappreciated by scientists, doctors, and usually ignored by decision-makers. Existing non-personalized neurorehabilitation programs largely exploit the placebo effect. Additionally the optimal dose and type of exercise is still unknown [2] to fully implement the concept of **Evidence-based Preventive Exercise & Sport medicine**.

New so lution has been suggested after the paradigm shift from delayed reactive medical services to evidence-based **Predictive, Preventive and Personalized Medicine (PPPM)** and healthcare practice. This novel integrated Science supposing the hand-in-hand standardization and individualization in the most optimal way, in order to *treat the right patient with the right intervention in the right dose at the right time point* [4-7], is the only instrument to debunk the number of existing myths and stereotypes regarding use of exercise and diet, to integrate multidisciplinary expertise and fill the evidence gaps promoting the individuals' healthy choices about ***what to eat and how to go to the exercises*.**

**Predictive medicine** can be effectively implemented via development broad panel of biomarkers adding novel high-quality instruments based on measurable effects (including clinical criteria, imaging and molecular pain / sport biomarkers) that are associated with modifiable factors (physical activity, diet, lifestyle, etc.) to focus on the patient`s needs.

**The old and novel technique on the horizon to evaluate individual profiles based on posture and muscle fitness.** The concept of *repetitive injury* and the evaluation of *trigger point* neuromuscular phenomena evoking muscle and visceral pain can justify integrated multi-parameter approach in the field [7-10]. In this regard study of motion using *neuromuscular rehabilitative ultrasound (US), Computer Assisted Rehabilitation*

*Environment (CAREN)*, using static and dynamic balance tests, pressure analysis can elucidates functional *postural patterns*, and provide extensive **mechanical patient profiling**. Recently we studied different patterns of decreasing motility, contractility (muscle contracted/rested thickness) on M-mode ultrasound [9]. *CAREN* is a versatile, multi-sensory Virtual Reality system for treatment and rehabilitation of the human locomotion (walking), back pain, posture, balance, spinal stability and motor control integration [10]. Extensive evaluation of motion posture in extremities, pelvis and spine and diaphragm is feasible and informative protocol. We observed the preliminary correlation between the changes (muscle hypertrophy) in contralateral extrinsic / intrinsic at the same levels and distal / proximal muscles, due to biomechanical instability; local areas of spasticity (trigger points) mostly in the trunk [9]. Documented images can be collected and accessible for tele-medical consulting and put to the registry (radiomics).

**Integrative movement-structure analysis and extensive molecular profiling for prediction individual metabolic phenotype.** Chronic tensions are associated with inflammation in tendons and in muscles involving both immune and non-immune pathways contributing to intramuscular fat accumulation, muscle damage, weakness and fatigue. It has been hypothesized that adipose-based inflammation links obesity, MetS, and musculoskeletal (MSK) tissue damage and there is a central role for muscle damage with chronic exposure to an obesity-inducing diet [11]. Thus, US, CAREN, pain biomarkers can provide information on muscle fitness / fatique / contractibility, the postural role of the trunk muscles, and more; the profound analysis of the regulatory pathways and mutual links between immune mechanics in tendon and skeletal muscle and their function and spasticity evoking myofascial pain is needed. Research on vascular dys/regulation and hypoxia signaling, study of microbiome under stress and role of mitochondria during physical activity provide novel insights into molecular mechanism to understand gut-brain-circulation-pain interaction as a whole.

**Gut–muscle axis: interplay between MSK–metabolic profile and microbiota.** The *human microbiome* is an extension of the self and, together with the genetic makeup, determines the physiology of an organism, metabolism and digestion and has been recognized as an important contributor to pathological conditions such as obesity and metabolic disorders and cancer. However, gut microbiota is underestimated player in metabolic equilibrium of human health, largely modulating metabolism of the host in gut and in distant sites, is mutually associated with physical activity. The implicating microbiota in physical activity and stress-related disorders and links between lifestyle and

microbiome is promising, however causation links are still unclear [12]. Gut-brain axis is hypothesized as pain reducing mechanism via regulating nerve and muscle inflammation, and thus its function, and affecting central sensitization. The potential for precise therapeutic microbiome interventions can target microbial-mitochondrial metabolic communication and to enrich microbial diversity and improve muscle fitness. The multi-scale regulatory role of the gut microbiota in immune and inflammatory and metabolic activity provides a novel avenue of research for musculoskeletal diseases with potentially novel treatment options. **Age- and sex**-specific aspects should be carefully studied and approved to provide reliable recommendations; the study of cohorts under risk, children, considering conditions such as *Flammer syndrome* is another substantive item needed to take into account.

**Personalized** treatment programs for sport and rehabilitation need to be developed and include the above points and constitute novel physiological, safe and personalized therapies, exercise, healthy lifestyle, personalized sleep algorithms, additionally supported with minimally interventional pain management and physiotherapy, such as dry needling, neuromodulation; regenerative therapy, guided by advanced imaging techniques, using 3D modelling, prospects for development of rapid prototyping, robotics, smart prosthetics are the desirable focuses of innovation of the pain management, etc.

Number of misinterpretations are the limit for effective application of personalized EM like underestimated role of placebo, the *false* statements on physical inactivity and obesity, e.g., *`you can outrun a bad diet`* [13]. However, physical activity itself does not promote weight loss, while appropriate diet is essential to combat obesity [13]; including fat, ketone bodies, can be the best fuel for most exercises.

Individual **dietary recommendations** should be given along with individualized exercise programs with broad concordance and free from controversies and/or uncertainty, the stereotypes and poor evidence.

Since physical activity decreases over the lifespan, the dietary habits are more influential to improve cardiovascular risks regardless of age [14]. In this respect **microbiome modulation** during physical exercises through individualized using probiotic, prebiotic and diet has a pivotal role. Thus, the microbiome can be an essential supplier of metabolites that act at the level of resident mitochondria of host in skeletal muscle to stabilize host metabolism; strategies to use probiotics for modulating the gut microbiota in sport and exercise medicine require selecting specific individualized strains according to their properties [15].

**Preventive** programs implementation is a challenging task that lays in the integrated person-oriented vision via predictive diagnosis and having strong evidence behind. Thus, the combination of moderate physical activity and a diet including protein-rich foods as nuts, dairy, and eggs associated with better favorable changes in risk factors for CVD than age [15]. Excessive progress of metastatic cancer in individuals with Flammer syndrome and hypoxic niches in tissues supposes specific physical activity and lifestyle preventive interventions [16]. Early exercises might beneficially alter metabolic profile; prevention of obesity and MetS should be started in the school setting.

**Conclusions and recommendations**

Predictive, preventive and personalized medicine as the medicine of future can justifiy person-centered application of Exercise Medicine for patients with obesity, metabolic syndrome and CVD via predictive diagnosis and multipara meter stratification, considering evidence on cancer risks, life expectancy, quality of life, and yield targeted prevention of wide spectrum of MetS-associated collateral diseases and suggesting new health care policy, smart decision-making, and advances in education for economic benefits for aging society and working population. Further reliability studies, comparative RCT designed under PPPM context needed to complete evidence on capability of EM for prevention discussed above disorders, personalization of EM preventive interventions together with personalized nutrition, lifestyle and environment correction with focus on the particular case needs.

Finally, the huge challenge for health care professionals is to develop educational programs that include informing society and young people regarding maintaining a so called ‘healthy weight’; to motivate their patients to participate in EM programs; and to educate on reasonable expectations of weight loss and impact on health.

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# RESISTANCE VERSUS COMBINED EXERCISE IN STRENGTH DEVELOPMENT AMONG SEDENTARY STUDENT

**Raja Nurul Jannat Binti Raja Hussain**
Asia College of Exercise and Sports Medicine,
Faculty of Sports Science and Recreation,
Universiti Teknologi MARA, MALAYSIA
*Email: rajanuruljannat@gmail.com*

**Abstract**: Strength is crucially important for individuals to perform daily activities. However, without endurance an individual could not sustain longer in doing any activity. Obese people are highly associated with increase in functional limitations and also having a propensity to get tired easily while performing activities of daily living (ADL) compared to normal people. Therefore, strength and endurance is important for obese individual to carry their weight for a long period of time. This study aims to examine the effect of resistance (RE), and combined resistance and endurance (RE+EE) exercise among obese on muscular strength development. Sedentary obese collegiate female (N=39; 22.82±1.70years; 86.93±10.72kg, 34.08±3.42kg/$m^2$) were randomly assigned (n=13) into RE, RE+EE and control groups. Participants exercised 3 $d \cdot w^{-1}$ for 8 weeks. RE trained 3 set of 6-8 machine exercise at 50-70% of 1 repetition maximum (1-RM). RE+EE trained 20 minutes of treadmill jogging at 40-60% $HR_{max}$ and 2 set of 6-8 machine exercise at 50-70% of 1-RM. Selected parameters were measured pre- and post-interventions. There was statistically significant improvement in upper body strength and lower body strength in RE group. Conclusively, RE improved overall strength in obese females compared to RE+EE.

Keywords: Collegiate, aerobic training, inactive, weight training, random assignment.

# FITNESS AND MORTALITY

**Dr. Sitha Phongphibool,**
PhD, ACSM-RCEP, CPET
Registered Clinical Exercise Physiologist/Specialist
Thailand
*Email: sitha.p@chula.ac.th*

Aerobic capacity, functional capacity, and maximal oxygen consumption ($VO_2max$) are used synonymously and are generally referred to "the maximal amount of oxygen that the body can consume and utilize during extreme physical exertion." It is an important measurement because it defines the limits of the cardiopulmonary system and physical fitness. High level of aerobic capacity signifies that an individual has high level of cardiorespiratory fitness. Many epidemiological and clinical evidence have shown an inverse relationship between the cardiorespiratory fitness and all causes of mortality. The growing number of studies has also demonstrated that cardiorespiratory fitness is a powerful predictor of mortality risk than traditional risk factors such as hypertension, smoking, obesity, hyperlipidaemia, and type-2 diabetes. Other similar reports reveal that for every 1 MET increase in fitness, there is a 21% reduction in the risk in all sexes in a large healthy population. Individuals with a cardiorespiratory level <5 METs tend to have a particularly high risk for mortality, whereas many epidemiological studies have observed that cardiorespiratory level >8 to 10 METs are associated with relative protection.

Research has shown clinical importance of aerobic capacity in predicting survivability. The data revealed that in the clinical population such as people with chronic heart failure who has maximal aerobic capacity less than 10 ml/kg/min have a 1-year survivability of 47%. Conversely, heart failure individual who has maximal aerobic capacity greater than 14 ml/kg/min is associated with excellent chance of survival (1-year survivability of 94%) and better prognostic outlook than those who are lower. Data also indicated that for every 1 MET (3.5 ml/kg/min) increase in aerobic capacity translates to 12% improvement in survival.

Blair and colleagues (1989) evaluated middle-aged men (n=10,224) and women (n=3,120) patients with maximal treadmill exercise test for their fitness levels. The subjects were categorized into different fitness levels (i.e. low, moderate, and high) and were followed for an average of 8 years. What the investigators discovered was that the death rate from coronary incidence was lower in those who possessed high fitness level (3.1 for males; 0.8 for females) when compared to those with low fitness level (24.6 for males; 7.4

for females). Blair and associates (1995) also further assessed in the change is aerobic capacity and the risk of mortality. A large number of men (n=9,777) ages range of 20-82 years old underwent two maximal treadmill exercise test at a mean interval of 4.9 years and these subject were followed for 5.1 years to assess the change in physical fitness on the risk of coronary death. The investigators found that more death from coronary events occurred more in those that were unfit. On the other hand, those that improved in their physical fitness (increased aerobic capacity) experienced an age-adjusted relative risk of 0.48 (52% reduction in risk; 95% confidence interval 0.31-0.74). From the data provided, it is clear that aerobic capacity contribute to the survivability; thus, improvement in aerobic capacity will ultimately contribute to longer life span and improve quality of life.

Participation in regular physical activity and exercise is important health behaviour in improving aerobic capacity and ultimately the cardiorespiratory fitness. Major organizations in health promotion and disease prevention such as the American College of Sports Medicine (ACSM), American Heart Association (AHA), American Diabetes Association (ADA), World Health Organization (WHO), Center and Disease Control and Prevention (CDC), and Institute of Medicine (IOM) encourage all individuals to be physically active in order to improve their physical fitness.

If physical activity and exercise are good for ones' health then why do most people are still sedentary? The question may sound simple but yet difficult to answer. Many health experts are still sceptical about the reasons why people are sedentary. Although, many do believe that technological advancement in our society has contributed to our sedentariness. Many other factors also influence current human behaviour thus implementing certain policy may help to move the people from being sedentary into a more active category.

# ADDRESSING NON-COMMUNICABLE DISEASES IN MALAYSIA: AN INTEGRATIVE PROCESS OF SYSTEMS AND COMMUNITY

**Dr. Omar bin Mihat**
*Email: dromarmihat@gmail.com*

Omar Mihat 1,Feisul Idzwan Mustapha1, ainal Ariffin Omar1, Kamaliah Md Noh2, Noraryana1 Rotina Abu Bakar1

1- Ministry of health Malaysia
2- Maternal and Child Health Division

**Abstract**

The prevalence of non-communicable diseases (NCDs) and NCD risk factors in Malaysia have risen substantially in the last two decades. The Malaysian Ministry of Health responded by implementing, "The National Strategic Plan for Non-Communicable Diseases (NSP-NCD) 2010-2014", and the "NCD Prevention 1 Malaysia" (NCDP-1M) @ KOSPEN program. This paper outlines the primary health system context in which the NCDP-1M is framed. We also discuss the role of community in facilitating the integration of this program, and outline some of the key challenges in addressing the sustainability of the plan over the next few years. The paper thus provides an analysis of an integration of a program that involved a multi-sectoral approach with the view to contributing to a broader discourse on the development of responsive health systems.

# THE ROLE OF EXERCISE MEDICINE IN THE PARADIGM SHIFT FROM REACTIVE TO PREDICTIVE, PREVENTIVE AND PERSONALISED MEDICAL SERVICES: SHARING LONG-TERM EXPERIENCE OF BELARUS

**Dr. Volha Raznitsyna, MD,**
Mogilev City Hospital,
Department of General Surgery.
Belarus.
*Email: olga.razni@mail.ru*

Belarus is a country of Eastern Europe with a territory of 207 595 $km^2$ and a population of 9 491, 8 people. Bearus is a country which made its name in the world by impressive achievements in the sport.

For example:

- Belarus appeared at the 15 place from 92 countries in the medal table in 2018 Olympic Games
- Belarus was honored to hold the II European Games
- Minsk was named among the most sportive cities in the world, it is in the top-20 from 610 metropolitan cities
- During the years 2012-2018 Belarus held a great amount of different international competitions. The most important are: The final stage of the World Cup in Rhythmic Gymnastics, World Championship in cycling on the track, European Boxing Championships, Ice Hockey World Championship, World Championship in biathlon among juniors and juniors, World Cup freestyle stage (aerial acrobatics), European Rhythmic Gymnastics Championships, European Speed Skating Championships, International Martial Arts Games, World Championship in helicopter sport and others.
- A lot of competitions Belarus is going to accept during 2018-2020 years.
- Many our sportsmen are widely known in the world, like Daria Domracheva – a phenomenal champion (Four-time a winner, silver and bronze medallist of Olympic Games). In Sochi (Olympic Games-2014 she won 3 races one after another and became a three-time winner, the first woman in biathlon, who got three highest awards at the same Olympic Games.

All these facts allowed Belarus to be considered sportive country. People health, development of Physical Education and sport are proclaimed to be a priority area of social

politics. All questions related to the topic of people's education in health and mass sport development are in the focus of attention of the President, Alexander Lukashenko. Nowadays there are more than 130 kinds of sport in Belarus.

Here there are some facts about what has been doing at the country level to develop mass sport:

- Nowadays there are more than 23.000 of sport objects, among them are 136 stadiums, 327 swimming pools (with small ones – 958), 52 sport tracks, 4510 gym halls, 35 buildings with artificial ice.
- Professional sportsmen are prepared in 457 organizations of Physical Education and sport.
- Special State programs were worked out: "State Program for the development of physical education and sport in Belarus for 2016-2020", "State Program of student sport development in Belarus for 2016-2020", and also the National conception of cycling development was accepted. Among its main goals is expansion of cycle using in the cities (with a population of 50.000 and more) to 8-10 %, and in smaller cities – to 15-20%, and in towns - more than 40%.
- A Minsk Union of Cyclists reports, that for now in Minsk a part of cycling use in the all transfers is more than 1% and the number is growing constantly.

Annually in Belarus take part more than 22.000 sportive events. The most popular are "Belarussian Ski Track", "Belarussian Physical and Sportive Festival dedicated to the Independence Day", different crosses; football, handball competitions among juniors, and a famous National Jockey Challenge.

As a revival of Soviet traditions, industrial sport competitions are very popular and widely spread. So, the workers from different spheres compete with each other on different stages. The best ones then are selected for the Republican competition in the combined team. The financial support belongs to Federation of Trade unions.

According the Law of the Republic of Belarus on Physical Education and Sport, Physical education of students is carried out on the lessons, sportive events among pupils and students of colleagues and universities. There are no less than 2-3 academic hours per week during the general education.

There is no doubt that the main goal of all the initiatives of sport popularization is to improve determinants of health in population. Regular sport activity is the main tool of an effective preventive measure against non-contagious disease. Non-contagious disease remain the main cause of death as in Belarus, as in other countries of the world.

In society we can observe a gradual process of acceptance a healthy lifestyle as the very important one. In Belarus the health occupies the first position among 22 the most important values of people. 44,1% of people assure, that their attitude to health and lifestyle changed and became more attentive.

But still there is a wide field to improve health indicators. According to the research "STEPS" (2017, World Health Organization), Belarussians can be characterized by the next facts:

- 13,2% of responders have a low level of physical activity (less than 150 min recommended by WHO).
- 60,6% of population has overweight and 25,4% suffer from obesity.

In spite of it, more than half of the responders (55,3%) has a high level of physical activity and 83,3% - high and moderate. These data say that it is well known that a physical activity is one of the most important aspects of healthy lifestyle.

# WALKING AND JOGGING WITH PODIATRIC PROBLEMS

**Dr. Johson Boey Chee**
*Email: johnsonbce@gmail.com*

The gait cycle comprised of the stance and swing phase. The stance phase is further subdivided into contact, midstance and propulsive phase. During dynamic gait, the foot follow through series of pronatory and supinatory motion in two of the major joints in the foot, the subtalar joint (STJ) and midtarsal joint (MTJ). The STJ is formed between articulating surface of talus and calcaneus. Functionally, the STJ is distinct from the anatomical STJ, in that, the former comprised of anterior, middle and posterior facets while the posterior facet falls out in defining anatomical STJ. Midtarsal joint, also known as transverse tarsal or Chopart joint consisted of two separate anatomical articulating joints of the talonavicular and calcaneocuboid. Initially, the heel strikes the ground at slight inverted position. In response, the ground reaction forces exert a pronatory force on lateral calcaneus which results in STJ to pronate to allow the midfoot loading. When the STJ pronates, the longitudinal axis of MTJ supinates while the oblique axis pronates, thus increasing midfoot mobility. As the opposite limb swing pass the support limb, the tibial of the support limb externally rotate, causing talus to abduct to facilitate the initiation of STJ supination in late midstance. Supination of STJ will lock the MTJ to create a stable foot in preparation of a rigid lever to propel the foot forward.

**Plantar heel pain** is one of the common disorders of the foot among many athletes. Two commonly encountered plantar heel pains in daily practice, the plantar fasciitis and heel spur, bear close resemblance with each other, creating much confusion to differentiate between them. Plantar fasciitis is characterized by the inflammation of plantar fascia. It is often described as “first step pain” in the morning or after prolonged rest which typically improved with walking but may recur after long walking or standing. Though often asymptomatic, on the other hand, the plantar heel spur precipitated as tenderness over osseous overgrowth distal to medial calcaneal tubercle, and is exacerbated with walking or standing and only relieved with resting. The etiology of plantar fasciitis is believed to be multifactorial, including previous trauma, aging, fat pad atrophy, poor footwear, flatfeet, and leg-length discrepancy. The pathomechanics involved in the mechanical-induced plantar fasciitis includes abnormal STJ pronation and MTJ supination. Moreover, not all patients with excessive STJ pronation alone will develop plantar fasciitis. For instances, the medial band of plantar fascia may not always appear taut when STJ is abnormally pronated

in absence of forefoot pathology. In comparison, tightness in the medial band of plantar fascia will almost always co-exist with abnormal MTJ supination. From this phenomenon, it does suggest that abnormal MTJ supination plays a more dominate role than STJ pathology in the pathogenesis of plantar fasciitis. Abnormal MTJ supination is typically caused by excessive STJ pronation and flexible forefoot valgus. Excessive STJ pronation stimulates the MTJ supination as the foot maintain in a plantigrade position. Secondly, with forefoot valgus deformity, the everted position of the forefoot caused an increased amount of ground reaction force to load on the medial column, eventually leading to supination of MTJ. Physical examination includes palpation of the plantar fascia, the Jack's test, and passive ankle dorsiflexion-eversion test, Tinel's test. Radiological investigation may aid in the investigation to exclude plantar heel spur and calcaneal stress fracture. Initial treatment involves lifestyle changes, change of footwear, stretching exercises, arch support, padding, and pharmacotherapy such as non-steroidal anti-inflammatory medications and corticosteroid injections. Night splint, customized foot orthoses, and physical therapy have been considered as second-line treatment. Low-dye taping, initially discovered by Ralph Dye, aimed to provide support for the arch by decreasing the excessive subtalar joint pronation. Several studies have shown that taping can only provide short-term relief of pain. In many cases, taping has been used in conjunction with other treatment modalities and never used alone. Recently, extracorporeal shock wave therapy (ESWT) has been considered for treatment of tendinopathy, including plantar fasciitis. ESWT has been described to be "low-energy" or "high-energy" but no fixed value has been given to correspond to these descriptions. Moreover, several meta-analyses drew no firm conclusion to suggest their superiority over other conservative treatments. Many physicians consider the use of silicon heel pad or arch pad can address the plantar fasciitis. Though these pads can provide short-term relief, but it does not address the mechanical imbalance related to abnormal MTJ supination. Instead, to reduce the excessive MTJ supination, a lateral stabilizing force is needed. This can be achieved by applying forefoot valgus wedge. In patients with everted heel, 2mm medial heel skive can be added to the orthotic prescription, which increase the supinatory moment arm of the STJ to reinvert the STJ to its neutral position. Additionally, many podiatric physicians will consider adding plantar fascial groove or poron pad into customized orthosis, especially in those patients with very tender plantar fascia. Surgical interventions are reserved as the last treatment after all conservative treatments have failed.

**Posterior tibial tendon dysfunction** (PTTD) plays a significant role in the development of adult-acquired flatfeet. The PTT function primarily as supinator and plantarflexor of the midfoot and ankle, respectively. It eccentrically contracts to absorb shock and limit heel eversion during contact phase, facilitate the locking of MTJ in late midstance phase by adducting the oblique axis of the midtarsal joint. PTT dysfunction is a progressive condition where initial presentation is characterized by the insidious onset of localized tenderness to an area just posterior to medial malleolus with persistent swelling, reduced medial ankle instability and inability to weight-bear. PTTD is often preceded by previous trauma or sudden increased in frequency and/or intensity of physical activity. The pathophysiology starts with tenosynovitis with soft tissue swelling, eventually leading to tendon degeneration. As the tendon becomes dysfunctional and elongates, there will be insufficient heel inversion to lock the MTJ, resulting in unstable foot at midstance which function as a less rigid lever for propelling the foot forward. Meanwhile, markedly increase pronatory forces created by the unopposed pull of the peroneal tendons occurred which result in the attenuation of the spring ligaments occurred and resultant valgus deformity. The mechanical pull of Achilles tendon is altered from plantarflexor to evertor by the valgus deformity, as it lies lateral to the STJ axis, leading to worsening the valgus deformity. Following this, the talus plantarflexed, the calcaneus everted, the collapse of medial arch with concomitant failure of spring ligament, the forefoot will abduct at the talonavicular joint. As the deformity becomes fixed and more severe, tension build-up on the soft tissue structures of medial ankle. At late staging of PTTD, the deltoid ligament gives way leading to valgus tilting of the ankle. Physical examination of the foot includes palpation of area of tenderness, strength of PTT, Silfverskiöld test and the heel raise test (both single and double-heel raise). Classification of PTTD was initially described by Johnson and Strom as a 3-staging progressive condition, starting from tendinopathy without structural deformity, and ultimately leading to posterior tendon rupture. At the late stage, patient may present with fixed pes Plano valgus deformity with degenerative arthrosis and subsequent instability. Later, Myerson added a fourth stage to the existing Johnson-Strom classification, in which the deltoid ligament may be deficit and the deformity may progress proximally to involve ankle valgus, with or without lateral tibiotalar arthritis. Several diagnostic imaging techniques can aid the physician in confirming their provisional diagnosis. Though the role of plain radiography in the diagnosis of PTTD staging have remains debatable, it seems helpful to rule out other differentials. These include traumatic fracture or dislocation, tarsal coalition and degenerative arthritis. Physician should order the standard 3 views, namely the

anteroposterior, lateral and medial oblique. Among those quantitative parameters, the lateral talocalcaneal angle, the lateral talo-metatarsal angle and talonavicular articulation in the lateral view, while in the AP view, the talocalcaneal angle, talo-first metatarsal angle (also called Meary's angle) are used to assess the extent of pronation/supination in the foot. Magnetic resonance imaging (MRI) are proved to be more superior than plain radiography as it can demonstrate soft tissue oedema, accumulation of synovial fluid and can assist examiner to rule of soft tissue injuries from bony abnormality. Ultrasonography (US) provides a cheap and accurate alternative to MRI in the assessment of tendon structural integrity. Normal tendon gives a homogenous hyperechoic signal while degenerated tendon appears thickened and diffused hypoechoic. In the case of tendinosynovitis, the tendon is characterized by a hypoechoic rim in longitudinal scan while a homogenous hyperechoic continuous tendon is surrounded by hypoechoic excessive synovial fluid (target sign) in transverse scan. Several studies have suggested the sensitivity and accuracy of US is comparable to that of MRI, and has been suggested to be a reliable tool in diagnosing PTTD.

Treatment for PTTD is prescribed according to severity of deformity, flexible or fixed, ranging from conservative to surgical intervention. In the inflammatory phase of stage 1, the core of the treatment is immobilization with cast, walker boot or ankle brace for period of 6 weeks in concomitant with non-steroid anti-inflammatory drugs to facilitate tendon healing and reduce soft tissue swelling. For those patients with mild symptoms, over-the-counter orthosis with arch support should be sufficient. In stage 2 where the deformity is more obvious, customised orthosis with medial rearfoot posting and arch support is preferable over over-the-counter orthosis. Additionally, medial heel skive is added to the orthotic shell to augment the supinatory moment of STJ by shifting the GRF medially, thereby reduce STJ pronation and the subsequent loosening of the MTJ. In some cases, medial flange is added to the medial arch of the orthotic shell to serve two purposes. It accommodate for the medial bulging of the abductor hallucis muscle belly in case of severe pronation and improves control by increasing the surface area.

In more advanced stages of 3 and 4, conservative treatment is merely to accommodate the deformity rather than correction, as the deformity is usually rigid and fixed. The goal of the treatment is restriction of motion of STJ, MTJ and ankle joint. It is important that these restrictions are done to all 3 joints in the foot. Many podiatric physicians prescribe moulded polypropylene ankle-Foot-Orthosis (AFO) device to place the foot in fixed position. If the restriction is done only to STJ and ankle joint, it may exacerbate further degenerative changes as the MTJ will dorsiflex by compensating for the

lack of ankle dorsiflexion. Alternatively, AFO gauntlet which featured a customized polypropylene interior shell wrapped in lace-up leather on its exterior. This type of AFO can be fitted into shoes fairly easily without the need for customised footwear. Nevertheless, it is to note that conservative medical treatments have its limitation in late stage PTTD. Surgical intervention should be considered when all conservative treatment modalities fails or advanced fixed deformity is present.

The pathophysiological development in the foot as discussed in this paper has taken us into a different realm of medicine. Perhaps the mechanical side of medicine. Let's us not forgetting the foot is still form an intricate part of the body. Any pathology that happens in the feet can affect the knees, hip and the spine proximally. To complicate things more, the foot has 26 bones, 33 articulation joints with numerous muscles, tendons and ligaments, but all function as a single unit, to propel us forward.

# MUSCLE STRENGTHENING EXERCISE IN KNEE OSTEOARTHRITIS

**Dr. Adrian Jenny Khu Sp.OT**
Department of Orthopedics and Traumatology,
Prima University,
Medan, Indonesia.
*Email: adrianortho@yahoo.com*

## Abstract

The initiation, progression, and severity of knee osteoarthritis (OA) have been associated with decreased muscular strength and alterations in joint biomechanics. Chronic OA pain may lead to anxiety, depression, fear of movement, and poor psychological outlook. The fear of movement may prevent participation in exercise and social events which could lead to further physical and social isolation. Exercise is provided as a complex intervention combining multiple modes and provided in various settings under a range of conditions. Regardless of the variability in results and inherent biases in trials, exercise appears to reduce pain and improve function for persons with knee osteoarthritis and provide pain relief. Given the complexity of exercise interventions and the specific issues related to study design, novel approaches to the evaluation of exercise are warranted.

## Introduction

Knee osteoarthritis (OA) is characterized by pain, articular cartilage deterioration, and joint space narrowing and reduced muscle strength. Epidemiologic data indicate the impact of osteoarthritis on work disability in men over 50 years of age is only second to ischemic heart disease.[1,2] Some epidemiologic studies rely on radiographic evidence of osteoarthritis, but the correlation between radiographic changes in the joints and symptoms is modest at best[3,4]. While osteoarthritis may present in the spine and hands, the large weight-bearing joints such as the hips and knees are most frequently affected.

Clinical manifestations of osteoarthritis include altered proprioception, muscle weakness and atrophy, pain, stiffness, and limitations in func- tional activities and social participation. With progressive disease, malalignment and bone-on-bone joint pain may be present. Osteoarthritis management focuses on pain relief and maximizing function and independence. Pharmacotherapeutic options include acetaminophen, anti-inflammatory med- ications, glucosamine, chondroitin sulfate, capsa- icin and opiate derivatives.[2,5,6,7] These medications target inflammation and relieve pain. The integration of nonpharma-

cologic interventions such as therapeutic exer- cise, manual therapy, splinting, bracing, orthotics and assistive devices are recommended and provide a low-cost and minimal-risk option for patients to manage their disease. Among these nonpharmacologic interventions, therapeutic exercise is the most studied and supported in the literature.[6,8,9] In fact, exercise is a component of the management guidelines for hip and knee osteoarthritis among numerous professional rheumatologic and health societies.

While options exist to treat pain due to OA, few treatments can affect the above mentioned factors underlying OA. Muscle strengthening through resistance exercise (RX) increases physical function, decreases pain due to OA, and reduces self-reported disability.[5,9,10] RX, defined here as the use of machines (i.e. machines using a weight stack or added weights allowing selection of a given resistance load) or free weights as the external load, may combat the multi-faceted etiology of OA. This article will synopsize the highest quality evidence of the effects of RX on OA, and provide clinical guidelines for the prescription and expected adaptations to RX in the knee OA population.

**Etiology and Diagnosis**

OA can be seen as a two-part degenerative, chronic, and often progressive joint disease. It is the most common musculoskeletal complaint worldwide and is associated with significant health and welfare costs.[1] Within a joint such as the knee, there is a smooth fibrous connective tissue known as articular cartilage. This cartilage surrounds the bone where it comes into contact with another bone. In a normal joint, the cartilage acts as a shock absorber as well as it allows for even movement of the joint without pain. When cartilage degrades, it becomes thinner and may even disappear altogether leading to joint pain and difficulty in movement such as in knee OA. OA is characterized by a repetitive inflammatory response of the articular cartilage due to focal loss or erosion of the articular cartilage and a hypertrophy of osteoblastic activity or a reparative bone response known as osteophytosis.[10] Both of these defining characteristics result in a joint space narrowing or subchondral sclerosis, leading to pain, immobility, and often disability.[8,12] The symptoms of OA, such as pain and stiffness of the joints and muscle weakness, are serious risk factors for mobility limitation and lead to impaired quality of life for the affected population.[4]

To diagnose OA, the clinician might assess the nature and severity of the pain. It can also be diagnosed to measure the amount of movement in the joint. An X-ray of the knee-narrowing of the joint space is a good indicator of OA. Bony spurs can also be seen on an X-ray. In some cases, for further clarity and better diagnosis, the magnetic resonance imaging (MRI) scan may be necessary. This allows the clinician to see whether any damage to the soft tissue has taken place within the joint. In certain cases, a blood sample may be necessary to rule out the presence of other types of types of arthritis.[13]

**Non-pharmacological treatment modalities**

In this section, the currently available different non-pharmacological treatment modalities for cure of OA are discussed. Weight reduction is one of the first and unproblematic measures that can be taken to reduce knee OA. Studies of OA have constantly shown that overweight people have higher rates of knee OA than non-overweight control subjects. This is due to the fact that force across the knees is 3-6 times the body weight; therefore, people who have more mass cause extreme forces on their knees, leading to the early onset or steady progression of knee OA condition.[22] Individuals who are overweight may have circulation problems, possibly including a cartilage growth problem or a bone problem, which has the ability to cause cartilage breakdown or affect the bone underneath the cartilage, thereby leading to OA. Finally, overweight people have higher bone mineral densities, and high bone mineral density (or the absence of osteoporosis) may itself be a risk factor for OA.[9,23] Weight loss is therefore a logical step to relieve pain in these joints and to slow the progression of degenerative arthritis. According to a study conducted by Mao-Hsiung Huang and group, pain reduction and improvement of walking speed in various degrees of severity of arthritis was observed in the OA population undergoing prescribed weight loss procedures.[22]

Apart from weight reduction and avoiding activities that exert excessive stress on the joint cartilage, there has been no specific treatment to prevent cartilage degeneration or to repair damaged cartilage in OA. Therefore, for the past several years, research has focused on determining the causes of knee OA and to discover how to stop the progression of the disease, aside from lowering the effects such as pain and discomfort by therapy.[1,3,6] Some studies have even hoped to help reform the lost cartilage to return the knee back to health. A potential technique that can augment cartilage growth (stem cell tissue engineering approaches) is the use of electromagnetic field therapy (EFT). Modulation of

cell signalling events by weak electromagnetic fields is associated with binding of hormones, antibodies, and neurotransmitters to their specific binding sites.[24] Pulsed electromagnetic fields (PEMF) treatment preserves the morphology of articular cartilage and retards the development of OA lesions.[25] However, while supply limitations of stem cells can be overcome, the lack of tissue quality, specifically in the preparation of the differentiated stem cells toward the articular cartilage phenotype is still a major challenge for the researchers.[26]

However, the most widely used remedy for knee OA is rehabilitation and physical therapy (PT). PT has proved to be useful in helping patients with pain and mobility.[14,15] Fitness walking, aerobic exercise, and strength training have all been reported to result in functional improvement in patients with OA of the knee.[27] Having a clinical PT program has the benefits of onsite direction and availability of sophisticated equipment.[28] By and large, various studies[12,20,29] have shown that having these added benefits contributes to program adherence and overall higher outcomes while in the care of the PT.[12] These programs may be divided into PT at rehabilitation centre under the supervision and monitoring of doctors and trained specialists and the other one carried out through personal care as prescribed by medical practitioner at home.

**Resistance Exercise Programming**

Components of a RX program include resistance load, repetitions, velocity of movement and frequency of sessions per week. A periodic increase in the resistance load for each exercise permits continued muscular adaptations over time. Strength is best improved with lifting heavier loads with fewer repetitions, whereas muscle endurance is optimized by lifting lighter weights with more repetitions. RX can be described in terms of workload (number of repetitions at a given weight). When exercise total workload is kept constant, high-intensity (~6 to 8 repetitions at 80% of 1RM) and low-intensity (~12 to 15 repetitions at 60% of 1RM) induce similar strength and health adaptations in older men and women.[11–13] For knee OA, benefits can be obtained with leg exercises alone, or a combination of lower and upper body exercise for general strengthening. Basic components of the OA prescription should include seated leg presses (or a variation of squats), leg extensions and leg curls (with ankle or wrist cuff weights to provide resistance). Inclusion of hip adduction and hip abduction and calf/toe presses can help with improving and maintaining appropriate knee mechanics.

Initiation of a resistance training program requires assessment of strength, total knee range of motion, knee pain throughout the range of motion, and the patient's access to exercise equipment. Studies commonly report exercise intensity as the percentage of 1RM at which the exercises are performed. The term "repetition maximum" (RM) refers to the maximal number of times a load can be lifted before fatigue using appropriate form and technique (a 1RM = the maximum load that can be lifted once with proper form). Monitoring intensity during an RX program can be achieved by monthly reassessment of the exercise 1RM and readjustment of the resistance to provide an appropriate stimulus, or by subjective ratings of muscle effort during the exercise (e.g., Borg's rating of relative perceived exertion scale).[14] The 0–10 or 6–20 points relative perceived exertion (RPE) scales can effectively be used to help guide the difficulty of exertion during RX for each exercise.[15] Hoeger et al [15] demonstrated that exercises performed at the same percent of 1RM did not correlate to the same level of perceived difficulty. This may indicate that using the RPE scale to monitor effort may allow for each exercise to be performed at a similar level of perceived difficulty.

The severity of knee pain symptoms at rest and during the 1RM testing will provide important information when developing the initial resistance loads. While the radiographic findings are typically used to stage OA, these data have poor correlation to subjective pain ratings and functional limitations. Pain and range of motion are therefore more useful indicators of how to initiate and advance a RX program. For example, patients with low to moderate pain (between a 1–5 on a10 point scale) may be able to initially tolerate higher loads or repetitions compared with patients who report higher pain levels. A successful program will incorporate exercises to which the patient has access. If access to RX machines is limited or is cost prohibitive, a home based exercise program using dumbbells or weight cuffs can be substituted.

**Functional and Strength Improvements**

Functional change may be assessed using self-report instruments or objective functional tests. Disability questionnaires may ask objective questions of perceived ability, or have distinct activity subscales relating to ambulation, stair climbing, transfer activities, upper extremity tasks, basic activities of daily living, and complex activities of daily living. Objective functional tests used in these studies include: stair climb and descent times, picking up and carrying a 10 pound weight, and timed task of getting in and out of a

simulated car. Longer tasks include the six minute walk and walking endurance on an aerobic treadmill test.

Improving walking ability is clinically important as it is related to maintenance of functional independence, as well as a lower risk of mortality and admission to a nursing home.[27] Studies have shown that RX can decrease walking time on level surfaces for 60 meters by 8–10%[25] and improve six minute walking distance by an average of 28–45%.[28] Other studies have shown increases in median walking speed from 0.97 to approximately 1.12 meters per second (~15% change)[26] and 11% increases in habitual gait speed with RX and Sham groups over a six month period.[29] These improvements in gait speed[26, 29] are considered clinically relevant.[30] Other tasks such as times to perform climbing a flight of stairs and rising from a chair reflect the ability of the individual to transfer body weight. Stair climbing power has been shown to increase by 19%[28] and self-efficacy of climbing stairs significantly improves after RX.[23] Other data support that chair rise time decreases in similar ranges of 12–28%.[25, 28] Hence, in persons with knee OA, these mobility tasks become easier and are performed more efficaciously after RX training.

Muscle strength of the knee flexors and extensors consistently increases with RX interventions.[25, 26, 29] In a study that compared strength improvement with an RX intervention (leg press, leg extension) or a sham intervention (leg press, leg extension) Foroughi et al. found that both groups increased muscle strength in the knee flexors and extensors as well as the hip flexors and abductors with greater changes occurring in the RX group (25–49% strength improvement in the RX group versus 2–15% increase in the sham group).[29] Isokinetic knee torque can increase more following higher RX intensities (higher resistance loads, fewer repetitions) than low RX intensities (low resistance for high repetition number).[20] Dose-dependent improvements in isokinetic strength occurred with chair rise time, stair climb power and six minute walking distance post-training, with higher intensity exercise inducing the greatest change with no adverse safety issues. Specifically, walking time to complete a 12 meter walk on a spongy surface decreases by 42%–50% following low and high intensity RX and the time to complete a figure eight pattern with two 50 meter circles decreases by 38% to 45%.[25]

An advantage of a high intensity program is decreased total work-out time which may improve adherence. Long term studies that are

initially supervised and transition to home based programs show that knee extensor and flexor torque increased most during the initial 3–6 month phase and then muscle strength slowly declines over the following years after the transition occurred.[31] These data support the concept that improvements in symptoms and function are directly related to exercise intensity and that higher intensity RX (if maintained over time) would sustain muscle strength and preserve functional abilities. Figure 1 summarizes a potential pathway by which RX improves OA symptoms and disability.

**Resistance Exercise Prescription for Knee OA**

The prescription of RX for knee OA is provided in Table 1. Note that as the severity of the OA pain increases, modifications to the initial program and progression should be made for patient comfort and adherence. In general, the initiation phase of RX programs can involve strengthening exercise twice a week and work up to three times a week. The initial resistance loads and the range of motion of the exercises can be tailored to the patient tolerance. The goal should be to encourage training at an intensity to induce an RPE of 13–15 ("somewhat hard" to "hard"). The joint range of motion for the different leg exercises should be set as the maximum range that can be tolerated by the patient. During the progression stage the resistance loads or number of weekly sessions can be increased as the patient gains strength, confidence, and becomes skilled at rating muscle effort and interpreting knee pain during the exercise. A minimum of 24 hours rest between sessions should be implemented. Maintenance of strength gains and function over time can be achieved by performing leg exercises at an intensity that induces an RPE of 15–16. Variety in the exercise program can be infused with different leg exercises, performing unilateral versus bilateral exercise, or substituting free weight exercise such as squats with dumbbells, lunges, or step ups on to a stair or platform while holding light weights. Variety within the RX program fosters adherence and reduces stagnation. By following some guidelines for the relative RX activity (Table 2), injury risk is minimized in persons with knee OA.

In patients with severe pain (exceeding 7 out of 10), physicians should consider beginning with physical therapy and pharmaceutically controlling pain prior to adding greater resistance loads. An important point is that RX programs for OA need to be flexible to accommodate the disease flares and episodic pain bouts. Our experience revealed that minor modifications to the prescription (particularly to reducing resistance load and/or

range of motion) on “bad days” permits the patient to continue exercising, improves adherence, and bolsters self-confidence that they can still accomplish an exercise session. Within a few days, the patient may be back at the designated training load and joint motion.

## Conclusion

RX exercise is a vital component of the treatment for some of the underlying mechanisms of knee OA, including muscle strength insufficiency, muscle activation imbalance and aberrant biomechanics and cartilage loading. RX can be modified based on the patient symptoms and access to equipment. Progression and maintenance of benefits can be safely achieved by following the guidelines presented here.

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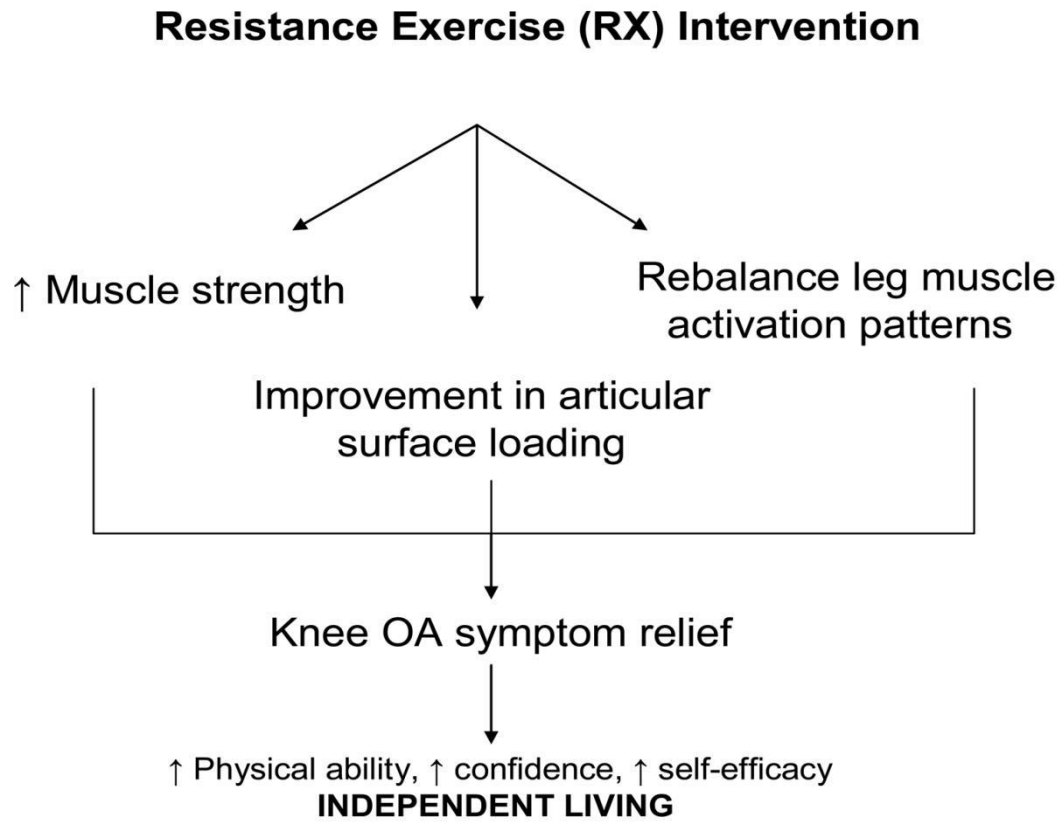





Figure 1 : Summary of main effects of resistance exercise (RX) on key musculoskeletal mechanisms underlying knee OA.

**Table 2**

Resistance exercise (RX) guidelines and prescription for individuals with knee OA.

| Severity of Knee Pain | Mild (1–4 points out of 10) | Moderate (5–7 points out of 10) | Severe (>7 points out of 10) |
|---|---|---|---|
| **INTIATION** | 2 days a week | 2 days a week | 2 days a week |
| | 40% 1RM | 40% 1RM | 30% 1RM |
| | RPE 13–15 | RPE 13–15 | RPE 13 |
| | Encourage full knee ROM | Encourage full knee ROM or ROM as tolerated | ROM as tolerated |
| **Notes:** | Ice and manage pain as needed | Take day off if flare is bad | Take day off if flare is bad |
| | | Manage pain as needed | Ice and manage pain as needed |
| **PROGRESSION** | Increase RPE up to 15–16 over 8 weeks | Increase RPE up to 15–16 over 8 weeks | Increase RPE as tolerated or up to 15 |
| | Increase frequency up to 3 days a week, at least 24 hrs between sessions | Increase frequency up to 3 days a week, at least 24 hrs between sessions | 2 days per week, if tolerated, potentially up to 3 sessions per week; at least 24 hrs between sessions |
| **MAINTENANCE** | Maintain 2–3 days per week | Maintain 2–3 days per week | Maintain 2–3 days per week |
| | Adjust resistance load to keep RPE at 15–16 | Adjust resistance load to keep RPE at 15–16 | Adjust resistance load to keep RPE ≤15 |

(ROM = range of motion; RPE = rating of perceived exertion)

Table 1

Relative RX activity guidelines for knee OA

**RX Progression:**

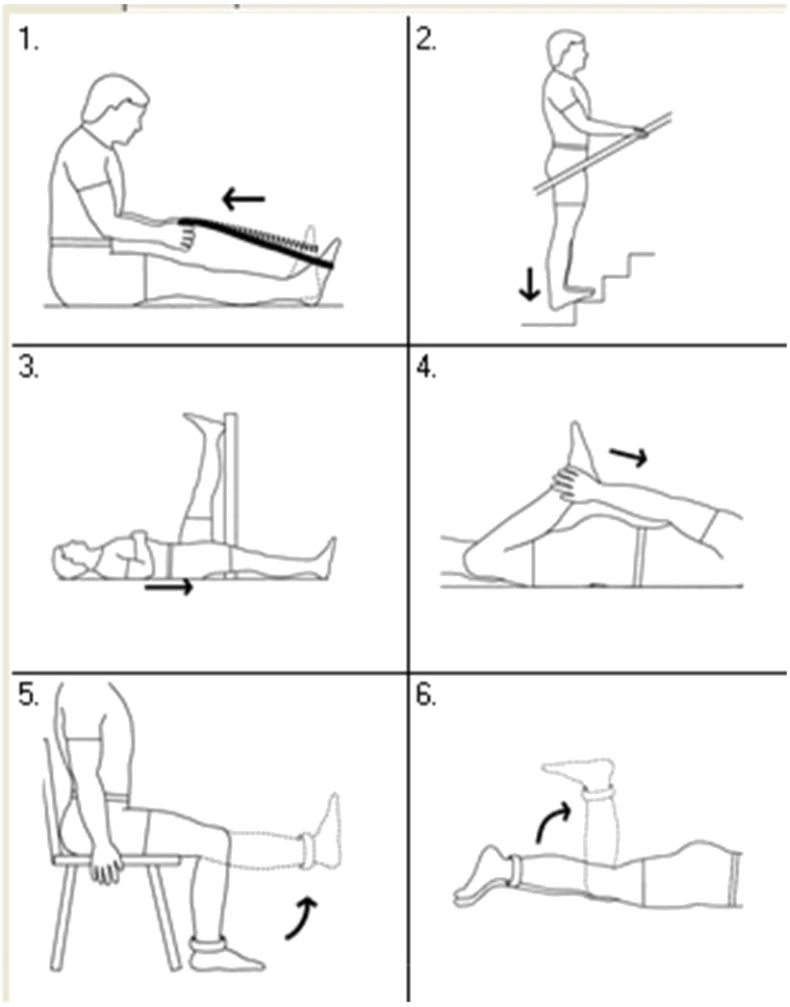
- Only change one variable of the program at a time (repetitions, resistance, frequency).
- Keep RPE in the recommended range and do not increase training volume by more than 5% per week.
- Ceiling Effect: The participant may find a training level at which the pain symptoms increase. This is the ceiling at which the volume should not be increased. At this time, other exercises can be mixed in to the program or substituted to provide a novel stimulus to the muscle group (e.g., substitute a lunge exercise periodically with a leg extension machine exercise).
- Do not perform RX for the same muscle group on consecutive days.

**Pain and Exercise:**

- No more than mild discomfort (0–3/10 point scale).
- If the participant feels moderate pain (4–6/10): recommend reducing the RX activity until pain level is mild.
- Pain that decreases with activity is generally **OK;** discontinue the exercise or reduce the intensity if pain progressively worsens during the exercise.
- Pain should not carry over to the next day – the " 24 hour Pain Rule". If pain is worsened by 24 hours after the RX session, allow the pain to subside and lower the resistance on the next RX session.
- No limping allowed.: If the exercise induced pain alters the participant's gait pattern, the activity was performed to intensely or incorrectly. Avoid the activity until it can be performed with normal biomechanics.

From Vincent KR et al. "RX Activity Guidelines for Knee OA"

Table 2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# OVERUSE INJURIES

**Dr. Edgar Michael T. Eufemio**
*Email: gareufemio@gmail.com*
*jonaruizo@yahoo.com*

The world is constantly evolving; individuals are now doing more activities that the human body was simply not originally designed to do - from everyday movements to sports.

This talk will be a combination of two previous lectures ***"Orthopedic Conditions in Millennials***" and ***"Diagnosis and Management of Common Sports Injuries"***.

From a sociological standpoint, the different eras in recent history has been divided into:

1) The Greatest Generation

2) Baby Boomers

3) Generation X

4) Generation Y or the Millennials

If you will look at all the images connected with the Millennials, you will see youngsters tinkering with their phones, tablets and laptops. Technology and Social Media has consumed this peer group. Words used to describe this age bracket include "techno-savvy" and ambitious.

The following are the most common musculoskeletal complaints in Millennials:

1) *"Text Neck"*

2) *"Selfie Elbow"*

3) *"Twitter Thumb"*

4) Carpal Tunnel Syndrome

5) de Quervain's Tenosynovitis

6) Low Back Pain

7) Osteoarthritis

A review of the census of Sports Clinics will show that the most common consults per region are:

1) Rotator Cuff Tendinitis

2) Low Back Pain

3) Patellofemoral Stress Syndrome

4) Plantar Fasciitis

We will discuss each entity and focus on tips to help diagnose and manage them better.

# EXERCISE AND EXTREME WORK HAZARD

**Lieutenant Colonel John Sham,**
'Scratch' RMAF
Malaysia
*Email: johnshamrmaf@gmail.com*

## Abstract

The lifestyle of a military fighter pilot is often associated with classic movies such as "Top Gun" or "Iron Eagle". Skydivers and stunt drivers on the other hand usually gravitate toward "Point Break", the James Bond or the Fast and Furious franchises. The silver screen usually showcases the glamorous, thrilling, exhilarating and exciting lifestyle of these dream jobs. Even though some aspects of the job description may be true, Hollywood manages to enthral their audiences with over-inflated truths that have their patrons wanting more.

A Fighter Pilot for example, experiences dangerous G-Force environments where blood pools into their lower extremities causing G-induced loss of consciousness (G-LOC). This debilitating environment has claimed the lives of many pilots. Thrill-seekers who pursue skydiving for pleasure, have been known to receive serious injuries when the parachute slows down the forward speeds of between 20 to 30 mph to a standstill during the landing phase. Formula One (F1) drivers, who subject themselves to rapid acceleration and deceleration, put tremendous stresses upon their bodies and have been known to suffer neck, joint, muscle and spine injuries.

Even though there are countermeasure mechanisms in place to diminish risks associated with these professions and pursuits, one should always be mindful of the limitations of human performance and physical abilities.

This paper sets out to highlight the many hazards associated with Fighter Pilots, Thrill Seekers (Skydivers), Stunt and F1 drivers; predominantly focusing on Fighter Pilots. Firstly, it will examine and evaluate hazards and threats associated with these professions and feature risks that result from these extreme work environments. Subsequently, the paper will discuss the relevance of exercise to mitigate these risks. Exercise and Extreme Work Hazard will also discuss the positive and negative impacts of exercise for these jobs. It shall not however, examine and present empirical data relating to injuries and medical details.

Finally, this paper will demonstrate the positive impacts of effective training and exercise regimens on Fighter Pilots, including evidences that prove the benefits of exercise.

Exercise and Extreme Work Hazard will conclude with the emphasis on the values derived from exercise, especially in the world of extreme work hazards.

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# HEALTH RELATED FITNESS TESTING IN CHILDREN: IS IT BENEFICIAL TO DEAL WITH NON-COMMUNICABLE DISEASES? SOME LITERATURE REVIEW

**Dr. Mahmoud Abdullah Othman**
Assistant Professor,
Faculty of Education,
Damascus University,
Branch of third Daraa.
*Email: Mahmoud1971@gmail.com*

## Introduction

Council of Europe have defined physical fitness (PF) as the ability to carry out daily tasks with vigour and alertness without undue fatigue, and with enough energy remaining to enjoy leisure-time pursuits and to negotiate unusual situations and unforeseen emergencies (Council of Europe 1983). In childhood, fitness encompasses performance (skill) -related and health-related components which can be appraised via standardized tests in laboratory or in field-based environmental contexts (IOM 2012). Components of skill related fitness are Balance, Reaction Time, Coordination, Agility, Speed, Power, and the health-related components of fitness are cardiovascular fitness (aerobic capacity), muscular strength and endurance, flexibility and body composition. These components are of particular awareness since they are interrelated to specific "health" or "disease" consequences, in our case "non-communicable diseases". The aim of the present paper is to clarify the relationship between physical activity, physical fitness and health, also to demonstrate the main actualities and contradictions related to children fitness testing throughout the associated literature.

## Health-related fitness vs Performance-related fitness?

Health-related fitness dimensions are related to overall health in children and adults. For instance, aerobic capacity is essential for decreasing risks of heart disease, diabetes, and strokes. Nevertheless, skill-related fitness components are linked to the attributes related to performance outcomes in various sports or in certain occupations, but they do not influence a person's health status directly (ACSM 2014, Xiangli & Melinda 2016). It's still important for children to develop physical skills in order to perform physical activity as adults, but health-related fitness is a more important objective and is necessary for all people. At any case, not all children can become elite athletes, but all children can enjoy the benefits of a physically active lifestyle. Health related PF is an important factor of health, and PA surely affects level of PF confirmed the significant correlations between the level of PF and

morbidity and mortality rates caused by noncommunicable diseases (de Souza 2014, Arriscado et al. 2014).

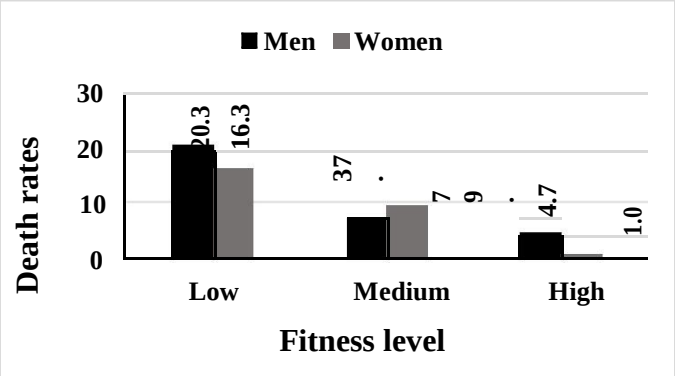


**Figure 1: effects of physical fitness on mortality rates*.**
(Modified from Gwen et al. 2017)

It is also suggested that PF is an integrated dimension of most, if not all, functions of the human body related to physical activity. The level of PA and PF in childhood and adolescence has an influence on the health status in adulthood (Cadenas-Sánchez et al. 2016). By exploring other views linked to morbidity and mortality, Gwen et al. (2017) provides definite evidences that physical fitness is associated with longevity (Figure 1). In this 8-year study, the subjects were categorized into physical fitness levels based on the treadmill test. The greatest reduction in risk of death occurred between the low and medium levels of fitness. Consequently, a modest improvement in fitness among the most unfit can bring about substantial health benefits.

**Children physical fitness assessment is problematic**

Even though, PF monitoring has been employed with children for decades, however, the methodological problems including the unpredicted and rising complications of assessing children's PF have been extensively acknowledged (Millard-Stafford et al. 2013). This may due to numerous reasons, most important are (Harris & Cale 2007):

1. The appropriateness of some fitness tests for use with children is questionable (the Multistage Fitness Test was developed for use with elite, adult populations).
2. A child's metabolic, cardiopulmonary, thermoregulatory, and perceptual responses to exercise are different from those of adults.
3. The reliability and validity of some fitness tests for use with children are questionable and the need for additional evidence of the reliability and validity of tests and test batteries has been documented.
4. Concerns about reliability and validity also stem from the fact that many factors influence children's performance on fitness tests and will be reflected in fitness test scores, namely: the environment/test conditions (temperature, humidity, wind

speed/direction); lifestyle (exercise/nutrition); test protocol/procedures; motivation, intellectual and mechanical skill at taking the test; heredity or genetic potential, and maturation.

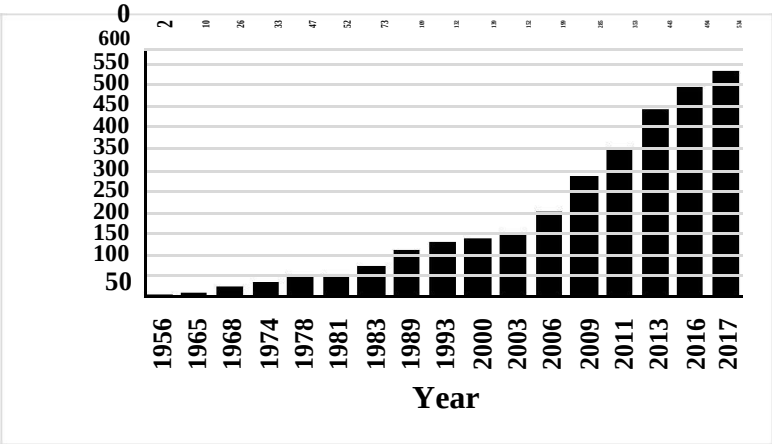


**Figure 2: tendency of investigating children's fitness testing (**Data had been composed from WebMD and Embase 2018 (April)

Since the early eighteenth of the last century and despite the rising problematic issues, there is an ascending progression related to the predisposition regarding children fitness testing (figure2).

**Fitness testing environmental contexts**

Physical fitness can be measured accurately through laboratory methods, however numerous of rising limitations can be recorded relating to laboratory fitness testing, most important are: the necessity for qualified technicians, sophisticated instruments, the high costs, time constraints and it is still not achievable for laboratory tests to be conducted on large samples in any particular location. On the contrary, field-based fitness tests (test batteries) are easy to administer, involve minimal equipment, have a low cost and can be applied on a larger number of participants over a period of time (Romero et al., 2010). In addition, these test batteries are widely used for measuring and assessing PF and health related PF in children and adolescents. There are several well-known, health-related fitness batteries to assess fitness in all its dimensions in young people. Some of these batteries are summarized in Table1.

**Table 1. Selected field-based physical fitness test batteries for children and adolescents.**

| Age | Acronym | Society/Organization | State/ Region |
|---|---|---|---|
| **6–18** | **EUROFIT** | Council of Europe Committee for the Development of Sport | Europe |
| **5–17** | **FITNESSGRAM** | The Cooper Institute | USA |
| **6–17** | **PCHF** | The President's Council on Physical Fitness and Sports/American Association for Health, Physical | USA |

| | | | |
|---|---|---|---|
| | | Education, and Recreation (AAHPER) | |
| **6–17** | **PCPF** | The President's Council on Physical Fitness and Sports/American Association for Health, Physical Education, and Recreation | USA |
| **6–17** | **AAUTB** | Amateur Athletic Union Test Battery. Chrysler Foundation/Amateur Athletic Union | USA |
| **6–17** | **YMCAYFT** | YMCA Youth Fitness Test | USA |
| **5–17** | **NYPFP** | National Youth Physical Program. The United States Marines Youth Foundation | USA |
| **5–18** | **HRFT** | Health-Related Fitness Test, American Association for Health, Physical Education, and Recreation (AAHPER) | USA |
| **5–18** | **Physical Best** | American Association for Health, Physical Education, and Recreation (AAHPER) | USA |
| **9–19** | **IPFT** | International Physical Fitness Test (United States Sports Academic/General Organization of Youth and Sport of Bahrain) | USA/Bahrain |
| **7–69** | **CAHPER-FPT II** | Fitness Performance Test II. Canadian Association for Health, Physical Education and Recreation (CAHPER) | Canada |
| **15–69** | **CPAFLA** | The Canadian Physical Activity, Fitness & Lifestyle Approach (Canadian Society for Exercise Physiology) | Canada |
| **9–19+** | **NFTP-PRC** | National Fitness Test Program in the Popular Republic China (China's National Sport and Physical Education Committee) | China |
| **6–12** | **NZFT** | New Zealand Fitness Test. Rusell/Department of Education | New Zealand |
| **9–19** | **AFEA** | Australian Fitness Education Award. The Australian Council for Health, Education and Recreation, ACHER | Australia |

A respectable example in Europe is the Eurofit battery and in the USA is the Fitness gram batteries, which both have been applied in many countries and for various purposes.

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# EXERCISE MEDICINE: DIABETES CARE IN FIGURES: CURRENT PITFALLS AND FUTURE SCENARIO

**Dr. Alexandre Assuane Duarte**
*Email: alexandreassuane@hotmail.com*

## Abstract

Diabetes mellitus (DM) epidemic—on a global scale—is a major and snowballing threat to public health, healthcare systems and economy, due to the cascade of pathologies triggered in a long-term manner after the DM manifestation. There are remarkable differences in the geographic disease spread and acceleration of an increasing DM prevalence recorded. Specifically, the highest initial prevalence of DM was recorded in the Eastern-Mediterranean region in 1980 followed by the highest acceleration of the epidemic characterised by 0.23% of an annual increase resulted in 2.3 times higher prevalence in the year 2014. In contrast, while the European region in 1980 demonstrated the second highest prevalence, the DM epidemic developments were kept much better under control compared to all other regions in the world. Although both non-modifiable and modifiable risk factors play a role in DM predisposition, cross-sectional investigations recently conducted amongst elderly individuals demonstrate that ageing as a non-modifiable risk factor is directly linked to unhealthy lifestyle as a well-acknowledged modifiable risk factor which, in turn, may strongly promote ageing process related to DM even in young populations. Consequently, specifically modifiable risk factors should receive a particular attention in the context of currently observed DM epidemic prognosed to expand significantly over 600 million of diabetes-diseased people by the year 2045. The article analyses demographic profiles of DM patient cohorts as well as the economic component of the DM-related crisis and provides prognosis for future scenarios on a global scale. The innovative approach by predictive diagnostics, targeted prevention and treatments tailored to the person in a suboptimal health condition (before clinical onset of the disease), as the medicine of the future is the most prominent option to reverse currently persisting disastrous trends in diabetes care. The key role of biomedical sciences in the future developments of diabetes care is discussed.

# INNOVATIVE TECHNOLOGIES TO FOSTER WELL BEING

**Dr. Alessandra Orlandi**
Humanitas Mirasole S.p.A
Rozzano (Milan), Italy
*Email: alessandra.orlandi@humanitas.it*

Connected health, also dubbed technology-enabled care (TEC), involves the intertwining of health technology, digital media and mobile devices and enables all the actors of the health space – patients/citizens, cares and healthcare professionals - to access data and information more easily to improve the quality and outcomes of health and social care. Due to the world's growing and ageing of the population, the rising costs of advanced medical treatments and highly constrained healthcare budgets, TEC is capable of providing cost-effective solutions to the increasing demand of services. The use and popularity of mobile technology has hence tremendously increased in the last decade thanks to the growing population of smartphone and tablet users, even among the elderly, and the proliferation of health apps and bio sensing wearables generating a continuous flow of Patient-Generated-Data (PGD) highly impacting patient and health professionals relationship and empowering and engaging people in sharing knowledge and awareness on their life styles to become co-producers of their health and wellness.

The presentation will detail the areas in which the use of the innovative data-based technologies, also known as Internet of Things (IoT), offer growing evidence for outcomes improvements, cost reduction and expansion of access to care. It will in particular focus on cases of transition from acute illness to normal health where event-specific data for a limited time period can improve the quality of recovery, it will discuss cases of chronic disease management where a continuous data stream helps to optimally manage a narrow set of known health issues, finally it will discuss the generation of high volumes of data to better-understand how certain determinants of health can affect patient populations and inform treatment guidelines. Next the implications of these technologies for healthcare providers will be discussed; in particular cases of remote monitoring of changes in health and the use of digital messages to remind or alert patients to adhere to their treatment or therapy will be detailed. The potential to shift some treatments from primary care clinics or hospitals to home care through the use of digital communication like e-visits, e-prescriptions and remote monitoring will be showed. The presentation will then highlight how the entry into the healthcare space of global technology and pharmaceutical companies

is creating new healthcare provider models and approaches to clinical research deeply transforming the patient experience and access to cutting-edge care.

The barriers to realize the full potential of data-based technologies will then be presented: particular emphasis will be put on issues such as quality, reliability, data overload, privacy and security. Further it will be discussed how these technology-driven solutions, often created without the involvement of the healthcare professionals, have been adopted with some level of reluctance and diffidence partly because of lack of education and training and concerns over liability and funding.

Finally, as the paradigmatic shift cannot happen by overriding existing wellness and chronic disease management practices and services, some of the most urgent trends to be supported will be presented as suggestions to both policy makers and researchers.

# AN ANALYSIS ON ADHD AND PHYSICAL ACTIVITY

**Sivashangkari D/O S.Silvakumar**
Asia college of exercise and sports medicine
*Email: shangkari.silva@gmail.com*

Attention deficit hyperactivity disorder (ADHD) is considered to be one of the most common neuro-developmental disorders, and is characterized by the following core symptoms: impulsivity, lack of attention, and behavioural motor symptoms. Less is understood about the relationship between ADHD symptoms and Physical Activity in adolescents. As such, the aim of the present study was to investigate the prospective relationship between ADHD symptoms and physical activity performance in a community adolescent sample. Fifty Five participants, aged 20 and 25, completed measures of ADHD, anxiety, depression, and motivation, and a test of general ability.

Participants were also asked for permission for their physical activity result to be viewed on a later occasion (approximately 6 months later). In regression analyses, ADHD symptoms were the most significant independent psychopathological predictor of physical activity performance, and were almost as significant as motivation. The result shows that adolescents and physical activity sparks real, positive changes in the brain that increase attention and improve mood. What's more, exercise is an inexpensive, self-prescribed, and accessible supplemental treatment option for adults with ADHD.

Endorphins, for one, hormone-like compounds that regulate mood, pleasure, and pain. That same burst of activity also elevates the brain's dopamine, norepinephrine, and serotonin levels. These brain chemicals affect focus and attention, which are in short supply in those with ADHD. Exercise isn't a miracle cure for ADHD, but it can make a contribution to a child's functioning better and feeling better, and it's definitely something worth trying.

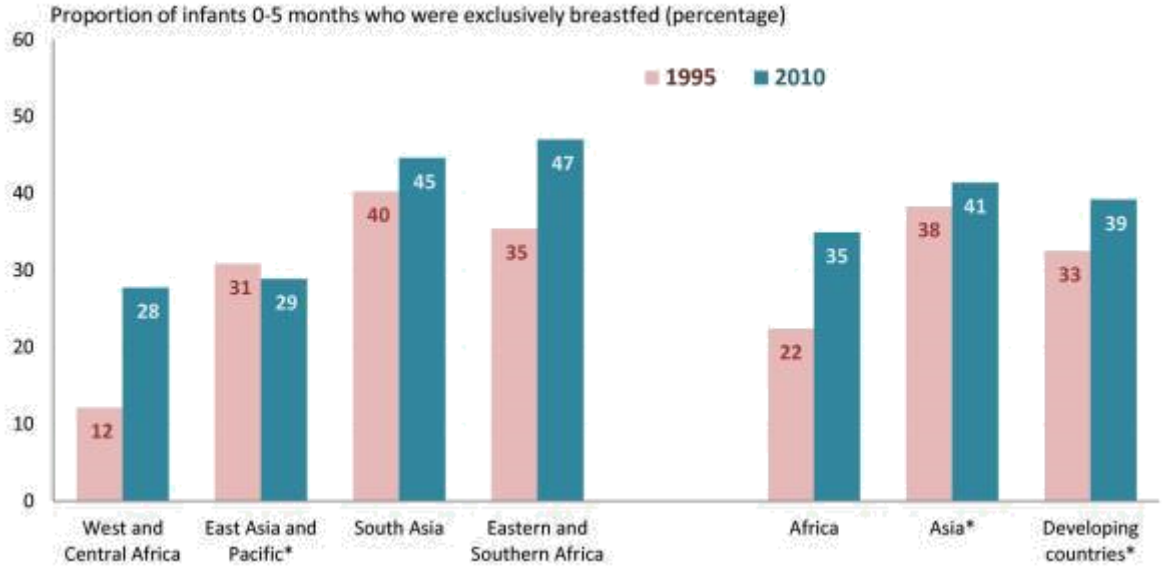
# IMPORTANCE OF EARLY INTERVENTION AND COMMUNITY SUPPORT TOWARDS SUSTAINING BREASTFEEDING

**Dr. Tengku Nur Atiqah**
MB, BCH, BAO (ucc ireland)
Certified lactation counsellor

*Email: bondahaven@gmail.com*

A mother's breastfeeding practice has a direct impact towards the survival rate and health of her new born infant. The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) recommend initiation of breastfeeding within an hour of birth, exclusive breastfeeding for the first 6 months of life, and continued breastfeeding beyond 6 months for at least up to 2 years of age, along with the introduction of nutritionally adequate and safe complementary foods. Optimal breastfeeding practices are so critical that they could prevent around 12% of deaths in children under five annually, which in 2013 would have amounted to around 800 000 lives saved in low and middle income countries. Children who are breastfed for longer periods have lower rates of infectious disease and death than children who are breastfed for shorter periods or who are not breastfed. Optimal breastfeeding practices also improve mother and infant bonding, help achieve optimum growth and development, protect against non-communicable diseases and benefit maternal health.

Globally, 44% of new-borns are put to the breast within the first hour after birth. Trend data suggest the prevalence of exclusive breastfeeding among infants younger than six months in developing countries increased from 33% in 1995 to 39% in 2010 (Figure 1). The prevalence increased in almost all regions in the developing world, with the biggest improvement seen in West and Central Africa where the prevalence of exclusive breastfeeding more than doubled from 12% in 1995 to 28% in 2010. Continuous improvement and research should be done to continue this increasing trend, and to reduce the drop-out rate of breastfeeding, especially in the first 6 months.




Lack of knowledge and confidence were found as the main reasons among mothers for less than optimum breastfeeding duration. Perception of insufficient milk and work outside the home were cited as common reasons for premature weaning or not breastfeeding exclusively. Paediatricians, nurses, midwives and lay counsellors should therefore actively promote and educate, while taking into account mothers' situational limitations.

The Baby Friendly Hospital Initiative (BFHI) and peer counsellor support are among the key strategies that has increased the success rate of breastfeeding. Other strategies that have been employed to increase education include mother-to-mother support and contact with lay counselors or trained personnel via home visits or telephone-based support. These interventions may be carried out in a one-to-one counselling session or may occur in a group setting or peer support groups. Apart from interactive counselling strategies, large-scale awareness programs have also been launched via mass, electronic and print media.

Multiple reviews have been published to establish the importance of peer counsellors and early intervention towards breastfeeding initiation, duration and exclusivity. A recent Cochrane review by Lumbiganon et al found that peer counselling, lactation consultation and formal BF education during pregnancy increased BF duration. The review conducted by Imdad et al concludes that EBF rates rose significantly as a result of educational interventions, with a greater effect observed in developing countries.

Prenatal education, screening and early interventions towards breastfeeding issues should be highlighted and further developed, especially in developing countries. Women are

significantly more in contact with the healthcare system during their pregnancy and first month of postnatal period. This opportune time should be optimally used to ensure that breastfeeding education have been delivered effectively. Screening and early interventions must be done should any breastfeeding issue arise to increase the rate of sustained EBF of at least 6 months, and then continued to at least 2 years, with introduction of nutritious and safe complementary foods.

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# HOW TO HELP WOMEN PREPARE SMARTER BODY FOR PREGNANCY: PRE-NATAL FUNCTIONAL TRAINING PROGRAM

**Dr. Vicky, Ya-Chi Hung**
Founder of Believe Functional Academy Lecturer of National Taipei University of Nursing and Health Sciences Department of Exercise and Health Science *Email: vickyhung@me.com*

Pregnant women were considered vulnerable and were advised to reduce their level of activity, whether it is a voluntary reduction by pregnant women themselves or the surrounding people (Barakat et al., 2008). But the whole pregnancy process is already a long term overload situation. Under this nature stress, pregnant women will be more cautious in physical activity and changes in their daily life during pregnancy.

Even exercise or physical activity can help women in many ways, the reality is this concept still hard to sell, not only for pregnant women but also for general population. The pregnancy process changes the structure of women on musculoskeletal and neuromuscular coordination which makes them unstable. The exercise suggestion for them is to engage in moderate to high intensity aerobic and resistance training. That is like encourage them to drive on the highway with car tires do not have four wheel alignment, which is high risk and energy waste, both are not good for pregnant women.

Exercise and pregnancy both will cause physical and mental stress for pregnant women. The physical stress is a 40 weeks continuing process, and the physical activity or exercise is a shorten stimulator. Healthy body can response stress better and adapt sooner. Pre-natal training is to establish a greater foundation in order for women to response the long/short term pregnancy stress well, not to put extra load to stress the body that is already been overloading. Therefore we need to discuss “How to prepare” instead of “How to stress” for it.

## Pre-natal Functional Training Program

The biomechanical structure of pregnant women is the first significant change. Gradually increasing abdomen changes the arrangement of posture caused muscle imbalance. It will altered the force couples of muscles, length-tension relationship, joint motion and change neuromuscular coordination. Before we encourage pregnant women to

start reparative and stressful exercise, they need to be taught how to prepare and move their body well.

The functional exercise program for pregnancy will contains the following elements: (1) 3D dynamic movement/Fascial work, (2) Muscle activation/Joint stability Training, (3) Movement preparation, (4) cardiovascular and strength training.

**1. 3D dynamic movement/Fascial work**

Pregnant women are not aligned the same way they were before pregnancy, The growing uterus can cause a woman's center of gravity to shift, making balance a bit awkward at times. On top of all this, the placenta produces the hormone “relaxin”, it relaxes the connections between bones, making it difficult for ligaments and other connective tissue to support certain joints.

Therefore the program start with **3D dynamic movement/Fascial Work** to increase the blood circulation, loose up the positioning tightness muscles, increase muscle awareness and also raise body temperature. The reason it start with movement work instead of static stretch is that because pregnant women tend to mobile then before which means the joints are less stable. That is not what we expect for pre-natal exercise. 3D Dynamic movement and fascial work can ease muscle tension and tightness, teach joint relationship, introduce corrected alignment and posture. Which open up the space; allow certain neuromuscular awareness inside the sensorimotor system to prepare for upcoming work as well.

**2. Muscle activation/Joint stability Training**

Once they know how to align the body and increase the freedom of movement. than is the time to introduce the muscle work. According to the posture characteristics of pregnant women, some segments will become weaker lead to faulty posture: rounded shoulder, forward head, lumbar extension, anterior pelvic tilt. Before starting a dynamic activity, these body parts must be stabilized to reduce the instability of the joints in the activity. Especially in certain area that tends to be affect by pregnancy:

(1) Shoulder Complex: shoulder girdle movement and shoulder stabilization
(2) Core / spine: trunk stiffness
(3) Lumbar-pelvic complex: pelvic stabilization

(4) Pelvic floor activation

Utilized isometric contraction in special poses to activate the target muscle group. Also via anti-movement strategy to increase segments stability.

**3. Movement preparation**

Exercise should be a function of numerous muscles working together to produce efficient movement patterns, as opposed to performing separate, discrete muscle actions. Improving movement skill requires using exercise to integrate how the central nervous system (CNS) receives sensory input from the environment with how the muscular system works to produce the appropriate motor response for movement. Movement preparation helps women to understand their body and execute their daily work as normal as possible.

Foundational Movement Pattern included: plank, push, pull, squat, lunge, hinge, rotate. Compare to cardiovascular and strength exercise, movement preparation more likely as low intensity dynamic activity, but it can still train the neuromuscular coordination and improve whole body blood and body fluid circulation.

**4. Cardiovascular and strength training**

This component requires more physical and mental effort and tolerance. Pregnancy with complication, sedentary life style before pregnant, before starting any exercise program should all need consult with other specialists.

The recently exercise prescription for pregnant women are: (1) Safety considerations during pregnancy: pre-exercise and ongoing risk assessment, appropriate hydration and energy, avoid hyperthermia, avoid hypoglycemia, prevent falling or over extension or over flexion (2) Exercise prescription for pregnancy women: aerobic exercise and strength training, performed for 30 minutes daily for five to seven days per week or 150 minutes per week, moderate intensity and increasing gradually.

**Conclusion**

Functional training is compound movements that are targeted at improving movement efficiency based on the natural patterns of human motion. Instead of asking pregnant

women to start exercising, it is better to prepare their body to deal the stress and handle all the change. The prenatal functional training program start with meaningful physical activity to improve joint mobilization and stability, movement preparation utilize body weight to learn how to move properly in the space. Finally, it is the aerobic and strength training. Exercise intensity gradually increases with four stages, and anyone can choose to stop at any stage. That will make the training itself more acceptable and less fearful. More able to let pregnant women start physical activity.

# EXERCISE AND LACTATION: SYSTEMATIC REVIEW AND EVIDENCE-BASED APPROACH TO EXAMINE THE EFFECT OF EXERCISE ON LACTATION-INDUCED BONE LOSS

**Dr. Ling-Ling Lee**
Department of Nursing, College of Nursing
Tzu Chi University of Science and Technology
Hualien, Taiwan
*Email: lllee@ems.tcust.edu.tw*

Beneficial effects of exercise on health have been well documented (American College of Sports Medicine, 2006). Previous review mentioned that approximately 200 mg/day of calcium is lost from maternal bones for producing milk during full breast-feeding (Prentice, 2000). The impact of exercise on lactation-induced bone loss is still unclear though the American College of Sports Medicine (ACSM) has appeal to a need for randomised controlled study and exercise interventions to examine the outcomes of mothers and their children in the prevention of chronic diseases for decade. This study aimed to systematically review the evidence for the impact of exercise on lactation-induced bone loss among postpartum women aged less than 40.

A systematic search of the literature was conducted using a range of electronic and evidence-based databases to identify studies. Criteria for study inclusion were a randomised controlled trial or observational study design; study samples were postpartum women without time limit aged less than 40 years; the intervention was any form of exercise and outcomes were focused on bone marrow density (BMD). Cochrane risk of bias table was used for appraising methodological quality. Review Manager 5.3 was used for data synthesis and an initial attempt of meta-analysis was carried out.

A total of three studies were included in the current review and two out of three were randomized controlled trials (Lovelady, Bopp, Colleran, Mackie, & Wideman, 2009) (Colleran, Wideman, & Lovelady, 2012) while the other was a case control design (Little & Clapp, 1998). Various forms of exercises, such as weight bearing aerobic exercise, resistance training or self-selected recreational exercise probably tend to slow lactation-induced bone loss. Results of analysis using fixed effect model showed that exercise might decrease 3% ($p=0.05$), 1% ($p$=0.24) and increase 2% ($p$=0.24) of BMD in total body, femur neck and lumbar spine, respectively (Figure 1).

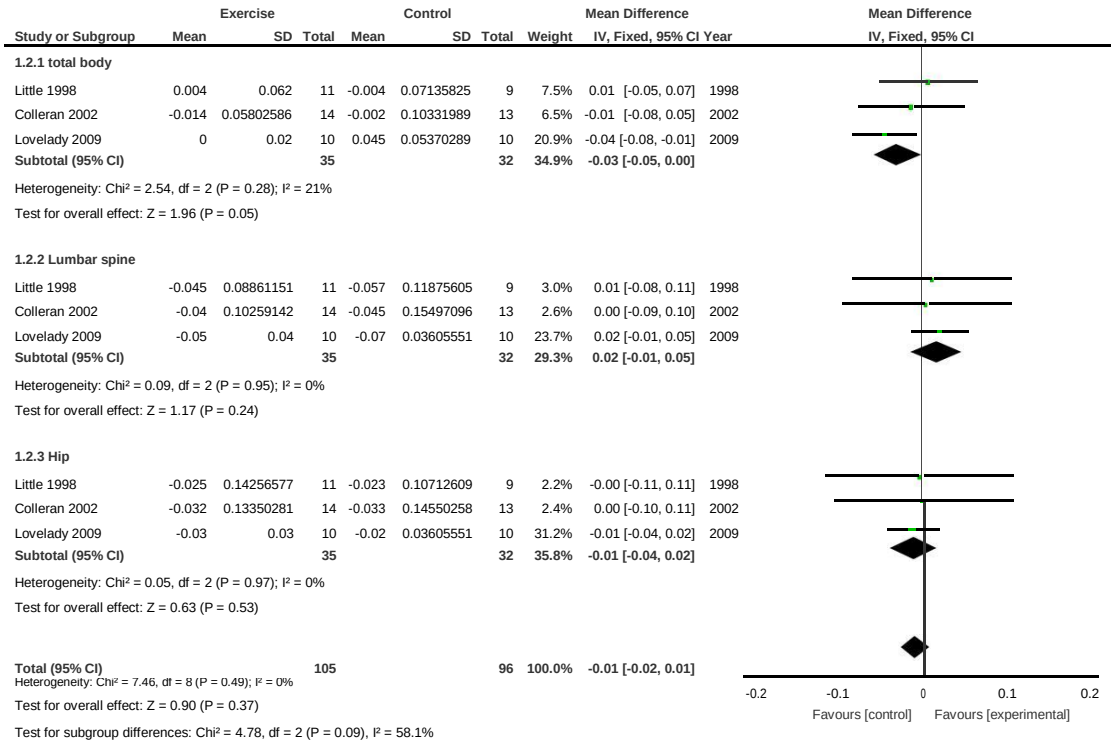


**Fig. 1 The effect of exercise on BMD of total body, lumbar spine and femur neck/hip**

The effect of exercise on lactation-induced bone loss could be impacted by the small sample sizes in the three included studies, which ranged from 20 to 27. Estimation of attrition rate is challenged when two out of three studies (Little & Clapp, 1998; Lovelady et al., 2009) did not mention the procedures of randomization and random sequence generation. The other clearly introduced the randomization procedure has the attrition rate less than 20% (Colleran et al., 2012). In addition, intervention designs of exercise among the three studies are heterogeneous, including resistant training and weight bearing aerobic exercise (Lovelady et al., 2009), regular self-selected recreational exercise (Little & Clapp, 1998) and with or without energy restriction (Colleran et al., 2012).

Evidence from this review suggests that various forms of exercise might slow or slightly increase bone marrow density, particularly in the lumbar spine compared to total body and femur neck. There are several potential confounders from different aspects. From exercise intervention design, intensity, adherence to exercise protocol, nutrition and diet composition, and with or without energy restriction may confound the results of BMD; from the aspect of lactating women, age, parity, body weight, body mass index may also impact their bone density among different studies. Future study with rigorous design of

exercise intervention to achieve better adherence and methodological quality is warranted. Only then, robust and applicable evidence can be built.

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# EXERCISE AND NEUROLOGICAL DISEASE

**Dr. Hyo Youl Moon**
Department of physical education,
Seoul National University,
Republic of Korea.
*Email: skyman19@snu.ac.kr*

Neurodegeneration is a disease of the central and peripheral nervous system including Alzheimer's, Parkinson's and various types of dementias. The pathology of these disorders is not uniform across the individuals due to different occurrence spots and causes of malfunction. Among these causes, aging is most closely related to the progression of these diseases. In terms of the sharply growing rate of life expectancy, it seems we need to prepare social, economic, and medical solutions for these neurodegenerative diseases. Indeed, neurological disorder such as dementia are the major burden for society, but often impact of it on the health and social services is less considered (Moon, Townsend, Whitlatch, & Dilworth-Anderson, 2017).

Along with aging, changes to the sedentary lifestyle accelerate the onset of brain-related diseases as well as metabolic diseases. Accumulated studies suggest that exercise capacity is a strong survival predictor for cardiovascular related diseases (Korpelainen et al., 2016; Myers et al., 2002) and the possible hall markers of prevention in neurodegenerative diseases (Barnes & Yaffe, 2011; Benka Wallen, Franzen, Nero, & Hagstromer, 2015; Loprinzi, 2015). Indeed, planned and repetitive exercise is one of strategies widely used to prevent or slow the effects of neurodegenerative diseases. Cognitive impairment is considered as one of the first clinical manifestation in many neurodegenerative diseases. Coelho et al. (2013) and Nascimento et al. (2012) found that subjects participating in regular aerobic exercise for more than 16 weeks improve the global cognitive functions (Coelho et al., 2013; Nascimento, Teixeira, Gobbi, Gobbi, & Stella, 2012). Despite the large number of evidences, the researchers concede that there is still no concord or sufficient theoretical ground to define the best physical activity intervention program for neurodegenerative diseases population (Farina, Rusted, & Tabet, 2014). It is difficult to generalize the results of the studies because of the difference in the severity of the subjects or the intensity, time, and frequency of the exercise that were used in the studies. To reduce these differences, one of the ideas is applying these physical activity trials based on an

objective, valid and mechanism-based accurate biomarker that representing stages of neurodegenerative diseases or exercise.

Several other studies attempt to clarify the underlying mechanism of beneficial exercise effects on neurodegenerative diseases. In this presentation, I would like to focus on the following contents as to what mechanism can affect exercise in neuronal disorders; Neurotrophic and circulating factors (Cooper, Moon, & van Praag, 2018), Vascular changes (Choi, Lee, & Lee, 2016), Mitochondrial changes (E, Burns, & Swerdlow, 2014), Epigenetics (Elsner et al., 2013) and Oxidative stress (Zajac, Chalimoniuk, Maszczyk, Golas, & Lngfort, 2015).

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# EXERCISE AND ALZHEIMER'S DISEASE

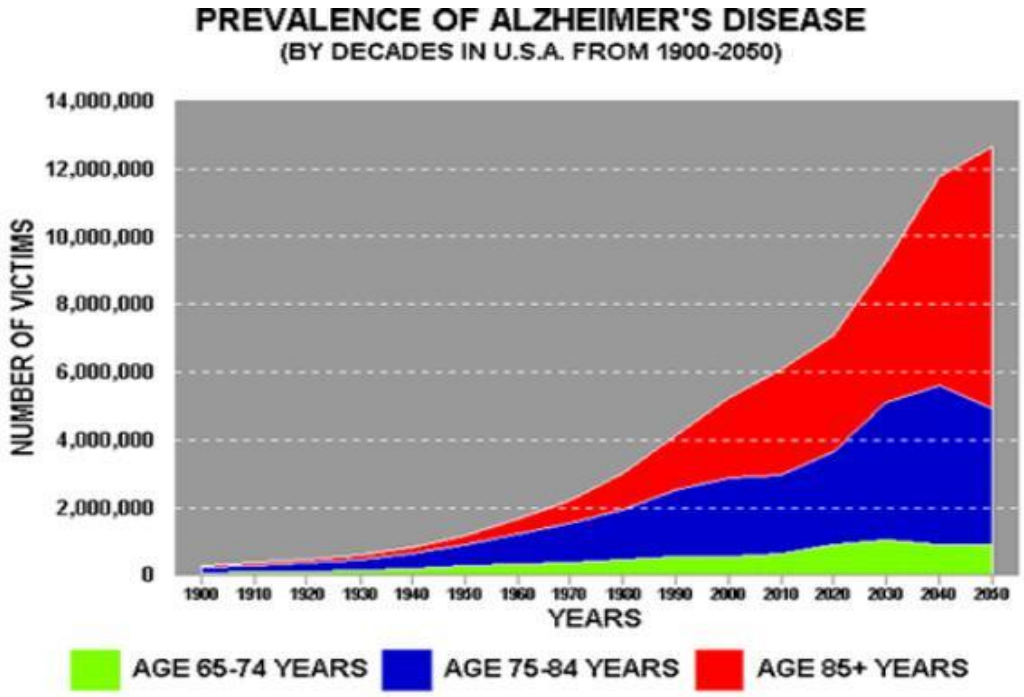
**Dr. Ravikumar katta**
Head of the department
Physiotherapy department
Lincoln University College
India
*Email: ravikumar@lincoln.edu.my*

Alzheimer's disease (AD) is a neurodegenerative disease in which brain cells are progressively destroyed causing a loss of cognitive, memory and physical function and a progressive decline in quality of life. Alzheimer's disease (AD) mostly affects older people, and is the leading cause of dementia. Molecular hallmarks of the disease are characterized by extracellular deposition of the amyloid β peptide (Aβ) in senile plaques, the appearance of intracellular neurofibrillary tangles(NFT), cholinergic deficit, extensive neuronal loss and synaptic changes in the cerebral cortex and hippocampus and other areas of brain essential for cognitive and memory functions. Aβ deposition causes neuronal death via a number of possible mechanisms including oxidative stress, excitotoxicity, energy depletion, inflammation and apoptosis.

According to WHO Alzheimer's statistics in 2015 Worldwide, nearly 47 million people have Alzheimer's or a related dementia .Among them63% live in low economic countries and this proportion is projected to rise to 71% by 2050. The total number of new cases Alzheimer's and related dementia each year worldwide is nearly 9.9 million, implying 1 new case in every 3 seconds. The number of people with Alzheimer's is expected to increase to 82 million in 2030 and 152 million in 2050. Only 1-in-4 people with Alzheimer's disease have been diagnosed. This number includes an estimated 5.5 million people age 65 and older and approximately 200,000 individuals under age 65 who have younger-onset Alzheimer's. One in 10 people age 65 and older (10 percent) has Alzheimer's dementia. Almost two-thirds of Americans with Alzheimer's are women.

Ageing is a risk factor of cognitive function impairment and dementia including Alzheimer's disease, which is characterized by **Cognitive symptoms :** mental decline, difficulty thinking and understanding, confusion in the evening hours, delusion, disorientation, forgetfulness, making things up, mental confusion, difficulty concentrating, inability to create new memories, inability to do simple maths, or inability to recognise common things **Behavioural symptoms :** aggression, agitation, difficulty with self care, irritability, meaningless repetition of own words, personality changes, restlessness, lack of

restraint, or wandering and getting lost **Mood:** anger, apathy, general discontent, loneliness, or mood swings **Psychological symptoms:** depression, hallucination, or paranoia **Other common symptoms:** inability to combine muscle movements, jumbled speech, or loss of appetite




## WHY EXERCISE IS IMPORTANT

The risk factors for Alzheimer's disease — which are largely associated with reduced physical activity — suggest that exercise can help to prevent or delay Alzheimer's disease.

Exercise can also be used as a 'medicine' for managing established Alzheimer's disease (AD) by: slowing the progression of Alzheimer's disease (AD) in people with mild to moderate cognitive impairment improving physical and mental function slowing or reversing the muscle wasting often associated with advanced disease improving mood and depression in patients with existing disease and lessening behavioural problems in people with advanced disease.

People who are physically active have a lower risk of developing Alzheimer's disease (AD) that those who are inactive. Furthermore, starting and maintaining an exercise

program is associated with reduced levels of beta amyloid — a protein that forms plaques on the brain and is currently thought to be the main cause of AD.

Exercise is important for people with Alzheimer's disease. Physical activity promotes a routine for a day and may increase emotional well-being. Moreover physical activity should be continued for as long as possible. This is to help prevent muscle weakness and to help prevent other health complications associated with inactivity. Exercise may raise brain chemicals that help protect nerve cells. Exercise also promotes a normal day and night routine, and may help improve mood.

**Beneficial effects of physical exercise on Alzheimer's disease**

Although there is a lack of consensus regarding optimal physical activities associated with AD prevention or improvement, aerobic activities and balanced training of moderate-to-severe intensities are considered optimal. Research studies suggested that although exercise has a positive effect on cognitive performance, cardiovascular fitness alone (VO2 Max) does not explain these benefits (43). However, the regular practice of walking improves cognition in Alzheimer's disease (AD), while strength training is particularly more effective for improving postural and motor function, and reducing the risk of developing AD, since it improves muscle mass and strength, shown to be affected in Alzheimer's disease (AD) patients. In addition, environmental conditions such as bright light exposure and good nutrition may play an important role in improving training results. Moreover regular physical exercise enhances the endurance of cells, tissues and organs to oxidative stress, increase energy metabolism, vascularization as well as neurotrophic synthesis, all of which constitute important inducers of neurogenesis, muscle development, memory improvement and brain plasticity. These benefits are important in the prevention of Alzheimer's disease (AD) and provide treatment options for age-associated neurodegenerative disorders such as Alzheimer's disease (AD)

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# EXERCISE AND PARKINSONS DISEASE

**Dr. Srikanth Babu Venga**
Chief Physiotherapist,
Menara Medical Centre,
International Journal of Physiotherapy and Research
*Email: jespalcoolsmile@yahoo.com*

Parkinson's disease is a progressive neurodegenerative disorder affecting the physical, psychological, social and functional status of individuals. Parkinson's disease affects between 4.1 and 4.6 million individuals over the age of 50 making it the second most common neurodegenerative disorder after Alzheimer's disease[1].

The initial clinical signs appear after the degeneration of about 60% of the dopaminergic neurons of the substantia nigra[2]. The manifestations of Parkinson's disease are in the form of motor and non-motor, resting tremors, bradykinesia, muscular rigidity and postural instability are the motor symptoms whereas non motor symptoms such as constipation, olfactory dysfunction, depression and cognitive deficits also occurs. Disease tends to worse with time leading to a general decrease in activity, an increased risk of falling, immobility and cognitive impairments[3].

Medical advances such as introduction of Levodopa Therapy have changed the life expectancy of patients with Parkinson's disease but this and other medications often results in side effects and long term complication such as dyskinesia and motor fluctuations[4].

There is growing evidence that exercise particularly vigorous exercise may provide Neuroprotective effect that can improve motor function, cognition and quality of life in patients with Parkinson's disease[5]. Underlying mechanism for the potential Neuroprotective effect are unclear, elevated plasma uric acid levels seen in vigorous exercises is hypothesized to play a role in the decreased risk and slower progression of the disease.

Cardiovascular Training that increases heart rate and oxygen demand appear to have direct benefit for the Parkinson's disease. Moderate (60%-65% of Max Heart rate for 4 days per week) to High intensity (80% to 85% of Maximum Heart Rate for 4 days per week) cardiovascular exercises in the form of Treadmill training[6] or assisted Cycling[7] for up to 30 min per session every other day has shown to reduce Bradykinesia and improve gait parameters.

Resistance training showed increase in muscle strength, muscle endurance, neuromuscular function, muscle force production and gait speed, all these improvements impact functional mobility. Moderate volume (3 sets each) high load resistance training 2-3 times per week helps to increase muscle strength without causing excessive fatigue[8]. Eccentric exercises results in high muscle force with low metabolic demand. Concentric exercises increases muscle hypertrophy.

Balance Training has a significant effect on postural instability, balance impairments and also improves gait. Virtual reality technology is proposed as a new Rehabilitation tool with a possible added value over traditional exercise approach. Studies suggest that 4-12 weeks of intervention leads to a moderate improvements in Step and stride length, balance and quality of life of patients with Parkinson's disease[9].

For patients who present with more advanced stage of Parkinson's disease or who cannot adhere to an intensive exercise regimen at home should seek the assistance and guidance from Exercise specialist.

**Conclusion:** In a clinical setting patients who undergo exercises consisting of strength training, balance retraining and gait training in addition to medications show short and long term increase in quality of life, mobility, walking speed and activities of daily living (ADL"S) compared to patients who only receive medication.

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# DELAYING ONSET OF OSTEOPOROSIS THROUGH EXERCISE

**Associate Professor Dr. Ooi Foong Kiew,**
Exercise and Sports Science Programme,
School of Health Sciences,
Universiti Sains Malaysia,
16150 Kubang Kerian,
Kelantan, Malaysia.
*Email: fkooi@usm.my*

Bones are like dynamic factories, where bone cells are continuously engaged in the remodeling of the bones. Bone remodeling consists of two processes, i.e. bone resorption and bone formation. During young age, bone formation rate is higher than resorption rate, thus bone growth occurs. In older population, bone resorption rate is higher than bone formation rate, thus osteoporosis occurs. The recognition of osteoporosis as a major health problem among the growing number of elderly people around the world has resulted in widespread efforts to determine the causes of the disease and how it might be delayed or prevented. Osteoporosis is a silent disease characterized by low bone mass and deterioration of bone tissue, which increases fracture risk. Osteoporotic fractures are common in vertebral body, hip and wrist; the sites where bone is more active metabolically. Fracture of vertebrae resulting in kyphosis, a typical widow's hump which causes back pain. It is known that a number of factors may predispose a person to develop osteoporosis. These risk factors include reduced bone mineral density, female sex, early menopause, low body weight, immobilization, malnutrition, deficiency of protein, calcium and vitamin D deficiency, alcoholism, cigarette smoke, heredity, geographic and racial differences. Many previous studies support the notion that proper diet, adequate intake of calcium and vitamin D, and regular exercise can help one to prevent and reduce the risk for developing osteoporosis.

In older population, the aim of physical activity for the elderly is to minimize bone mineral density losses, maintaining bone mass, increasing and maintaining general fitness, muscle strength, stability and coordination, and most importantly the prevention of falls that may lead to bone fracture. Bone fracture in elderly needs prolonged and expensive care. It is notable that physical inactivity, postural instability and muscle weakness are contributors to the risk of fall, and subsequently bone fracture. Regarding the exercise prescription for elderly, it is suggested that elderly should exercise for 2 to 3 times per week, 20 to 30 minutes per session with low impact exercises, based on the fact that bones in elderly are

unable to cope with the high stress elicited by high impact exercises, and high impact exercises may be injurious to the osteoporotic bones. The targeted exercise activities for elderly should also have a greater impact than general programs for preventing falls. A comprehensive fitness program including cardiorespiratory, flexibility and strength training is recommended. The prescribed exercise needs to be modified depending on pre-existing health condition. The proposed activities are such as walking, Tai Chi, dance, swimming, chair exercises, mild stretching, supervised resistance exercise with free weight attached to the limbs, or rubber tubes attached to a secure object etc. It is believed that although walking at moderate intensity is not a strong bone stimulus, the maintenance of muscle strength and the coordination associated with regular walking can be highly advantageous in reducing falls related to frailty. Exercises which should be avoided by elderly include dynamic abdominal exercises, for instance, 'Sit ups', and some movements such as twisting as in golf, and trunk flexion as in bowling and rowing. Activities with abrupt, explosive and high impact loading such as down hill skiing; mountain biking, horse riding should also be avoided.

Generally, the suggestions for maximizing the effects of exercise on the bone and potentially reducing the incidence of bone fracture include: i. Starting exercise when young while the bone is most responsive to mechanical stimuli. ii. Selecting weight bearing exercises that are high impact to maximize bone responses in children and adults. iii. Continuing to exercise as ones age to prevent bone loss and reduce the risk of falls. Following these steps may help to promote skeletal health at all ages and reduce an individual's risk for fracture by augmenting bone mass, size and strength during youth, while reducing age-related bone loss later in life.

In conclusion, prevention of osteoporotic fractures should begin at an early age. Since small changes in bone mass during youth can have a meaningful impact on bone health later in life, therefore life long regular exercise initiated early in life, combined with a balanced diet are recommended to enhancing bone health for preventing osteoporosis.

# SUDDEN DEATH IN EXERCISE

**Dr. Mohd Sapawi Mohamed**
Consultant Cardiologist
Hospital Raja Perempuan Zainab II
15586 Kota Bharu,
Kelantan, Malaysia.
*Email: drmsapawi@moh.gov.my*

Exercise and/or physical activity is beneficial for healthy individuals and for those at high risk for cardiovascular disease (CVD), as well as for those with established CVD. In contrast, physical inactivity and sedentary lifestyle is an additional risk factor for CVD. Despite the putative benefits of habitual physical activity, convincing evidences has shown that vigorous physical activity transiently increases the risk for sudden cardiac death (SCD) and acute myocardial infarction (AMI).

Fatal cardiac events related to exercise and sports are a particular tragedy as it may strike apparently physically healthy individuals. SCD associated with exercise are quite rare. The incidence varies according to population studied and highly gender-dependent with rates in females being 2-25 times lower than men. The overall incidence is between 1:50,000 and 1:100,000 per year in young athletes. It is higher in older adults, close to 1:7,000 healthy adult athletes per year.

By definition, sudden death during exercise is defined as those occurring during or within 1 hour after vigorous physical exertion. Vigorous exercise is defined as an absolute exercise rate of 6 METS or an oxygen uptake of approximately 21 ml/kg/min. It also has been defined as unexpected, atraumatic death occurring within 6 hour of a normal or stable state of health. It includes fatality during or shortly (< 30 minutes) after completion of activity.

Many of these deaths are unexplained. Nevertheless, a substantial number of young victims (age < 35) have underlying structural and potentially detectable cardiovascular diseases. This includes hypertrophic cardiomyopathy (HCM), anomalous origin of a coronary artery, coronary atherosclerosis, arrhythmogenic right ventricular cardiomyopathy (ARVC) and myocarditis with some variations among different studies. SCD during athletics also occurs in the absence of structural heart disease (primary electrical disease or channelopathy). Examples include long QT syndrome, Brugada syndrome, catecholaminergic polymorphic VT (CPVT), short QT syndrome and early repolarization

syndrome (ERS). Majority of these events are due to ventricular fibrillation (VF) or ventricular tachycardia (VT) degenerating into VF which occurs during or shortly after exercise. The rhythm could have been deteriorated to asystole before the first rhythm able to be captured by cardiac monitoring device. Intensive and chronic exercise training and competitive sport participation is a trigger that may favour life-threatening ventricular tachyarrhythmia in these predisposed individuals. In addition to this, in predisposed individuals, intense exercise itself has been shown as a promoter of cardiac injury by accelerating an inherited predisposition to cardiomyopathy, exacerbating the severity of cardiac damage due to undercurrent illness (such as myocarditis) and causing arrhythmogenic remodelling.

In persons aged 35 or older, coronary artery disease is the major cause of death during exercise or sports. The mechanism causing exercise-related sudden death in persons with established disease, especially of the coronary arteries is attributed to myocardial ischemia due to coronary plaque rupture or thrombosis and also ventricular arrhythmias originating from myocardial scar. Coronary artery disease in subjects below 35 years is rare and most often caused by familial hypercholesterolemia. Over the past 5 years, in our clinical practice, we are seeing increasing numbers of younger individuals who suffers from coronary artery disease. Our National Cardiovascular Disease Database (NCVD) data showed an alarming albeit small increasing trend of younger age group (< 40 years) presented with acute coronary syndrome (ACS) with 7.12% in 2015 as compared to 6.5% in 2011.

Individuals at risk of SCD includes those with traditional risk factors, namely age (men > 45, women > 55), family history of coronary artery disease or SCD, cigarette smoking, hypertension, diabetes, dyslipidaemia, obesity and sedentary lifestyle, particularly if combined. Undeniably those individuals who already had established coronary artery disease are at even higher risk. Early identification, appropriate treatment followed by physical activity adjustment may be implemented to minimize the risk of SCD. The AHA 14-points Questionnaires which include personal and family history as well as physical examination should be implemented. The high risk individuals should be assessed by physician and undergo series of tests and investigations to identify their risk of SCD before they engage in intense exercise. Both the American Heart Association (AHA) and the American College of Cardiology (ACC), as well as the European Society of Cardiology (ESC), recommend pre-participation screening for athletes. The ESC (but not the AHA)

recommends including a resting electrocardiogram (ECG) in the screening evaluation. The Sports Cardiology Section of the European Association of Preventive Cardiology (EAPC) recently in 2018 has updated their recommendations on sports participation for patients-athletes with coronary artery disease (CAD), coronary artery anomalies (CAAs), or spontaneous dissection of the coronary arteries (SCAD).

Comprehensive and thoughtful emergency response planning and implementation is crucial to prepare for and manage sudden cardiac arrest (SCA) in the athletic settings. Effective communication with local emergency facilities should be encouraged. Public access to automated external defibrillator (AED) and first-responder AED programs improve survival from SCA.

Some patients with channelopathy and all survivors of SCA should receive implantable cardioverter defibrillator (ICD) as prevention for sudden death. Some patients with cardiac rhythm disorders may benefit from ablation procedure. The European and Bethesda recommendations state that roughly every athlete with channelopathy is not eligible to participate in sports on a presumed risk of VT/VF. General advice is that all patients should avoid stressful environment and strenuous exercise, dehydration and/or excessive sweating, electrolyte disturbances, hyperthermia, and exercise during fever. Nevertheless, recently, there are studies which show that individuals with channelopathy and ICD are safe to resume their exercise and sport activities. Recommendations and decision for resuming exercise activity and the type of sports for this patients should be individualized and consultation with electrophysiologist or cardiologist should be sought after.

# CARDIOVASCULAR REHABILITATION

**Dr. Nidal Tourkmani. MD**
Algeria
*Email: nidaltou@gmail.com*

Cardiac Rehabilitation (CR) is the branch of cardiology interested in improving clinical, functional, physical, and psychological status of patients who suffer from cardiac disease such as acute coronary syndrome (ACS), heart failure (HF) or those who underwent cardiac surgery or percutaneous intervention. This task involves exercise training, control of cardiovascular risk factors and psycho-social support by a multidisciplinary team. Although the current data available in recent literature confirms that cardiac rehabilitation structured in secondary prevention programs, exercise training, health education, and counseling is able to reduce cardiovascular mortality, cardiac rehabilitation participation rates are low for men and women. Additionally, the current evidence has demonstrated gender differences for the access to cardiac rehabilitation programs.

Differences in the enrolment of patients for cardiac rehabilitation might be explained by the higher age, the higher percentage of functional dependence and worse clinical performances. However, these wrong beliefs must be overcome as cardiac rehabilitation programs are useful to improve clinical performance and functional status also in a more compromised.

Cardiac rehabilitation has evolved over the past decades from simple monitoring for the safe return to physical activities to a multidisciplinary approach that focuses on patient education, individually tailored exercise training, modification of the risk factors and the overall well-being of cardiac patients. It has been proven to be an effective tool for the care of the patients with heart diseases.

Recent research in cardiac rehabilitation has demonstrated that tremendous benefits can be derived from the optimal use of cardiac rehabilitation in patients with various cardiac pathologies including ischemic heart disease, heart failure and post heart surgery. The benefits of cardiac rehabilitation include mortality reduction, symptom relief, and reduction in smoking and improve exercise tolerance, risk factors modification and the overall psychological wellbeing. Unfortunately, cardiac rehabilitation remains considerably underutilized mainly because of referral problems and poor enrollment. The development of

alternate approaches and the use of trans telephonic and other means of monitoring and surveillance will help expand the utilization of cardiac rehabilitation.

Sex differences are found to impact cardiac rehabilitation participation with women having poorer participation rates than men. Barriers to women's participation include the lack of financial resources, transportation difficulties, and the lack of social or emotional support.

Although studies have shown that the elderly might have greater needs for cardiac rehabilitation and that they achieve excellent outcomes with a low of adverse events, older individuals are less likely to be referred to and to participate in cardiac rehabilitation.

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# ECTOPIC HEARTBEATS AND EXERCISE

**Dr. Domenico Cianflone**
University of Milan,
Italy
*Email: d.cianflone@hsr.it*

Ectopic beats are a common finding in either in symptomatic or asymptomatic subjects. Their occurrence triggers a number of clinical actions along with a certain degree of wariness on patients. These arrhythmias are casually detected during a screening visit, possibly for a preliminary assessment before to subscribing to a gym or a physical activity event or non-professional competition. Their occurrence usually bears no clinical significance.

Nevertheless, since in some cases the presence of ventricular ectopic beats indicates susceptibility towards life-threatening arrhythmias or an underlying cardiac disease a thorough clinical assessment is required.

Moreover, in competitive athletes ectopics may be occasionally recorded during pre-event ECGs. The clinical importance of these findings is still debatable with studies implying a benign consequence of athlete's heart, while other suggest a structural heart disease (or cellular/molecular) with a risk for sudden death.

Back in 1950 Wood's *Diseases of the Heart and Circulation* stated ".. it is wise to assume to assume the innocence of ectopic beats under any condition and to judge organic disease on other grounds". Still in the 28 April 1973 of the British Medical Journal a paper on the significance of ectopic beats concluded that there was no firm conclusion that should not warrant an antiarrhythmic fight and subjects with more frequent ectopic beats with exercise to avoid strenuous exertion.

The "Prevalence and long-term significance of exercise-induced frequent or repetitive ventricular ectopic beats in apparently healthy volunteers" paper (JACC 1989) concluded that "frequent or repetitive exercise induced ventricular ectopic beats in asymptomatic individuals without apparent heart disease do not predict increased cardiac morbidity or mortality and therefore, do not require specific therapy."

Nevertheless, in those years the usage of *anti*-arrhythmic drugs was widespread until the famous CAST study which demonstrated the unfavorable *pro*-arrhythmic effects: increased mortality with the indiscriminate use of those drugs.

This approach seeded medical knowledge so deeply that even today the key issue is the frequency of arrhythmic events that demands for the exclusion of an actual cardiac disease of any kind.

Still, ventricular ectopic beats not provoked by exercise or reduced during exercise can be regarded as without clinical significance. However, this notion is not thoroughly supported by scientific examination.

Exercise testing is the most commonly used procedure to diagnose myocardial ischemia and to stratify patients with ischemic heart disease. Early papers did not establish an association between exercise induced ventricular ectopic beats and prognosis over a relatively short follow up period.

Exercise has undoubted benefits and results in many structural and functional changes of the myocardium that enhance performance and may prevent heart failure. Nevertheless, intense exercise also presents a significant challenge to right hearth secondary to an excessive increase in afterload and wall stress up to an actual damage that can be now measured with circulating cardiac troponin levels.

Fortunately, the approach of classifying ventricular arrhythmias by their origin as provided an important and simple tool to stratify patients. A relatively benign prognosis is the case of right ventricular outflow tract tachycardia. It is a form of idiopathic ventricular tachycardia's, in the absence of structural heart disease.

All these concepts are tied to a simplified cardiac diagnostic approach with which stress-ECG and echocardiogram are the key and (most commonly) the only diagnostic testing considered.

Moreover, since the last two decades novel cardiac diseases have been identified and these conditions carry the burden of increased complex arrhythmias and sudden cardiac death:

- Long QT syndrome
- Brugada Syndrome (and its triggers)
- Hypertrophic cardiomyopathies
- Arrhythmogenic right ventricular cardiomyopathy (ARVC)
- Non-Compaction myocardium

❖ Miocarditis

Currently in selected patients the addition of cardiac MRI allows to asses and diagnose patients in whom a significant cardiac disorder is of tantamount value: let's just consider how many cases of mild and self-limiting/healing myocarditis can nowadays be identified

In summary: The appropriate indication to an adequate diagnostic assessment is the cornerstone for subjects with ectopic beats.

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# IS EXERCISE TRAINING BENEFICIAL FOR HEART FAILURE PATIENTS TAKING BETA-ADRENERGIC BLOCKERS IN IMPROVING QUALITY OF LIFE AND CARDIORESPIRATORY FITNESS?

**Dr. Hashbullah Ismail**
Cardiovascular Rehabilitation
University of New England
*Email: hashbull@yahoo.com*

Published trials and reviews have identified benefits of exercise therapy or training for people with heart failure (HF), including fewer hospitalizations, increased cardiorespiratory fitness, better quality of life, reduced brain natriuretic peptides, increased left ventricular ejection fraction (LVEF) and possibly improved survival. A large number of Chronic Heart Failure (CHF) patients still have poor quality of life regardless of recent improvements in pharmacological treatments. A study by Skotzko et al. (2000) showed that more than 50% of CHF patients were depressed. Exercise training has now become a cornerstone for implementing more efficient therapeutic approaches to improve quality of life. A systematic review by Williams et al. (2001) reported data from 16 studies, over two-thirds reported improved quality of life in CHF patients who exercised. A meta-analysis by Van Tol et al. (2006) also reported there was improved health-related quality of life in exercising CHF patients which was assessed through Minnesota Living with Heart Failure Questionnaire (MLWHFQ). Exercise training in patients with chronic heart failure is useful for improving their psychosocial status. Improvements in psychological status seem to be independent of the aerobic gains. Nevertheless, the efficacy of exercise training on functional capacity and quality of life is not yet known in terms of long-term effects, although it has been known to give benefits in the short term. Large, long-term, pragmatic trials of exercise training in patients with HF are needed to determine the effectiveness of exercise training on morbidity, quality of life, and mortality. Part of the justification for this work was to prevent withdrawal from beta-blocker treatment, especially in older patients with chronic heart-failure has been reported to be twice that previously reported in younger patients. As with our analyses, the work of Baxter found there was no evidence of a negative impact on symptoms or exercise capacity in patients who tolerated bisoprolol (Baxter et al., 2002). Another reason for poor uptake of, and compliance with, beta-blockers is fear of depression.

This body of work seeks to add to the evidence-base of safe and practical guidelines for the implementation of exercise training to improve quality of life in chronic heart failure

(CHF) patients. We aimed to compare various exercise program characteristics to see which produced larger effect sizes for change in peak $VO_2$ compared to sedentary controls. A systematic review and meta-analysis was conducted to compare the effect of exercise training in heart failure patients taking beta-blockers vs. those who do not. We archived data on types of beta-blocker, age, gender, peak $VO_2$ and ventricular ejection fraction. Energy expenditure on aerobic training was calculated using established equations (O'Connor et al., 2009).

Minnesota living with heart failure score (quality of life questionnaire) was significantly better in the exercise versus sedentary control (both groups taking beta-blockers) MD -11.3 (95% C.I. -15.9 to -6.8, $p<0.00001$). Our work also showed that there were no differences between classifications of beta-blockers on the magnitude of exercise training adaptations, despite previous reports that beta-adrenoceptor blocking agents with intrinsic sympathy-mimetic activity (ISA) have lesser effects on exercise capacity (Ades, 1987). The physiological rationale is that beta-blockers with intrinsic sympathy-mimetic activity (ISA) have smaller reductions in heart rate compared to beta-blockers without ISA (Wilmore et al., 1985). Other effects of ISA are reduced skeletal and cardiac cardio-toxicity and inhibited myocardial apoptosis (Cruickshank, 2007). It seems that the absence of intrinsic sympathy-mimetic activity is the vital component for optimal results.

Our analyses showed quality of life was significantly better in patients exercising and taking beta-blockers, compared to sedentary patients taking beta-blockers. Depression should not be the reason for reluctance in prescribing beta-blockers to cardiovascular patients.

Our data suggest that exercise intensity may provide the greatest stimulus for adaptation to exercise training. Our data provided some evidence that weekly energy expenditure, program and session duration also have an impact on magnitude of adaptation. These data may offer the possibility that heart failure patients may be able to progress, with appropriate caution towards high intensity exercise if they should tolerate initial (lower) intensities adequately. Data from our analyses of exercise training intensity effects on cardio-respiratory fitness suggest a uniform decrease in percentage peak VO2 change with decreasing exercise intensity.

As a conclusion, exercise therapy or training seems to be safe and effective in improving functional capacity, quality of life, LVEF, cytokines, catecholamine and brain

natriuretic peptides expression. Exercise training appears safe and is recommended adjunct therapies for heart failure with reduce ejection fraction (HFrEF) and heart failure preserved ejection fraction (HFpEF) patients. Exercise training shows a dose response improvement in various clinical measures in CHF patients and future work is likely to focus on high intensity exercise training which has potential to yield even more favorable results for CHF patients. Future work should demonstrate robust study designs and reporting, thus strengthening inferences and conclusions from exercise training studies in cardiac populations.

# THE USE OF NOVEL EXERCISE MODALITIES IN CONTROLLING BLOOD GLUCOSE LEVELS IN PRE-DIEBATES AND TYPE 2 DIABETES

**Dr. James Brown**
*Email: j.e.p.brown@aston.ac.uk*

Obesity is a global pandemic that has drastically increased in incidence over recent decades, with over 2.8 million people dying annually worldwide due to overweight or obese body types (WHO). Obesity can be defined as accumulation of excessive adipose tissue that is associated with increased risk of a number of serious conditions including metabolic syndrome (MetS), cardiovascular disease and type 2 diabetes mellitus (T2DM). The prevalence of T2DM itself is increasing rapidly worldwide. In 2015 the global prevalence of adults with diabetes was estimated to be around 8%, with 90% of these cases thought to be T2DM, and this is projected to increase to over 10% by 2040 (1). T2DM is associated with insulin resistance in insulin-sensitive tissues, including adipose tissue, liver and skeletal muscle. Skeletal muscle accounts for the majority of post-prandial glucose disposal and is therefore a key tissue involved in regulating the risk of developing T2DM.

Studies have previously reported that physical activity (PA) can improve insulin sensitivity and that regular PA reduces the risk of insulin resistance, MetS and T2DM (2). Insulin sensitivity has been shown to improve when individuals comply with PA guidelines, providing a potential therapeutic target for individuals at risk of developing T2DM (prediabetes) or those newly diagnosed. Research has indicated a potential dose response, with higher exercise intensities producing greater benefits on whole-body SI, although these findings are not unanimous.

As barriers to PA exist in the population that T2DM occurs in, novel exercise modalities have recently been tested to see if blood glucose and glycated haemoglobin (HbA1c) can be regulated in shorter bursts of exercise. These modalities include high intensity interval training (HIIT), a form of exercise that involves alternating periods of high intensity exercise and periods of recovery and exercise snacking, which is a term used to describe shorter periods of exercise that collectively add up to meet the recommended guidelines for PA.

Data from recent studies has suggested that even low-volume HIIT leads to rapid improvements in glucose control in individuals with T2DM (3) and separately when subjects with T2DM broke their exercise up into three small portions performed shortly before breakfast, lunch and dinner this “exercise snacking” lowered blood sugar for the following 24 hours better than 30 minutes of continuous exercise (4).

Talen collectively, these studies suggest that novel exercise modalities are potentially useful tools in the treatment of prevention of T2DM. Further larger scale randomised controlled trials are needed to adequately test the efficacy and safety of these interventions.

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# EXERCISE AND NUTRITION IN TYPE – 1 DIABETES

**Dr. Luis Paulo Gomes Mascarenhas**
Universidade Estadual do Centro-Oeste,
Paraná, Brazil.
*Email: luismsk@gmail.com*

The management of type - 1 diabetes mellitus (T1DM) is based on three cares: insulin therapy, nutrition, and regular practice of physical activity. Physical exercises are associated with metabolic demands that depend on the individual's energy stores, level of physical conditioning, and modify according to environmental conditions and intensity, duration, and type of exercise (Mascarenhas *et al.*, 2016).

Patients with T1D for a safe practice of physical activity should have pre-exercise glucose levels below 14 mmol/L (250 mg/dL) and or ketonemia (<0.5 mmol/L). A routine of regular physical exercises and the maintenance of a good glycemic may bring several health benefits to diabetic patients and associated with the reduction of risk factors of cardiovascular diseases, maintenance of body weight, reduction in blood pressure and the incidence of chronic complications, such as diabetic nephropathy, retinopathy and neuropathy. Regular physical activity and improved cardiorespiratory fitness can play an important role in the prevention of these complications (Tonoli *et al.*, 2012).

Guidelines of the American Diabetes Association (2015) and the American College of Sports Medicine (2010) recommend the prescription of individualized exercise regimens with well-defined objectives to diabetic individuals. These recommendations include participation in exercise sessions of moderate intensity for at least 150 minutes a week in the absence of contraindications such as diabetic neuropathy, proliferative diabetic retinopathy, uncontrolled hypertension, and metabolic ketoacidosis (Robertson *et al.*, 2014).

Carbohydrates must comprise 50–60% of the daily diet of diabetic athletes performing regular exercises, which should be coordinated with the time of the exercise and the dose of insulin. This approach is fundamental to an ideal glycemic control, maintenance of muscle mass, and storage of hepatic and muscular glycogen, optimizing the exercise performance, reducing fatigue, and preventing complications (Macknight *et al.*, 2009).

Table 1. Nutritional recommendations for T1DM patients involved in physical activities.

| **During the activity** |
| --- |
| Ingestion of 0.5–0.6g of carbohydrates per kg of body weight for every hour of activity. In activities lasting more than 2 hours, ingestion of a larger amount of carbohydrates (0.8 g/kg) may be necessary. |

| |
|---|
| During prolonged and high-intensity (>70% $VO_2$max) training or competitions, ingestion of 15g of carbohydrates at each 30–45-minute interval.<br>This amount of carbohydrates may increase blood glucose levels by 30–50 mg/dL, 15 to 30 minutes after their ingestion (Gonder-Frederick, 2001). |
| Food rich in solid or liquid carbohydrate may be ingested. Liquid foods help with hydration, while solid foods may prevent hunger. However, liquid foods are more widely recommended (Coyle & Montain, 1992). |
| **After the activity** |
| Ingestion of 1.5g of carbohydrate per kg of body weight after the end of prolonged exercises (>90 minutes).<br>Ingestion of carbohydrates immediately after the exercise helps to replenish glucose stores in the muscle and liver (Ivy, katz & Cutler, 1988). |
| An additional amount of 1.5g of carbohydrate per kg of body weight may be required 1 to 2 hours after the exercise to reduce the risk of post-exercise hypoglycemia. |
| Blood glucose monitoring is required immediately after the exercise and 1 to 2 hours later to adjust the caloric intake and insulin dose. |

FONT: Mascarenhas et al., Motriz, 2016.

Glycemic control during the practice of physical activities becomes then challenging for professionals working with T1DM patients. The fitness improvement associated with regular physical exercise in T1DM patients clearly demonstrate the importance of physical activities in these patients' health and quality of life.

Review studies demonstrates that with the practice of 20 to 60 minutes of exercises continuous or intermittent (ranging from 4 to 30 sprints, duration time 4 to 15 seconds), with periods of passive recovery or active recovery of moderate intensity, can be expected a reduction in blood glucose. Through the analysis of the studies it can be concluded that the practice intermittent exercises may help in reducing the risk of hypoglycemia induced by exercise. However, the schedule of insulin application may be associated with exercise-induced hypoglycemia. Therefore, it is suggested to carry out new studies with a greater methodological rigor and higher number of subjects, to increase knowledge and to better inform and guide the practice of exercise and nutrition in a safe, adequate and effective way to type 1 diabetics.

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# NUTRITION FOR FEMALE EXERCISERS

Dr. Nur Farhana Abdul Hadi, MD
*Email: dextro.fafa@gmail.com*

Today's women are actively involved in physical activities and exercises than ever before. The U.S Bureau of Labor Statistics reported a 15 percent increase of sports and exercises among women in the US on an average day in year 2003. By year 2015, this figure has increased to 17.7 percent. (1)

This phenomenon happens because women nowadays start to realize the importance of being healthy. One of the key ingredients to good health is exercise. Exercise helps improve cardio respiratory and muscular health, bone density as well as reduce the risk of non-communicable diseases. (2) Exercise also helps keep depression at bay; an illness that is increasingly faced by modern women. (3)

The World Health Organization has suggested that at least 150 minutes of moderate intensity aerobic, or at least 75 minutes of vigorous intensity aerobic; or an equivalent combination of both should be done throughout the week for an optimum health benefit.

All these said, active women need a balanced nutrition to stay healthy and energetic. For that, every active woman must take a step back and have an honest relook at her diet: is her eating habits suitable with her nutritional needs?

The calorie needs of an average adult woman ranges from 1800 calories to 2400 calories per day, depending on how active a woman is in her day- to- day life. (4) But that's not all, a caloric requirement of a woman may differ according to one's age i.e. whether the woman is pre or post-menopausal, her metabolic rate, her level of activeness and her illness history, if any.

Generally speaking, calorie requirement decreases with age because the use of energy will be lower in an older woman as compared to a younger woman. This is also partly due to a significantly lower basal metabolic rate in the former as compared to the latter. (5)

On another note; it seems that due to time shortage, busy work schedule, looking after the family, so on and so forth; many women tend to neglect their nutritional needs. Unfortunately, when a woman does not get her adequate nutritional and energy needs whilst

carrying out her daily activities, she will be exposed to the risk of injury. She will also be facing slow muscle recovery post exercise. (6)

Talking about slow muscle recovery post exercise; a few studies have been made regarding physical activities and exercise- induced amenorrhea. It is found that the main reason that disturbs a woman's regular menstrual cycle are body weight problem, body composition, physical and physiological stress, energy imbalance, dietary habits and state of reproductive maturity. (7)

Some women who are active resort to reducing their calorie intakes so that they can get their dream body weight without taking into account the fat composition that they should maintain. The Frisch et al (1974) study stated that women can easily experience menstruation cycle hiccups when their body fat are 22 percent less than the correct amount of fat needed to maintain. This is because hypothalamus sensitivity of the gonadal steroids is altered. (8)

Now let's talk about bone health.

It is estimated that 200 million of women worldwide suffer from osteoporosis. (9) The main culprit is lack of calcium intake in everyday diet. Calcium intake for an active woman should be 1000 mg per day. As for a woman who is in her post-menopausal stage, she must take not less than 1200 mg of calcium per day. (10) This is because, menopause contributes to bone loss due to decrease in estrogen production. (11) Together with exercise; adequate calcium intake helps maximize bone health and inevitably reduces the risk of osteoporosis. (12)

Another important factor for women to look into is their red blood cells rate and iron intake. The normal rate of a woman's haemoglobin is >12 g/dL according to the World Health Organization. That said, a woman with menorrhagia and who are of childbearing age may experience blood loss and depletion of red blood cells. (13)

(13, 14)
This factor is crucial because a woman's activity may be hampered as she may easily become fatigued if her haemoglobin rate decreases, which is increasingly a common complaint. Therefore, women are advised to take ≥ 18mg of iron per day, combined with folic acid, vitamin C and B 12 to maintain their red blood cells count and their haemoglobin rate.

To finish off, it is advisable for women to do a regular routine health checkup so that potential health issues can be dealt with and nipped in the bud before they become serious. Women are also encouraged to seek professional advice from certified dietitians on meal plans and ways on how to correctly choose food that is suitable for one's own needs.

Last but not least, knowledge on the importance of nutrition must be taken seriously so that women can stay active and enjoy optimum health as they become older.

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# SUPPLEMENTATION FOR EXERCISERS

**Dr. Mahenderan Appukutty[1*] and A.M.G.C.P. Adikari[2]**

Faculty of Sports Science & Recreation, University Technology MARA, Shah Alam, Selangor, MALAYSIA University of Sri Jayewardenepura, Nugegoda, Sri Lanka *Email: mahen@salam.uitm.edu.my*

Sport and exercise nutrition is a constantly developing discipline that has received much attention. The advancement of sports has led to a significant increase in research and production of nutritional supplements for sporting performance. Healthy diet forms the foundation for physical performance. The macronutrients provide energy to maintain body functions during different kind of physical activities and rest. The importance of micronutrients has also been recognized not merely for athletes but also for those engaged in exercise. Carbohydrate is the predominant fuel source in moderate to high-intensity exercise. Protein-containing foods play a role in optimizing the adaptive response and assist recovery following exercise. According to the Burke et al. (2000), there are a wide variety of products that are available commercially; sports drinks, carbohydrate-rich energy products (sports gels and sports bar), protein and protein components, vitamins, minerals and herbal extracts in the form of powder, liquid, gel, bar, capsule and tablet. Nevertheless, it must be emphasized that these foods and ingredients are not considered as a magic bullet or solution for enhancing sporting performance. Healthy and properly designed diet is only one aspect of a comprehensive approach to improve performance and overall good health. This paper focuses on the nutritional supplements thought to enhance performances and local nutrition supplement products that are available but with limited information on efficacy and safety which requires further research to evaluate their potential for enhancing performances in sports.

Although there is no clear definition for the dietary supplements, Maughan, (2018) define it as a food, food component, nutrient, or non-food compound that is purposefully ingested in addition to the habitually consumed diet with the aim of achieving a specific health and/or performance benefit. The use of nutrition supplements is very rampant among elite and novice athletes which mainly due to heavily influenced by manufactures and marketing strategies who claim that the products able to increase muscle mass, improve stamina and so forth. Due to that for modern athletes, the term sports nutrition has become synonymous with nutrition supplements. The benefits of most supplements are still

equivocal. The claims are not backed up by scientific studies, unrealistic and some may not show any changes at all. The claims that manufacturers make about nutrition supplements are apparently difficult to regulate. There is not much strict regulation applies to test, advertising and promoting nutrition supplements. Athletes must critically examine the risk and benefits of the nutrition supplements based on claims made by the industry before using it. An advertisement may explain how a product enhances metabolism within a cell, which may sound very plausible. In reality, the research may report that the substance may not even reach the cell due to it not surviving the digestion process.

At present, many substances or treatments have been used in an attempt to increase performance capacities and one of these approaches that are being practiced is the nutrition based ergogenic aids. Nutrition based ergogenic aids are supplements, which purported to improve performance among athletes in a variety of ways, primarily by enhancing the energy efficacy, energy control or energy production. Although, there is evidence that nutrition-based ergogenic aids have enhanced physical performances especially in well-trained and well-nourished elite athletes, however, additional research is warranted to evaluate their potential for enhancing performance in specific athletic events (Singh R, 2010).

There are many metabolites, constituents, and extracts of plants and animals that supply a lot of benefits to athletes by increasing their performance directly or non-directly. In general, these products are theorized to enhance various physiological processes involved in energy production for sports performance. Many of these products consist of single ingredients, while others may be combinations of several substances. Ichihara, et al., (2018) revealed that 4 weeks paprika (xanthophylls) supplementation increase the total plasma xanthophylls and carotenoids and decrease oxygen uptake in high-intensity exercise and lower the fatigue after exercise. Similarly, Urbaniak, et al., (2018) revealed that daily usage of pomegranate juice contributed to a significant strengthening of plasma antioxidant potential in the group of well-trained rowers. However, the use of nutritional sports supplements substances and practices are controversial and there is great concern about the number of athletes engaging in the use of ergogenic aids. Due to ethical violations associated with the inequities that result in competition and health problems that can result, use of these unsubstantiated nutrition substances cannot be overlooked.

Intake of a broad range of dietary supplements in Malaysia using locally available for ergogenic or health purposes has been expanded considerably during the last decade. Although not much data available, there are some studies been conducted in local universities that have shown some interesting findings to explore either in human or animal trial. The local researchers have used many types of traditional food and combination with commercialized food in investigating the efficacy of food in sports performance such as Bee bread by Wong et al (2018), Herbal drink (AgroMas) by Ooi et al (2001), Young coconut drink by Saat et al. (2001); Ismail et al. (2007) and Singh, (2009), Palm vitamin E by Chen et al. (2006), Bovine colostrum by Appukutty et al. (2011); Appukutty et al. (2010); Appukutty et al. (2008); Appukutty et al. (2007); Appukutty et al. (2006), Probiotics by Appukutty & Ramasamy (2011), Sago by Abdul Rahman et al. (2006); Hishamuddin et al. (2005); Hishamuddin et al., (2006) and Soy by Ler et al., (2006).

Athletes who trained effectively and who adapt to new physical domains can easily lose their progress due to the lack of proper nutrition (Jeukendrup, 2017). Most nutritional problems occurred because athletes' train hard their sports but they do not train their gut. Due to that, nutritional advice programs should include in all sports programs, to cover substance abuse, counseling, and drug detection. All the stakeholders in sports must be educated about the use of nutritional supplements. Above all, a sports program must adopt the philosophy that "winning at all costs" is wrong. It is essential for athletes to perform at their very best by adhering to the rules of the sport and these eventually will lead to doing exactly what is expected of them. In conclusion, although food has its potential to enhance the health and sporting effects, there are concerns that the promotion of functional foods on claims may need sufficient scientific evidence. There are no good and bad foods, there are only good and bad dietary patterns. The athlete must be fully aware that functional foods are not a "magic bullet" and proper education is required for improving the dietary patterns. Future research should be directed to investigate supplement combinations, dose, and length of habitual supplementation, as well as the source of advice athletes, take regarding nutritional supplements.

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# ERECTILE DYSFUNCTION: ROLE AS A MARKER FOR ENDOTHELIAL DYSFUNCTION

**Dr. Goh Eng Hong**
Urology, Nephrology & Men's Health
Prince Court Medical Centre
*Email: bobby.goh@hotmail.com*

Erectile dysfunction is a common encounter in Urology practice and it is widely recognized nowadays to be a vascular disorder, namely secondary to endothelial dysfunction, whereby there is impaired bioavailability of vasodilators, especially nitric oxide (NO), with resultant vasoconstrictive effect. Evidence exists to strongly suggest the common impaired NO-pathway between erectile dysfunction and cardiovascular disorder including coronary artery disease, hypertension, cerebrovascular disease and peripheral arterial disease. In fact, erectile dysfunction may be considered as the early marker for atherosclerosis. Therefore, as Urology clinicians treating patients presented with erectile dysfunction, it is prudent that one should take every opportunity to look out for the subtle yet serious cardiovascular disorder. Understanding the nature of endothelial dysfunction hence allows not just improved management of the cardiovascular state but also permits better risk factor modification. A better state of cardiovascular health certainly will lead to improved sexual health and the overall quality of life.

# EXERCISE AND BREAST CANCER

**Assoc. Prof. Dr Ahmad Taufik Jamil**
Department of Public Health Medicine,
Faculty of Medicine, UiTM
*Email: atjamil@gmail.com*

Breast cancer is the commonest cancer in Malaysia, comprising 17.7% of all cancers. Among female, one third (31.1%) of cancers is breast cancer. Most cases are diagnosed above the age of 45 years old. Lifestyle is one of the important risk factor of breast cancer, where physical activity/inactivity is one of them. Being physically active was shown to reduce risk of breast cancer by 25 -50%. Association of between breast cancer and physical activity is supported by strong and highly suggestive evidence. Physical activity reduces the risk of breast cancer by reducing estrogen hormone, improving immune function and reducing inflammatory process. At the same time, physical activity will help improving obesity, which also one of the risk factor of breast cancer. Breast cancer survivors also may benefit from physical activity. They may improve fitness and reduce risk of heart disease by being physically active. At the same time, it prevents weight gain and improve energy balance. Other benefit will includes reduce anxiety, depression and stress and self-esteem, reduce side effect of treatment such as fatigue, nausea and improve personal and social functions. Overall, they may have better quality of life. They are recommended to be physically active according to recommendation by WHO.

# PHYSICAL ACTIVITY AND COLORECTAL CANCER PREVENTION

**Prof. Dr. Tsung-I Chen**
Vice Secretary General, Clinical Exercise Physiology Society, Taiwan, ROC
Faculty, Center for Physical Education Teaching,
College of Liberal Arts & Basic Education,
Tzu Chi University, Taiwan
*Email: tichen@gmail.tcu.edu.tw*

## Introduction

Colorectal cancer (CRC) is a significant public health concern. As a multistage and multifactorial disease, environmental and genetic factors interact at each stage of the process, and an individual's lifestyle also plays a relevant role [1]. The risk of CRC development can be attributed to both genetic and exogenous (such as diet, obesity and diabetes) factors. Importantly, it is estimated that lifestyle factors may be responsible for approximately 30–60% of the CRC risk [2]. Evidence from prospective studies in Western Europe and the USA suggests that low physical activity and high amounts of sedentary time are associated with increased CRC risk [3]. However, physical activity of sufficient intensity and duration reduces the risk of colon cancer by as much as 20–50% [2] in a dose-dependent manner [4].

### Colorectal cancer and visceral adipose tissue

It has been suggested that the observed association between adult weight gain and colon cancer could be primarily explained by attained abdominal fatness and biomarkers of metabolic dysfunction [5]. Epidemiologic, clinical, and preclinical data suggest that within the growth-promoting, pro-inflammatory microenvironment accompanying obesity, crosstalk between adipose tissue and cancer-prone cells may occur via obesity-associated hormones, cytokines, and other mediators that have been linked to increased cancer risk. Findings from these clinical studies reinforce preclinical data and suggest organ-dependent crosstalk between adipose tissue and carcinomas via vascular endothelial growth factor, interleukin 6, tumour necrosis factor alpha (TNF-α), and other mechanisms. Moreover, visceral white adipose tissue plays a more central role, as it is more bio-energetically active and is associated with a more pro-cancer secretome than subcutaneous adipose tissue [6]. Also, the peroxisome proliferator-activated receptor gamma coactivator 1 alpha (PGC-1α) gene has pleiotropic roles and is the main regulator of mitochondrial functions. The development of CRC has been associated with mitochondrial dysfunction; in addition, alterations in this organelle are associated with CRC risk factors, such as obesity, decreased

muscle mass, and the aging process [1]. Furthermore, obesity-induced insulin resistance leads to elevated levels of plasma insulin, glucose and fatty acids. Exposure of the colonocyte to heightened concentrations of insulin may induce a mitogenic effect within these cells, whereas exposure to glucose and fatty acids may induce metabolic perturbations, alterations in cell signaling pathways and oxidative stress. The importance of chronic inflammation in the pathogenesis of obesity has recently been highlighted and may represent an additional mechanism linking increased adiposity to colorectal carcinogenesis [7].

**Physical activity and colorectal cancer prevention**

Physical activity has been shown to have a significant inverse relationship with colon cancer risk [8]. These mechanisms include changes in gastrointestinal transit time [9], altered immune function and prostaglandin levels as well as changes in insulin levels, insulin-like growth factors (IGF), bile acid secretion, serum cholesterol and gastrointestinal and pancreatic hormone profiles [8]. The IGF axis is reported to promote the development and progression of carcinomas through cellular signalling in cancerous tissues [10]. Several epidemiological studies have shown that regular exercise can prevent the onset of colon cancer, although the mechanism involved is unclear. Expression of inducible nitric oxide synthase and cyclooxygenase-2 is often elevated in an initial step of tumorigenesis and promotes CRC [2]. Additionally, TNF-α was decreased by exercise in the colon and plasma [11]. Besides, exercise reduced the number of macrophages in polyps by 35% and apoptotic cells by 73% in all polyps [12]. Recently, increasingly reported data suggested myokines also play a critical role. For instance, exercise stimulates secreted protein acidic and rich in cysteine (SPARC) secretion from muscle tissues and that SPARC inhibits colon tumorigenesis by increasing apoptosis in colon mucosal cells and anti-inflammatory cytokines [13].

**Summary**

Physical activity is related to CRC mortality, with approximately 15% of CRC deaths worldwide attributable to physical inactivity [11]. Along with the cancer preventive benefit, there is emerging evidence that exercise may improve survival in patients who have already developed CRC [2]. Therefore, several biological mechanisms have been proposed to explain the association between physical activity and colon cancer; many of these mechanisms also support the observation that intense activities (3.5 to 4 hours of vigorous

activity per week) are most protective. Biological mechanisms include: physical activity increasing gut motility; enhancing the immune system; decreasing insulin and insulin-like growth factor levels; decreasing obesity; enhancing free radical scavenger systems; and influencing prostaglandin levels [14]. In conclusion, the accumulated evidence provides strong support for the sufficient physical activity exerting beneficial effects for CRC prevention.

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# EXERCISE AND CHEMOTHERAPY -The Magic pills

**Dr. Sivashanmuganathan**
M.B.,B.S LFOM (Ireland)
M.Med Fam. Med (CMC, Vellore)
Dip Derm AFPM (IOD, Bangkok)
FBSCH (Clin.Hypnotherapy) U.K
Deputy Course Director EIM Malaysia.
Vice President SEIM Malaysia.
*Email: drsiva57@yahoo.com*

**"What if there was one prescription that could prevent and treats dozens of diseases such as diabetes and hypertension and obesity, would you try it, certainly"**

For many years the patients with different kinds of cancers were advised by their physicians to rest and to reduce their Physical Activity- PA, although that is against what we all advocate about using exercise to improve our health and to rejuvenate.

A simple and quick search using google scholar as a search engine will yield over 200,000 article with a key words of exercise and chemotherapy. Majority of those articles will link the benefits of regular exercise to reduce the side effects of chemotherapy during and after treatment of different types of cancers.

Recently a Dutch Randomized clinical trial was presented in 2018 Cancer Survivorship Symposium in Orlando, Florida that showed that as much as 142 minutes per week or 20 minutes per day of PA helps those patients who were surveyed (128 patients) to engage in more PA years after. In other words, in spite of those patients who did not reach the recommended PA activity guidelines, it still reflects positively on their future health.

Research has found no harmful effects on patients with cancer from moderate exercise and, in fact, has demonstrated that those who exercised regularly had 40% to 50% less fatigue, the primary complaint during treatment.

Engaging in regular exercise increases muscle strength, joint flexibility and general conditioning, all of which may be impaired by surgery and some therapies. Exercise is known to improve cardiovascular function and to protect bones. It also elevates mood, offering drug-free relief for the feelings of depression that may accompany a cancer diagnosis.

Finally, exercise helps control weight -- a crucial factor, as studies have shown that gaining weight during and after treatment raises the risk of a cancer recurrence, particularly for breast, colon and prostate cancers.

PA guidelines have recommended for any exercise program to be effective it must have three components:

- An aerobic workout that pumps up your heart rate and has a direct effect on cardiovascular system. Examples include brisk walking (outdoors or on a treadmill), jogging, swimming, or bicycling
- Strength training to tone and build muscles. This includes lifting weights or working with a machine circuit or resistance bands. (Be sure to get instruction if you're new to this type of exercise; light weights are sufficient to maintain strength.)
- Stretching to keep muscles and joints limber.

Frequency, Intensity, Time and Type ( FITT ) module recommends involving in mild to moderate PA of a minimum of 150 minutes per week on average of 30 minutes per day for 5 days or 20 minutes of vigorous activity 2-3 days per week. Patients with limited time can accumulate bouts of exercise of 10 minutes to accumulate total of 30-40 minutes per day.

In Exercise is Medicine Malaysia National Center, we are committed to training quality Healthcare Providers and Exercise Professional that able to prescribe and advocate on exercise as part of routine patient visits. Furthermore, we are working on implementing Physical Activity as Vital Sign (PAVS) to be added to the rest of vital signs to indicate the PA level of each patient.

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https://meetinglibrary.asco.org/record/157818/abstract

https://www.nccn.org/patients/resources/life_with_cancer/exercise.aspx

# SPORT HABITUS INFLUENCING CITIZENS' SPORT PARTICIPATION

**Dr. Hanna VEHMAS**
Senior Lecturer,
Faculty of Sport and Health Sciences
P.O. Box 35 (L),
40014 University of Jyväskylä,
Finland
*Email: hanna.m.vehmas@jyu.fi*

**Abstract**

Physical activity and sport participation are significant societal phenomena in many parts of the world, for several reasons. First, research has shown that sport participation is associated with health promotion and prevention of many illnesses. Natural movement of human beings has decreased especially in the post-industrial societies both in people's work and leisure, which has caused different kinds of health problems. Based on contemporary research knowledge, for example cardio-vascular and musculoskeletal diseases and type-2 diabetes could be decreased and partly prevented with exercise and physical activity. Living healthy does not only have positive impact in individual lives, but also in national economies. Sick days will be decreased and work efficiency and functional capacity increased, when citizens are healthy.

Second, sport participation has different social functions. Sport clubs are important channels of socialization whereby the norms of the society are learned and acquired. Team and club mates together with couches have central roles in bringing up children and youth. Sport participation can also have integrative functions when people from different countries and cultures, immigrants for example adapt themselves to a new society. Sport can function as a "lingua franca", a common language for people with different cultural, ethnic and lingual backgrounds.

Therefore, at best active sport participation produces experiences of community spirit and enables life style choices and illustrations of social identification. In addition to the traditional sources of social capital, such as work, religion or family, nowadays also fitness center memberships, running schools and senior clubs have come to bind people together. For some people participation has become so "serious" that it has started to resemble work. Marathon runners, triathletes and golfers for example may commit themselves to their hobbies very comprehensively timely, economically and with goal attainment so that participation begins to resemble a working career rather than casual leisure participation. (e.g. Stebbins, 2008; Vehmas, 2010.)

Third, sport participation has several direct and indirect economic impacts Citizens spend more money on sport participation, sport equipment and related goods and services, such as tourism. In addition, people worldwide are directly and indirectly employed by the sport sector which offers business and job opportunities through the retail sales of sport equipment, sport clothing and other product development. Private sport providers, for example fitness clubs have significantly increased their market shares during the last 15 years. Especially the share of women as private fitness club customers has increased in Finland. (Koivisto, 2014; Laine, 2015) Moreover, sponsoring, sport events and sport tourism are visible parts of sport participation as they offer jobs and business opportunities at least part time and seasonally.

From the sociological point of view, sport participation can be observed through the concept of sport habitus, which is an application of the French sociologist Pierre Bourdieu's concept of habitus (see Bourdieu, 1984; 1985; 1990). This theoretical concept enables to explain and understand why there are differences in sport participation between and within cultures. First, sport participation depends on individual motives and reasons. Statistics show that for examples for Europeans in general health promotion is the primary reason to participate in sport. On the other hand, lacks of time, injury or illness are seen as main reasons that prevent from participation in sport.

Second, sport participation is influenced by the so called structural factors, such as general societal standard of living, level of education and for instance gender equality. Internationally compared Finland for example is a welfare society where the citizens have good possibilities and freedom to express themselves in leisure premises. There are approximately 30,000 sport facilities in Finland, which is estimated to be more per capita than in any other country in world. Out of these 75 per cent are owned by municipalities which mean that they are considered as public facilities and thus available to all citizens (OKM 2013.) Finns' high level of education can be also seen as a structural factor influencing sport participation rates. With higher education people are more prone to possess cultural capital, i.e. the knowledge for example about the health benefits of physical activity and skills that are required in sport participation. Economic capital on the other hand enables people to acquire enough money and free time for sport participation.

Third, sport participation is influenced by its functions in society. Sport participation can be seen as an important tool for health promotion and prolonging careers, prevention of illnesses; contributing to socialization and national identity; and enhancing business and employment opportunities. Historically for example in Finland physical culture has been formed around the

non-profit sport clubs. In line with the principles of the Nordic welfare society, sport participation has been an important part of the political agenda, which has over the years contributed to the sporting possibilities of the citizens. The Sports Act obligates the municipalities, with the help of government subsidies to create conditions for sport participation of the citizens. (e.g. Vehmas & Ilmanen 2017.)

Finally, sport participation is linked with cultural characteristics. Finnish culture and society can been described as having elements of the protestant working ethics in which diligence and achievements are valued. Active life style can be thus a way to express one's efficiency and capabilities. Sport participation may be used either consciously or unconsciously to accumulate forms of cultural, social, symbolic and economic capital. In addition to the actual physical activity and health related benefits, sport participation offers social networks and community spirit, which can be useful for example in working life. All in all sport participation in Finland is a highly appreciated form of leisure and lifestyle, which corresponds to the social norms of the society.

Despite all above however, it is important to keep in mind that individuals' wellbeing is dependent on many aspects, and thus, sedentary life style by itself is not a sign of a bad citizen. Many people draw wellbeing also from other spheres of life, such as good social relationships or cultural activities. The aim of this presentation is therefore to point out different elements of the so called sporting habitus, and to discuss in which ways health enhancing sport participation of the citizens could be promoted in different parts of the world.

# EXERCISE AND BEHAVIORAL CHANGE: A PERSPECTIVE FROM THE PHILIPPINES

## Transforming from Generation O to Generation H
## Healthier, Happier and Highly Active Filipinos

**Prof. Henry C. Daut**
Faculty, College of Sports,
Physical Education and Recreation
Mindanao state university,
Marawi City, Philippines.
*Email: henry_daut@yahoo.com*

Physical inactivity is one of the leading risk factors for global mortality associated with non-communicable diseases (NCDs) increasingly becoming biggest killer diseases not only in the Philippines but the world. Among Asian countries, Philippines has one of the highest percentage of citizens who don't exercise regularly and are categorized in the so-called "Generation O" described as "overworked, overweight and overwhelmed". Asia Health Index Survey conducted in 2016 revealed an alarming increase in Filipinos lacking in physical activity and exercise. Lack of time due to work, lack of personal motivation, distractions of modern life such as gadgets and engagements in social media, cost, lack of accessible venues are some of the reasons identified for not engaging in physical activity or exercise among Filipinos (Sun Life Financial Asia Health Index 2016).

Studies on physical activity participation of older adults in rural areas in the Philippines revealed a low percentage of Filipinos achieving the minimum standard required for physical activity participation with more respondents spending time sitting than engaging in physical activity (De la Cruz, Monte, Buan, 2016).

While Filipinos recognize the importance of healthy living to include good family relations, healthy eating, rest and sleep and good hygiene and environmental factors, exercise was not rated as among the top five drivers of healthy living. In a 2016 Healthy Living Index Survey, Filipinos are considered among the least healthy people in Asia, Filipinos though has high level of awareness but lacking in action to improve health conditions. Studies showed high levels of concern about many health conditions among Filipinos to include heart disease, stroke, diabetes, respiratory illness, anxiety and depression among others. All these can make use of regular physical activity and exercise to prevent, control or mediate to ensure longevity and healthy living).

While lagging behind other countries in terms of health index, Filipinos are positive about the overall state of their health and a high percentage of Filipinos are willing to exercise to improve physical and mental well-being. Filipinos believe the value of exercise, benefits of physical activities, weight control and energy improvement in combating problems on heart diseases and improving quality of life among others.

The declining health status index of the Filipinos should be a major concern not only by the government but by the individual themselves. The need to transform the Filipinos from the so- called "Generation O" – people who feel they are unhealthy but lack time, facilities resources or have existing disease problems that prevent them from going into healthy living" into what I call Generation H – Healthy, Happy and Highly Active Filipinos. Encouraging people to engage in physical activity and regular exercise for fitness, health, productivity is of primary importance in the promotion of healthy living and healthy and productive citizenry.

Accomplishing such objective requires behaviours change towards physical activity and exercise. The urgent need to address the problems of physical inactivity and lack of regular exercise among Filipinos is vital in the promotion and development of a healthy and fit, happy, and high performing citizens of the country. Programs and activities to increase the level of understanding and awareness of the significance of physical activity and regular exercise participation should be intensified. Behaviour change toward physical activity and exercise is vital in sustaining participation healthy living. People must transcend the early stages of exercise behaviour to reach the action and maintenance stage of regularly engaging in physical activity and exercise.

Comprehensive studies on the stages of exercise and behaviour change must be conducted to provide a basis for program prescription and intervention to improve the quality of life of Filipinos. Physical activity and regular exercise programs in both public and private workplaces must be instituted to ensure the health and fitness of employees. Provision of activity and exercise facilities should be included in the workplaces and communities to ensure adequate facilities for exercise among others. Building a strong nation and society requires the development of a healthy, fit, strong and productive citizenry by encouraging regular participation and engagement in appropriate physical activities and exercise at home, community, and work places.

# EXERCISE MIND AND BODY

**Dr. George E. Samuels**
United States
*Email: georgesamuels@hotmail.com*

## Introduction

Doctors have pondered the connection between our mental and physical health for centuries. Until the 1800s, most believed that emotions were linked to disease and advised patients to visit spas or seaside resorts when they were ill. Gradually emotions lost favour as other causes of illness, such as bacteria or toxins, emerged, and new treatments such as antibiotics cured illness after illness. Medicine is the science or practice of the diagnosis, treatment, and prevention of disease (in technical use often taken to exclude surgery). What is exercise? Activity requiring physical effort, carried out especially to sustain or improve health and fitness.

## What is Exercise Medicine?

Exercise Medicine is a way of providing physicians, other healthcare and alternative professionals with a simple, fast, and effective tool for integrating physical activity in their daily practice. By offering the right "dosage" of physical activity, you are prescribing a highly effective "drug" to your patients for the prevention, treatment, and management of NCDs and the most common chronic health conditions encountered in primary and alternative practice. Chinese medicine and Ayurveda are traditionally founded on the basis that good health lies in balance. In Chinese medicine it is the proper balance of the body's vital energy *(qi or chi)*, and in Ayurveda the three physiological principles called doshas (pitta, vata, kapha) need to be in balance for optimum health. The Greek physician, Hippocrates, wrote about the humours, or four properties, (blood, phlegm, yellow and black bile) which must be in balance for a person to be healthy. Across these systems, we find that the balance between the mind and body is a key factor. There is a strong belief that the state of mind can influence the state of the body, or the other way round.

## Methods

Although mind-body research is constantly evolving, some characteristics of these therapies make them more difficult to study than, say, standard drug treatments. So mind body exercise has many factors such as:

- Understanding the mind and how it influences the body to maintain health, and how it affects the causation of dis-ease (NCDs).

- Does the mind cause dis-ease or is it mental behaviour and what does one need to do to affect positive changes in their health and the effects of NCDs in the body. How does one change the mind in order to change the body?
- Does one need the mind and the body to heal NCDs or is the healing of the body just a physical characteristic.
- For total body healing what is needed from the mind and the body?
- Are there any forms or sets of exercises that can address the healing of NCDs that include the body and the mind?
- Why is the ancient art of Taiji-quan considered the art of healing exercise?
- Is the mind and body connected to our health, wellbeing and longevity?
- Are there case studies and/or research to confirm the body and mind connection to Exercise?
- How does the ancient art of Taiji-quan (Tai Chi) incorporate the body and mind?

**Results**

There are many methods of exercise that can be used to create or facilitate healing of the mind and body. There needs to be more research and studies to prove the positive affect, and outcomes of combining the mind and body together to affect total healing, and the prevention or elimination of NCDs.

At the same time the quest for positive outcomes and total cures of NCDs require exercise as a medicine. This needs to be introduced or reintroduced as an alternative medicine to cure or as a preventative tool, to stop or eliminate NCDs. There are a few case studies that inspiration can be drawn from but the proof is in the practice, positive outcomes and feedback from the practitioners. More than 250 million people practice mind body exercises (Taijiquan) every day.

**Discussion**

The medical community to date has not completed enough studies concerning the Mind Body Connection to exercise or health. Since the mainstream medical community focuses on the scientific basis of Allopathic care, Alternative care is not fully considered. Now many Universities and Medical research groups are studying the mind body connection because medicine has proven that it cannot heal patients or clients by itself as the "only" therapy. Many now realize that there is a need to provide Alternative medicinal

methods such as exercise, and include the body mind connection (total person) in order to affect a total cure. This is vital in order to reduce the high incidences of NCDs that appear to be escalating.

**Conclusion**

Research has proven that exercise will keep the body in optimal shape, improving function, balancing hormones, centring emotions and providing energy. At the same time exercise has been credited with improving or providing maintenance of the mind body connection that helps to improve assimilation of vitamins and medicines taken in the body. These improvements incorporating the mind and body prevent and decrease depression, lower blood pressure, help to control diabetes, strengthen the heart, increase toxin elimination and improve circulation to the organs and brain. Thus giving direct connection of the benefits of exercises that incorporates both the mind and bodies similar to Taijiquan or Yoga as a daily exercise or routine in the in treatment of NCDs. Exercise medicine can help to heal, eliminate and improve outcomes for the body especially those suffering from NCDs but both the mind and the body must work together.

Exercise Medicine will help to extend lives and longevity but mental health and physical health must be addressed at the same time. Healing of NCDs must include exercises incorporating both the mind and body as one in order to begin changing the statistical high incidence of NCD. Multiple avenues of research are continuing and the body mind connection is verifiable.

**Mechanism Behind Mind-body Connection Discovered, University of California**

**Los Angeles July 2008** ***Summary:*** New research discovered by the University of California, Los Angeles explains how chronic emotional stress ages the immune system. Immune cells end in protective caps called telomeres that are shorter in the elderly—and in persons suffering chronic stress. A new study suggests that the hormone cortisol is the culprit behind telomeres' early aging in stressed-out people and offers a potential drug target for protecting the immune system against the damage caused by long-term stress.

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# ACUTE EXERCISE AND COGNITIVE FUNCTION: AN UPDATE (IN COLLABORATION WITH UNITED NATION'S 17 SDGS ON #3 GOOD HEALTH AND WELL-BEING)

**Dr. Garry Kuan Pei Ern PhD**
Exercise and Sports Science Programme,
School of Health Sciences,
Universiti Sains Malaysia, Malaysia
*Email: garry@usm.my*

Acute exercise, the effect of a single session of exercise, has been demonstrated to affect cognitive function positively (e.g., Chang, Labban, Gapin, & Etnier, 2012; Lambourne & Tomporowski, 2010) and the issue has been recognised as one of the important research trends in exercise psychology. The premise underlying this research is that physiological changes in response to exercise have implications for cognitive function. The purpose of this presentation is to report on the current developments and to provide some updated studies on acute exercise and cognitive function. These studies emphasised: a) The dose-response relationship between acute exercise duration and cognitive function; b) The role of moderators between acute exercise and cognitive function; and c) The potential mechanism of how acute exercise affects cognitive function from a neuro-electrical perspective such as ERP and EEGs. Although the effects of acute exercise on cognitive performance are generally small, however, larger effects are possible for particular cognitive outcomes and when the specific exercise parameters are employed. The possible and recommended directions for further examination will also be discussed.

# EXERCISE AND HYPERTENSION

**Michael S. Carey, MD**
*Email: mcareysan@gmail.com*

## Introduction

It has been shown that physical activity may be as important as or even more important than pharmacology in the treatment of hypertension and reduction of mortality. (American Journal of Hypertension, 2013, Ruth Brown et.al.) The study included over 10,600 subjects from the NHANES study. Data was collected over 7 years and focused primarily on mortality but also included the effects of age, the degree of BP control, dietary salt, nature of exercise, and demographic data. The conclusion was clear that regular exercise was very important for health and for part of the management of hypertension.

## Background

Hypertension is present in about 30% of adults worldwide. Hypertension is the main risk factor for stroke, heart attack, left ventricular hypertrophy, heart failure and kidney disease. The economic impact is enormous. The prevalence of high blood pressure does vary from country to country and among subsets of the population, for example a low rate of 8% in rural India and a high rate of 42% in African Americans. Overall, high rates are seen in Eastern Europe, Russia, and sub-Saharan Africa. Relatively lower rates are seen in Canada, South Korea and Japan. The reason for these variations is unclear but may be related to such factors as stress, nutrition, hereditary factors, diet, activity and exercise. Also notable is the fact that worldwide there are more men with hypertension whereas in sub-Saharan Africa there is a female majority with high blood pressure.

## Definition

Normal blood pressure is defined as less than 120/80, pre-hypertension as 120-139/80-89 and hypertension as 140/90 or higher. JNC-7 further subdivides and adds numbers to these to include Stage 1, Stage 2, hypertensive urgency and hypertensive crisis. JNC-8 relaxed the treatment goals a little according to age and the presence of other disease such as diabetes. Can we help reduce hypertension and its impact on society by means of exercise? The answer is of course yes but we have to first define our target population. About 5% of cases of hypertension have a secondary cause such as kidney

disease, endocrine disorder, coarctation of the aorta and other rarities. In the majority of cases there is no obvious cause to be found and we call this disease “essential hypertension”. This is our target population. We are talking about more than a billion people!

**Results:**

We have to acknowledge the impact of landmark studies such as Framingham, which gave us cross-sectional and longitudinal observations of aging populations. Before such studies were made, we just accepted that blood pressure; cholesterol and senility were just natural side effects of aging. We have subsequently learned that this view of nature is incorrect and I am hopeful that other findings will emerge in the future. The World Health Organization is of tremendous benefit in compiling and sharing data especially on non-communicable disease such as hypertension and the benefit of exercise. The WHO recommends 150 minutes of exercise per week. The British Hypertension Society recommends 30 minutes a day as does the Green Prescription in New Zealand. JNC-7 recommends 30 minutes daily at least 5 days a week. New Zealand has had the Green Prescription for exercise in place since 1998. Many exercises are covered from simple walking to Maori dancing. From their annual reports the program has been quite successful for 20 years.

The success of exercise in reducing blood pressure compares favorably with other interventions as summarized in JNC7: Brisk walking 30 min/day reduced systolic BP by 10mm Hg; reducing alcohol consumption reduced BP by 3 points; low sodium diet reduced BP by 5 points; DASH diet showed 12 point reduction and simple weight loss had up to 20 point reduction! Quite clearly these reductions are significant. The systolic blood pressure at rest may be reduced as much as 20 points and the diastolic by 10 points. There is considerable variation for each person. It is quite possible for a person with pre-hypertension to drop into the normal range with exercise and diet alone. Similarly people with Stage 1 or Stage 2 disease may improve with exercise and drop down to a lower category. This may reduce the need for multiple prescription medicines. The health improvement and economic savings would be substantial.

**Discussion**

Everyone, including the healthy normal person, is encouraged to exercise. People with severely elevated pressures probably should be monitored or supervised during planned exercise; at least until there pressures are more controlled. People with disabilities or mobility problems may be candidates for adding resistance training or weights to their program. Pool exercises can be considered. (Heated pools in colder climates!) Both aerobic exercise and weight training can be helpful, with the caveat that heavy weight training can significantly raise the systolic pressure over 200 whereas this is rare with aerobic cardiovascular exercise. Home blood pressure monitoring gives important feedback to both the patient and the physician.

Here are some examples of exercise ranging from walking to skydiving. Which exercise is best? All activity has been shown to be beneficial, from the ordinary activities of daily living, to yoga and stretching, to strenuous weight training. It is important to let the patient have his or her input and to select a program that they can continue for life. The Green Prescription in New Zealand shows this flexibility and I think this is an important feature. We could discuss training at 60-80% maximum pulse rate for your age, but that might be another lecture! My own preferences are for Tai Chi, golf, and walking the dog!

Muscles at rest require about 20% of the cardiac output but this demand can rise to 70% during vigorous exercise. Long distance runners have been shown to increase their cardiac output not only by increasing heart rate and stroke volume, which of course raises systolic pressure, but also by lowering their diastolic pressure about 5 points. This appears to be a side effect of habitual training. How the body achieves this is a cause for wonder!

The gigantic problem worldwide is that up to 40% of the population is inactive or sedentary. They perform the usual activities of daily living, do a little shopping or drive to work and spend 8 hours behind a desk or in front of a computer. They may even play video games! How do we change this and encourage more people to exercise? This is of course the million-dollar question!

**Conclusion:**

The bottom line is that exercise, diet and weight control may work hand in hand to reduce blood pressure. This then may lead to reduced dependency on drugs for blood pressure

control. One less pill per day would bring tremendous economic savings, happier patients and happier doctors.

# WHY PRESCRIBE EXERCISE AS MEDICINE FOR PATIENTS WITH TYPE-2 DIABETES – WE HAVE A PILL FOR THAT!

**Mathias Ried-Larsen, PhD**.
Group leader
Centre of Inflammation and Metabolism,
Centre for Physical Activity Research,
Rigshospitalet, Denmark.
*Email: mathias.ried-larsen@regionh.dk*

As the prevalence of patients with type 2 diabetes (T2D) increases, so does the prevalence of diabetic complications. A large part of T2D cases is preventable through a healthy lifestyle, leaving little room for questions that lifestyle should be the first line of defence in the fight against the development of T2D. However, when it comes to the clinical care of T2D, the potential efficacy of lifestyle is much less clear-cut, both in terms of impacting the pathological metabolic biomarkers of the disease, and long-term complications. A healthy diet, high leisure-time physical activity and exercise are considered to be cornerstones albeit adjunct to drug therapy in the management of T2D. The prescription and effective implementation of structured exercise and other lifestyle interventions in the treatment of T2D has not been routinely used.

Thus issues as to why exercise and physical activity may not have reached the status of a viable and effective treatment in the clinical care of T2D to the same extent as pharmaceutical drugs clinical exercise studies in T2D need to be critically appraised and debated. A paramount reason why exercise therapy is not utilized to a satisfactory degree is multifaceted and primarily relates to a 'vicious cycle' with lack of proven efficacy on T2D complications and a lack of proven effectiveness on risk factors in the primary care of T2D. I.e. all but one trial in have investigated the effects of exercise and lifestyle intervention on intermediary end-points (i.e., HbA1c) not hard-endpoints such as micro- and macro vascular complications *per se.* Moreover, there is a lack of research establishing the optimal and/or the minimal dose of exercise required to prevent complications and improve quality of life for this patient group. As an alternative, an growing number of studies have focused on the role of lifestyle in introducing T2D remission, i.e. whether lifestyle intervention can eliminate the need for pharmacological glucose lowering medications while normalizing glycemic control and thereby indicate the potential as a curative treatment. While this is a sensible, albeit complex, way to direct the research, a deeper understanding of lifestyle treatment in fact slows or even stops the pathophysiological development of T2D.

Finally, advice-based exercise prescription only have limited success, thus structured exercise with heavy supervision may be needed to obtain a solid risk reduction in relation to the incidence of complication for this patient-group. Heavy supervision is likely un-feasible and expensive, given the higher prevalence and incidence of T2D worldwide. With the increasing utilization and availability of digital solutions as e.g. fitness tracks and smart phone apps, this may prove as feasible tools for large scale implementation. However, in order for this to assist with the supervision issues, the patients' health and digital literacy need to be taken into account.

Until solid evidence and knowledge have been obtained on these issues, widespread and sustained implementation of physical activity and exercise in the clinical treatment of T2D will likely not succeed.

# A CASE OF HOME REHABILITATION OF A CHILD REQUIRING MEDICAL CARE IN DAILY LIFE SPINNING THE FUTURE WITH LOVE, JOY, AND FAITH

**Mrs. Michiko Sugano**
Home Nurse CEO
*Email: info@home-nurse.jp*

## Introduction

The number of children requiring medical care in their daily lives continues to increase as the field of medicine advances. While development that has granted children with high degree of need for medical care life at home has made dramatic improvements, their recuperation environment touches interpretation of basic human rights.

With the child I worked with in this case, parents who provide care did not receive sufficient support at all, but they developed a relationship with the government and medical and social workers. They were pioneering the environment in which their child could most enjoy his life. At the same time, they were working on rehabilitation to overcome the top priority issues in order to enrich the quality of their child's life.

Working with this family, I learned the basic principle of home rehabilitation of children requiring medical care in their daily lives through this effort that is never smooth. As a freelance nurse, I summarize and report this case as a narrative in order to actualize nursing care specifically desired for home care that integrates individuality and overall image.

## Background

"A" is an eight-year old boy with congenital myopathy. After about one year of hospitalization, he transitioned to home care. The child suffered dyspnea and poor suckling since the neonatal period, and he required a respirator and tubal feeding. It is difficult to maintain a sitting position, but automatic motion in peripheral of forearm is good. In an environment that uses buoyancy such as bathing, the child is able to move the trunk in addition to hands and feet.

## Awareness

“A” was able to move forearms almost freely. His mother found the strength in “ability to move forearm freely”, and she attempted to converse with “A” using physical contact of hands. If “A” touches her hand, it was “yes”, and if it was “no”, he was to move his hand away. Initially, it was difficult to read the movement, and even parents had difficulty in communicating. However, parents were convinced that “A” had wishes and desires because of his expressions and occasional gestures that indicated playing alone, and they kept attempting communication by extending their hands to “A” every day.

One day, the mother was eating her meal and suddenly felt “A” looking at her. She felt that his gaze said “I want to eat, too”, and placed a small amount of tea in his mouth. “A” did not gag, and he appeared happy with refreshing sensation in his mouth. Concerned with pneumonia due to aspiration, he was only given water or tea orally, but it was determined that aspiration can be avoided by using a low-pressure continuous suction to remove saliva, and “A” was allowed to enjoy various flavours such as sweet juices, soup with umami, and miso soup.

Shortly after birth, “A” could not close his mouth, and had an expression in vertical direction as if his face was competing above and below. But at some point, he became able to close his mouth, and began expressing various emotions with rich expressions.

His rich expression today was acquired with enjoying tastes. By enjoying various tastes, impulse conduction to each plexus was activated, which led to awakening of facial muscles, allowing for movements in various directions such as tension, contraction, and loosening. The mother’s awareness and involvement due to love appeared unrelated to rehabilitation, yet it became the policy to advance rehabilitation for “A”.

**Challenges**

Though communication was not established, since “A” presented rich expressions, no one denied that he had will. These triggered the challenge of asking “A” for his opinion and learn his desires.

At the same time as asking his will (Yes or No) with touch of the hand, we incorporated a method to directly ask “want to do XXX” from “A”. We presented routine “want” of “A” on a whiteboard using picture cards, and “A” chose by pointing with his hand. Communicating his routine six “wants” such as “I want to read a book”, “I want to drink water”, and “I want to remove phlegm” was directly connected to quality of his life.

As a result of smiling expressions such as “happy”, “fun”, and “refreshed”, “A” gradually made communication reproducible. “Want to do XXX” of “A” further branched out. He enjoyed listening to books being read to him, and he followed letters with his eyes. After learning with the whiteboard, he became able to differentiate letters, and understood words. Once he learned numbers, he became able to perform calculations.

Now, “A” has become “fond of studying”, and as the whiteboard was insufficient, he began using the workbooks used in school lessons. As such, toward communication using “conversation”, which is the next step of expressing his will, he began rehearsing with an application on iPad to select the most appropriate tool that utilizes his strengths.

**Journey of acquisition**

“A” is in a growth period, and every time I see him, he seems to become taller. Usually growth of a child is to be celebrated, but with the condition “A” suffers, as the body grows, the weight of limbs increases, potentially inhibiting his mobility. This is different for each individual, and it cannot be determined until his body has changed. However, we cannot stop our progress in fear of unknown future, especially seeing how much fun “A” is experiencing. We must keep trying and stay positive. We have just begun working for the future we desire.

**Conclusions**

Today’s “A” is only possible because of his parents’ efforts. For “A” to live better, fostering of the base for “A” to live in the society, such as schools, short stays, and day services, dramatically supported rehabilitation for “A”. Strength of “A” that only his parents could become aware, his potential, environment that allows for discovery of such potential, and mental strength to maintain love for him: our job is to support these aspects.

We can only enter through the entrance of “want” that “A” creates for us. Parents are the ones who draw the most detailed map to show where this entrance is. In home rehabilitation of children requiring medical care in their daily lives, a comprehensive approach is necessary that provides appropriate respite for parents, fully utilizes the merit of the whole family being able to live together, has staff sharing the map of children’s “wants” that parents can draw, and has a faith in children’s abilities through trial and error, which also values individuality.

# EXERCISE-INDUCED MYOKINES IN AGING AND METABOLIC DISEASES

**Prof. Wook Song Ph.D.**
Health and Exercise Science Laboratory,
Institute of Sports Science, Institute on Aging,
Seoul National University,
Seoul, Korea.
*Email: songw3@snu.ac.kr*

Skeletal muscle has been emerging as a research field since the past two decades. Contraction of a muscle, which acts as a secretory organ, stimulates production, secretion, and expression of cytokines or other muscle fiber-derived peptides, i.e., myokines. Exercise-induced myokines influence crosstalk between different organs in an autocrine, endocrine, or paracrine fashion. Myokines are recently recognized as potential candidates for treating metabolic diseases through their ability to stimulate AMP-activated protein kinase signaling, increase glucose uptake, and improve lipolysis. Myokines may have positive effects on metabolic disorders, type-2 diabetes, or obesity. Numerous studies on myokines suggested that myokines offer a potential treatment option for preventing metabolic diseases. This presentation summarizes the current understanding of the positive effects of exercise-induced myokines, such as interleukin-15, brain-derived neurotrophic factor (BDNF), leukemia inhibitory factor (LIF), irisin, fibroblast growth factor 21 (FGF21), secreted protein acidic and rich in cysteine (SPARC), and fibroblast growth factor 2 (FGF-2). In addition, some of the recent research regarding exercise-induced myokines on aging, metabolic diseases, and cross-talk between muscle and bone will be presented and discussed.

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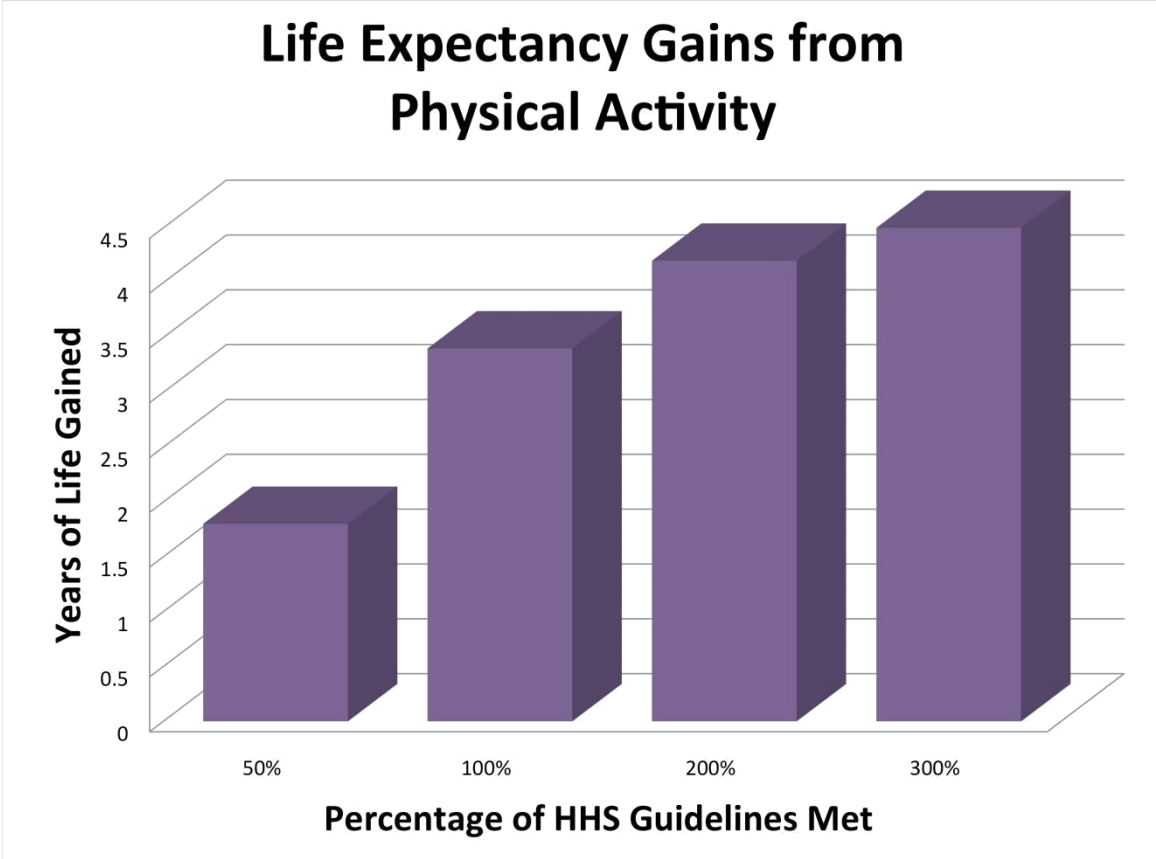
# LONGEVITY AND HEALTH: EFFECTS OF EXERCISE AND NUTRITION WITH SPECIAL EMPHASIS ON ANTIOXIDANTS

**Dr. Robert N. Girandola**
Department of Human Biology
University of Southern California
Los Angeles, CA,
United States.
*Email: girandol@usc.edu*

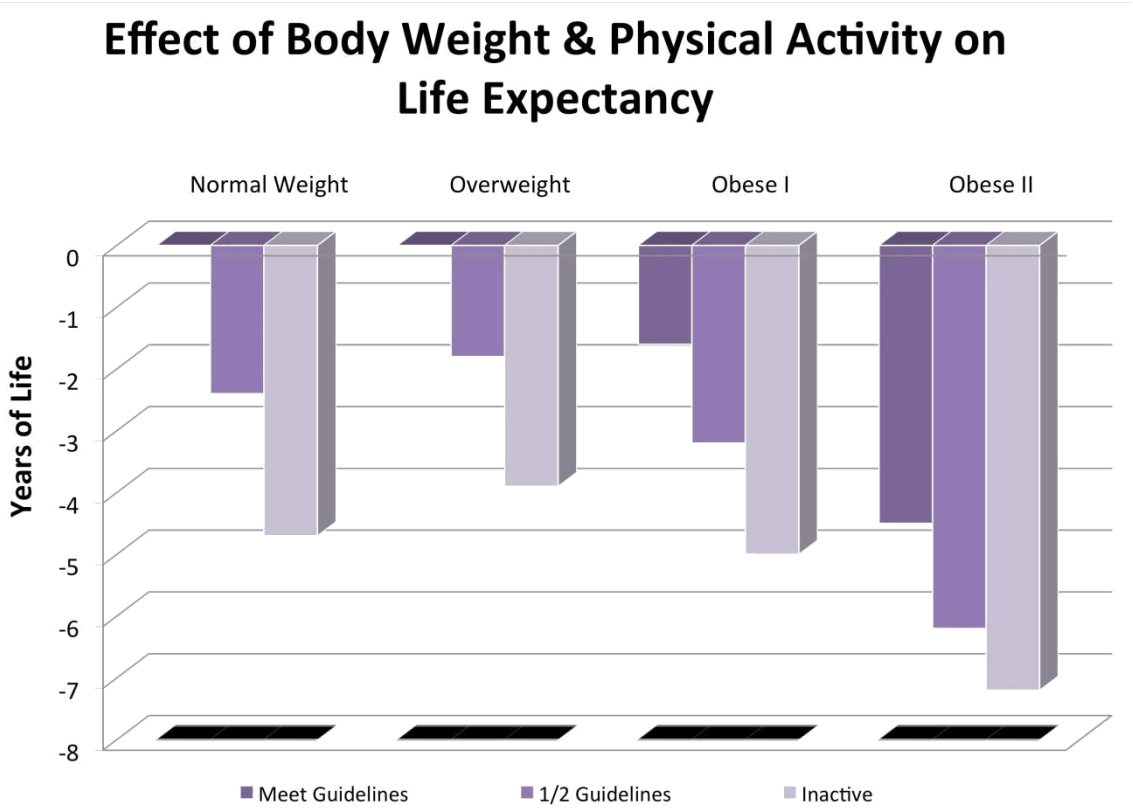
Just about everyone wants to be healthy and to live a long life. Of course if you ask a teenager or young adult that question, his/her response is quite a bit different from someone who is in their 50's and beyond. Whenever high school or university students are queried about longevity they usually only think weeks or months in advance. It is one major reason why to instil healthful living into their lifestyle (i.e. no smoking, no drugs, alcohol in moderation, good diet) usually falls on deaf ears. Most individuals only consider living long and healthy lives when they are at least into their $4^{th}$ or $5^{th}$ decade of life. Life expectancy has increased substantially over the past century; however there are many instances where death occurs a lot earlier than expected. We can eat a nutritious diet, be active, avoid alcohol (in excess), do not smoke or take certain drugs and despite all that an individual can succumb at 40 years. The confounding variable is Genetics. With the "right" Genes an individual can easily live into their 90's.

This paper will look at two of the most important variables in longevity; Exercise and Diet, with special reference to natural and supplemental antioxidants. Exercise benefits will be examined first. A study conducted in 2012 by NIH (USA) found that people who engaged in physical activity gained as much as 4.5 years. Recommendations are 2.5 hours of moderate intensity or 1.25 hours of vigorous activity/week. All subjects who did activity, even below minimal levels were benefitted. The relationship between life expectancy and activity was stronger among those with a history of CHD and Cancer.




With the incidence of obesity GLOBALLY it would seem that being active is extremely beneficial since the results of this study indicated that subjects who were obese AND sedentary had life expectancy between 5-7 years shorter than normal weight active individuals.

It is very clear from this data and other studies which will be presented at this conference that being active will extend one's life. However, is it enough just to add years to one's life? As fitness enthusiast and scientist has stated the important thing is to ADD life to your years, not just add years to your life. Being able to ambulate on one's own in the latter years of life is extremely rewarding.




*Obese class I = BMI 30-34.9 Obese class II = BMI 35+*

The role of nutrition, with a special emphasis on antioxidants is the next area of consideration. Antioxidants are substances that may prevent or delay some types of cell damage. It is clear that when people consume a diet containing substantial amounts of fruits and vegetables (the basic food sources of antioxidants) they live longer and healthier lives. However the predominant research has NOT found that supplements of antioxidants have been very beneficial in preventing diseases. Examples of antioxidants include: Vitamins A (Carotenoids), Vitamins C and E, and selenium. Large cohort studies have in fact revealed that excessive doses may prove harmful, as in the case of beta carotene supplements in smokers causing an increase in the risk of lung cancer. That caused the study to be terminated.

# ROLE OF ANTIOXIDANT SUPPLEMENTS IN REDUCING OXIDATIVE STRESS AMONG HEALTHY INDIVIDUALS-PHYSIOLOGICAL PERSPECTIVES

**Prof Dr. G L Khanna**
Dean
Faculty of Applied Sciences
Manav Rachna International University,
India
*Email: glkhanna.acess@gmail.com*

Studies have reported that an antioxidant is "any substance that delays, prevents or removes oxidative damage to a target molecule. Antioxidants are an inhibitor of the process of oxidation, even at relatively small concentration and thus have diverse physiological role in the body. The human body is protected from cardiovascular, neurological and carcinogenic diseases, delaying chronic health problems by the use of antioxidants.

For the past few decades, there is a great attention to the promotion of health pertaining to antioxidants and free radicals. Free radicals, which are atoms and molecules that have an unpaired electron, mainly derived from reactive oxygen species (ROS) produced by the body, when there is an alteration of pathophysiological conditions due to exposure to different physicochemical conditions such as oxidative stress, radiation, pollutants, heavy metals and xenobiotics. These free radicals can damage molecules important for cellular function, leading to a total loss of cellular function.

To combat the deleterious effect of free radicals, antioxidants produced by the body act in concert with their exogenous, mainly dietary, counterparts to provide protection against the ravages of ROS as well as RNS. These antioxidant defense systems are present in cells to protect the membranes and other cell organelles from the damaging effects of free radical reactions. Antioxidant defense systems act against lipid peroxidation by decreasing localized oxygen concentration, preventing initiation of peroxidation by scavenging species capable of abstracting hydrogen atoms, such as hydroxyl radical, quenching or scavenging singles oxygen, which can react directly with membrane lipids to produce peroxides, binding metal ions in forms that will not generate reactive species and or will not decompose lipid peroxides to peroxyl and alkoxyl radicals, removal of peroxides by converting them into non radical products, such as alcohols and chain breaking i.e. reacting with chain propagating radicals (peroxyl and possibly alkoxyl).

The primary antioxidant enzymes such as superoxide dismutase (SOD), glutathione peroxidase and catalase work by removing superoxide radicals, hydrogen peroxide, and organic hyper oxides. In addition to the three most important antioxidant enzymes (SOD, Catalase and glutathione peroxidase), there are several other enzymes, such as glutathione reductase (GR), Glucose 6-phosphate dehydrogenase ($G_6$PDH) and glutathione S-transferase (GST), which support the primary antioxidant enzymes by supplying either substrates or reducing equivalents.

The major dietary antioxidants vitamin E, beta-carotene and Vitamin C scavenge the active radicals, suppress chain initiation and/or break the chain propagation reactions. Vitamin E protects against lipid peroxidation by acting directly with a variety of oxygen radicals, including singlet oxygen, lipid peroxide products, and the superoxide radical, to form a relatively innocuous tocopherol radical. The ability of vitamin E to prevent oxidation of unsaturated fatty acids is believed to be its primary function in the body. Vitamin E also inhibits platelet activation and monocyte adhesion and is the predominant antioxidant in LDL. Ascorbic acid is a potent reducing agent, and it is effective in the quenching of free radicals. In addition, it is also vital in the protection of retinoid, carotenoids, tocopherols, B complex vitamins, and lipids and can improve arterial vase reactivity. Beta-carotene and vitamin A have antioxidant and immune enhancement properties. It has been identified as a possible antioxidant because of its ability to scavenge singlet oxygen.

Antioxidant minerals such as selenium, zinc, copper, iron, and manganese are mostly bound to proteins forming metalloid proteins, which are part of the enzymatic antioxidant system and have structural and storage functions. A deficiency of these minerals leads to undesirable pathological conditions. Apart from these vitamins and minerals, polyphenols also act as potent antioxidants and metal chelators. Empirical evidence shows that higher intake of foods with antioxidant abilities can lower the risk of disease such as diabetes, cardiovascular disease, cancer, arthritis, Alzheimer's and Parkinson's disease.

A lot of interest is growing among the scientific fraternity about the antioxidant properties of Indian foods spices and condiments and medicinal plants. Researchers suggest that Indian foods millets, turmeric, clove, pepper, cinnamon, ginger, garlic, onion, curry leaf, moringa leaves, fenugreek, spinach, aswagandha, tulasi, tea, honey, saffron, red chillies, amla, wheat grass and neem etc. have potent antioxidant and antitumor properties and complex studies can be can be treated with the foods. Extensive research trials are

undergoing for the in-depth understanding of functional properties of various foods to promote good health.

# TRADITIONAL CHINESE HERBS FOR ANTI-OXIDATION AND HEALTH BENEFITS

**Assist. Prof. Dr. Margaret KUO** Department of Tourism and Leisure Management China University of Technology
Taiwan
*Email: margaret.kuo@me.com*

Cells continuously produce free radicals and reactive oxygen species as part of metabolic processes. Nowadays exercise is a key role for health benefit, but especially when exhaustive, is also known to induce oxidative stress, inflammation, and muscle damage. Researches have been carried out to identify dietary strategies able to prevent the muscle damage and stress. Therefore, dietary antioxidant supplements are marketed to counteract the oxidative stress of exercise. This presentation focuses on review papers of traditional chinese herbs and discuss the role of herbs supplement for anti-oxidation and health promotion. Astragalus is used for immune enhancement and maintaining overall health. Cordyceps is a Chinese mushroom which used for many conditions, including fatigue, respiratory disorders, sexual dysfunction, enhancing the immune system, and improving exercise performance. *Eleutherococcus senticosus* may neutralize free radical created while exercising, and may protect cells from free radicals damage after exercise. After four weeks (400mg per day) of *Eleutherococcus senticosus* supplementation increase the level of free fatty acid ($p<0.05$). Suggest that ES may also effect on altering metabolic function. Heart rate is a more precise method to measure the intensity involved in a workout. Compared with P group, ES group increased HRmax 2.1% during the endurance exercise after the 4-week supplementation. Demonstrated that subjects were able to tolerate greater workloads at heart. Free fatty acid (FFA) is released by the action of hormone-sensitive lipase and fatty acids are the preferred fuel of muscle during endurance exercise. FFA at the beginning of the exhaustion exercise and showed that ES group does significantly affect the level of plasma FFA levels during exercise (270 ± 58 μmol/L increased to 350 ± 62 μmol/L) ($p<0.05$) after the 4-week supplementation. Suggesting that it had effect on altering metabolic function and can increase the β- oxidation. Phenolic or flavonoid compounds have also been recognized as potent antioxidants. Studies have shown that the active components of the yin herbs are mainly flavonoids. *Spatholobus suberectus, Sanguisorba officinalis and Agrimonia pilosa* were reported to contain flavonoids. Ginseng is marketed for many purposes, but the most common are to increase physical power, restore Qi or life energy,

increase overall health, enhance immunity, and increase vitality. Rhodiola, which directly enhance performance. The nutritional support of Chinese herbs are needed for not for young and old adult who wants to improve and extending their quality of life.

# ABSTRACTS

# ACUTE RESPONSE OF THE PARASYMPATHETIC CARDIAC MODULATION TO PHYSICAL EXERCISE IN ADOLESCENTS' WITH TYPE 1 DIABETES

Luis Paulo Gomes Mascarenhas (Midwestern Parana State University, Brazil).
Leandro Smouter (Midwestern Parana State University, Brazil).
Denise Barth Rebesco (Midwestern Parana State University, Brazil).
Erivelton Fontana de Laat (Midwestern Parana State University, Brazil).
Guilherme Eckhardt Molina (University of Brasilia, Brazil).
*Email: luismsk@gmail.com*

## INTRODUCTION

Heart Rate Variability (HRV) is a valid method used to assess the cardiac autonomic function in different clinical conditions. The reduction and/or low HRV has been considered to be a powerful and independent predictor of risk for cardiovascular and metabolic mortality and morbidity(1). At rest, adolescents' with Type 1 Diabetes Mellitus (T1DM) normally display a low HRV associated with a decrease of Parasympathetic Cardiac Modulation (PCM)(2). Several studies have shown(3) that during the Physical Exercise (PE) there is simultaneously increase in the sympathetic activity and decrease the parasympathetic activity, and consequently is observed a reduction of HRV during the PE. In this scenario, it is not clear whether different intensities of PE can reduce the HRV in different ways. Therefore, our objective was analyzing the acute response of PCM during Continuous Physical Exercise (CPE) comparatively to Intermittent Physical Exercise (IPE) in adolescents' with T1DM.

## METHODS

The experimental study included 15 adolescents' with T1DM (age: 13.2±1.6years; body mass index: 19.6±2.6Kg/m$^2$; glycated hemoglobin: 9.6±1.9%; diagnostic time: 6.2±3.8years). They performed two PE sessions in cycle ergometer, each session had 30 minutes of duration. In the first session, the volunteers performed the CPE with 60% of the Maximal Oxygen Uptake ($VO_2$max), and after 30 days they performed second session, IPE with 60% of the $VO_2$max, including a maximum sprint of 10 seconds to each 5 minutes of PE(4).

The morning sessions were performed in location with room temperature (23-24ºC), 1 hour after the insulin application and of the ingestion of the morning meal. There was continuous glucose monitoring before, during and after the sessions(5).

To identify the HRV, series of Interval between Two Successive R Waves (iR-R) were collected with a cardiac monitor Polar® (RS 800 CX; Polar OyInc, Kempele, Finland).

The Kubios® HRV software was used to trend removal and correction of ectopic beats in the series of iR-R. We use the Standard Deviation of Poincaré Plot Perpendicular to the Identity Line (SD1) how marker of the PCM[6]. To calculates it, the series spectrum of iR-R was divided into six windows 300 seconds (a SD1 for each window), totalizing six repeated measures.

In the data analysis, median values were plotted in a boxplot. The normality and the sphericity of the SD1 were evaluated with Shapiro-Wilk and Mauchly tests, respectively. To compare measures related, we used Friedman Variance Analysis (Friedman test), with post hoc of the pairwise type. The bilateral alpha error of 5% was considered in all analyses.

The study was approved by the Ethical Committee on Human Research of the Midwestern Parana State University, Brazil (number: 1202475).

## RESULTS

It was not possible to fulfill the normality principles and sphericity in the data distribution. According to Friedman test, there was significant difference between repeated measures, for the CPE, and to the IPE. In the post hoc for the SD1, the measure 1 was different from measures 2, 3, 4, 5 and 6, in the two PE forms. For the CPE, the median value for the SD1 in the 1st measure was 70.9ms, in the 2nd was 52.8ms, and followed with little variation until the 6th measure. In the IPE, the result was similar, the median value of the SD1 in the 1st measure was 87.3ms, and in the 2nd measure was 46.8ms. The Illustration 1 exhibits to the SD1 behavior according to time of CPE and IPE.

## DISCUSSION

The PCM analyzed by SD1 decreased during the beginning of the PE, as described in the literature[6]. Thus, the present study results agree with the literature, adding that PCM reduction occurs in CPE and IPE at the same magnitude.

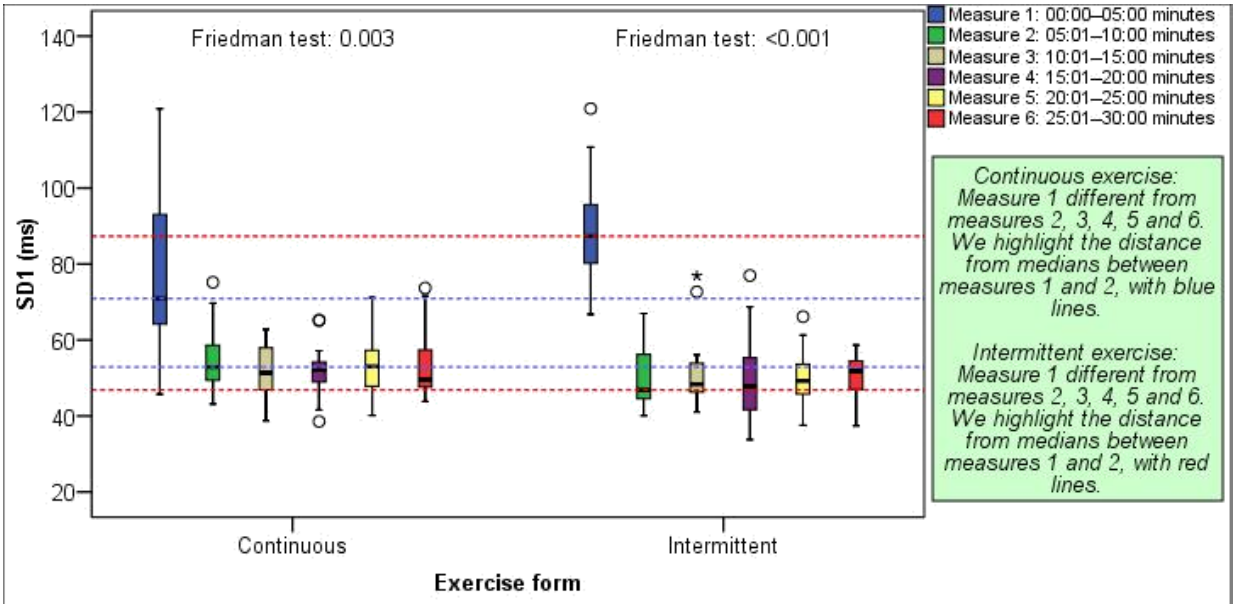



**Illustration 1 - SD1 index behavior during continuous physical exercise and intermittent physical exercise.**

The most vigorous muscle work may have caused parasympathetic reduction (Illustration 1). This stimulates the sympathetic autonomic activity, at the same time demands organism energy larger production, the heart rate increases so that the circulation blood supplies the energetic need of the muscle, reducing the PCM[3]. The differences absence, of the measure 2 until the measure 6, indicates that PCM stabilization in the two PE forms[6].

The time between PE forms is a limitation to be considered in results of the present study.

## CONCLUSION

We concluded that acute response of the PCM was not different ($p<0.05$) for CPE and IPE in adolescents' with T1DM. We suggest that PCM is independent of slight increases in PE intensity. Acknowledge: Fundação Araucaria.

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# EXERCISE SESSION (NEW INVENTION)
## 360° TITANIUM CORE STRENGTH EXERCISE ®

**Dr Lim Boon Hooi**
University of Malaya
Kuala Lumpur, MALAYSIA

**Abstract**

Core strength training differs from many traditional weight training routines by working both the lower back and abdominals in unison. The new invention - 360° TitaniUM Core Strength Exercise® is a new sequence of exercises to strengthen the whole core region muscles. It is easy to remember with no specific equipment needed to carry out this exercise. It is suitable for all athletes and non-athletes, regardless of gender and age. The structured sequence of exercises (12 exercises, continually with just two-turns) would enable the practitioners to experience greater efficiency of movement; improved body control and balance; increased power output from both the core musculature and peripheral muscles such as the shoulders, arms and legs; reduced risk of injury (the core muscles act as shock absorbers for jumps and rebounds etc.); improved balance and stability; and improved overall athletic performance. The whole training session will take approximately less than one hour, duration for this session will follow the progression principles, first set all participants will be performed 10 seconds/exercise, 2$^{nd}$ set is 15 seconds/set and final set will be performed at 20seconds/exercise. The book related to this New Invention of exercise is available for your future references (Figure 1).


Figure 1: 360° TitaniUM Core Strength Exercise® Book

# BONE HEALTH STATUS, MUSCULAR PERFORMANCE, AEROBIC AND ANAEROBIC CAPACITIES IN KELANTAN STATE ATHLETES REPRESENTING SPORTS WITH DIFFERENT LOADING CHARACTERISTICS ON THE SKELETON

Norsuriani Samsudin, Foong Kiew Ooi and Chee Keong Chen
Exercise and Sports Science Programme, School of Health Sciences, Health Campus, Universiti Sains Malaysia, 16150 Kelantan, Malaysia
Presenter: Norsuriani Samsudin,
Email: *norsurianisamsudin@gmail.com*

## ABSTRACT

Weightlifting, cycling and squash are popular activities among youth. The amount of bone loading in these sport varies greatly as weightlifting involves additional bone loading beyond body weight but without impact, cycling is non-weight bearing sport which involves repetitive motion, and squash involves repetitive weight-bearing, impact loading, accelerating and decelerating movements. This study was carried out to determine the differences in bone health status, muscular performance, aerobic and anaerobic capacities of male state level weightlifting, cycling and squash athletes. Forty four participants (mean age: 17.1 ± 1.6 years old) were divided into sedentary control, weightlifting, cycling and squash groups with 11 participant for each group. Participants' tibial and radial bone speed of sound (SOS) of dominant arm and leg were measured. Participants' estimated maximal oxygen uptake ($VO_{2max}$), Wingate anaerobic capacities, hand grip strength, back and leg strength were measured. One way ANOVA was performed for statistical analysis. The present study found that weightlifting, cycling and squash group exhibited significantly greater tibial and radial bone SOS ($p< 0.001$) compared to the sedentary control group. Bone speed of sound of the arm was highest in weightlifting group, followed by squash and cycling groups. Meanwhile, bone speed of sound of the leg was highest in cycling group, followed by weightlifting and squash groups. Cycling group showed significantly higher estimated $VO_{2max}$ ($p< 0.001$) compared to weightlifting and squash groups. Additionally, weightlifting group showed significantly greater dominant hand grip strength ($p< 0.001$), as well as back and leg strength ($p< 0.001$) compared to cycling and squash groups. In terms of Wingate anaerobic capacities, weightlifting group exhibited significantly greater peak power ($p< 0.05$) than cycling and squash groups. Cycling group showed significantly higher anaerobic capacity and power ($p< 0.001$), and significantly lower fatigue index ($p< 0.05$) than weightlifting and squash groups. These results imply bone health status and physiological profiles of the athletes are dependent on sport events they were involved in.

# QUALIFYING FLEXIBILITY

**Mallisah Kaur Inderjit Singh**
Department of Exercise and Sports Science, School of Health Science
University Sains Malaysia

## Abstract

Flexibility is acknowledged as an essential constituent of physical capability. Correspondingly to any other modules of fitness, flexibility is more vital for certain athletic sports than others. Hamstring flexibility has been investigated in current years because it is an essential component of physical fitness and spinal health. Hence this is because it is related to the lumbo-pelvic rhythm, the thoracic kyphosis, pathology of the spine and the muscle energy. Study done by Baltaci et.al, (2003) comparing three different sit and reach test, when measured using a Pearson correlation coefficient analysis was significant ($p<0.01$) for the traditional sit and reach test with back saver sit and reach test and flexibility of hamstrings ($r = 0.45$ and 0.65 for left and right legs, and 0.63 and 0.53 for left and right legs respectively). Also, the back saver sit and reach test for the left ($p<0.01$) and right ($p<0.05$) leg was significantly associated with hamstring flexibility ($r = 0.37$ and 0.25 for the left leg and 0.50 and 0.44 for the right leg respectively). Nevertheless, most of these studies included inactive populace, and studies which include athletes are limited. In review to this, Ayala et al found a high correlation ($r = 0.80$) between PSLR and SR in futsal players. Lo´ pez-Min˜ arro et al. found correlation values between PSLR and SR ($r = 0.75$) and between PSLR and TT ($r = 0.69$) in young paddlers. It is concluded that sit to reach test and modified sit to reach test is the best to be used because it requires minimal preparation time and equipment. In addition, it also eliminates excessive posterior compression of the vertebral disk.

# CURL UP AND SIT UP AS A TEST BATTERY

**Lee Wan Zhen**

Exercise And Sport Sciences Programme, School Of Helth Sciences , Universiti Sains Malaysia, Kelantan, Malaysia.

## Abstract

Muscular Endurance is a health-related component of physical fitness that relates to the muscle's ability to continue to perform without fatigue (USDHHS, 1996). Sit-up and curl up tests and exercises have been used to assess and develop abdominal muscular endurance. The study that conducted by by Bianco et al.( 2015) 381 participants volunteered for the study and randomly performed a sit up test (SUT), a push up test (PUT), and a free weight squat test (ST) and till exhaustion. The result shown that taking into consideration the sit up test as the dependent variable, the coefficients ($R2 = 0.23$; $r = 0.49$; $p < 0.001$), and ($R2 = 0.31$; $r = 0.57$; $p < 0.001$) emerged from a multiple regression analysis applied with respect to the push up test and the squat test, respectively. The SUT showed low inter-relation with the other proposed tests indicating that the adoption of a single test for the global evaluation of muscle endurance is not the optimal approach. Moreover, the SUT was found to be inexpensive, safe, and appropriate for core muscle endurance measurement for both male and female.

# ADHERENCE TO EXERCISE, A FACTOR OF NATURE OR NURTURE

**Lee Kean Mun**
University of Nottingham,
Malaysia
Email: leekeanmun@hotmail.com

The adoption of a sedentary lifestyle places the individual at risk of a variety of non-communicable health complications including coronary heart diseases, diabetes and poor mental health (Byrne and Byrne, 1993; Carayol, et al., 2012). In 2016, ischaemic heart disease was the leading cause of death worldwide, and in Malaysia (WHO, 2018; Department of Statistics Malaysia, 2017). Given the prominence of said epidemic, the promotion and cultivation of healthy lifestyles has become a necessity.

Obesity and overweight rates are still increasing in Malaysia. As of 2015, 30% of adults were classified as overweight and 17.7% as obese (Institute for Public Health, 2015; Nor, et al., 2018). While there are other factors such as poor quality diets, the sedentary lifestyle adopted by most Malaysians is a significant contributor to this epidemic. According to the Ministry of Health (2018), only 37.3% of Malaysian adolescents are considered physically active. This is remarkably low when compared to other countries such as the UK and Singapore, where 66% and 73.8% of the population met physical activity guidelines (Roth and Stamatakis, 2010; Win, et al., 2015). In order to combat this dilemma, promotion of physical exercise must occur.

The factors influencing an individual's propensity to exercise must be considered. The innate nature of an individual and nurturing received are the key factors determining their adherence to a physically active lifestyle (Huppertz, et al., 2014). Nature encompasses the aspect of genetics, directly affecting the phenotypic structure of an individual's body and its capabilities (Stubbe and de Geus, 2009). Nurture relates to experiences derived from exercising, which shapes the individual's attitude towards physical activity. Earlier research emphasised on influencing nurture via education and promotion of healthy lifestyles and its benefits (Hayes and Ross, 1986; Roth and Stamatakis, 2010). Recent research however, has shown correlations between specific genes and their potential impact towards exercise adherence (Stubbe, et al., 2006; Huppertz, et al., 2014). With regard to which factor has higher significance will depend on the analysis of research done to date.

## The Impact of Nurture

The concept of nurture is based on social cognitive models of health behaviour. Models such as the Health Belief Model (Becker, 1974) and Theory of Planned Behaviour (Ajzen, 1985) dictates that a person's actions elicit responses from the environment. This response then facilitates development or reinforcement of a particular attitude (Biddle and Nigg, 2000). Attitude is defined here as a psychological tendency expressed towards a particular entity after evaluation (Eagly and Chaiken, 1993). The adopted attitude then influences subsequent behaviour of the individual. If a person has pleasant experiences and enjoyed the benefits of exercise, their attitudes towards it will be generally positive. This outlook encourages them to adopt and maintain an active lifestyle. Therefore, experiences dictate our attitudes in this situation.

The types of environment an individual is exposed to is important due to its influences on attitude. Sources of environmental pressures contribute heavily to attitude, with some being more impactful than others. The major sources with regard to exercise adherence have been identified by researchers to be social class, ethnicity, and knowledge of exercise (Hayes and Ross, 1986; Roth and Stamatakis, 2010). Therefore, when planning for national health policies or campaigns, these factors must be taken into account.

Social class is noted to have a significant impact on an individual's propensity to exercise. People from high socioeconomic status (SES) tend to be thinner than their low SES counterparts. This is due to the acceptance of sedentary lifestyles in low SES societies, where people view that their health is not completely dependent on their actions and being physically inactive is normal (Hayes and Ross, 1986; James, Nelson, Ralph, and Leather, 1997; Stamatakis, et. al., 2005). The general attitude of low SES societies will affect individuals in the area, causing them to believe that exercise is not as beneficial. As the perceived benefits decrease, so does the willingness for individuals to exercise.

The culture, ethnicity and race of an individual greatly impacts their adherence to exercise. Asians are less likely to adopt an active lifestyle compared to Caucasians (Williams, Stamatakis, Chandola, and Hamer, 2011). According to Johnson (2000), asian communities tend to discourage recreational physical activities, opting to focus on academics in comparison. With the increased barriers, people are less inclined to exercise as the perceived benefits do not overcome the supposed detriments of exercising. Specifically targeting a population's perception on exercise may prove to be more useful than a blanket nationwide campaign (Kelly, Baker, Brownson, and Schootman, 2007).

Despite the asian communities' prioritisation of academic over exercise, education can help promote exercise adherence. By educating the population on the benefits and methods of exercise, people are more inclined to live active lifestyles. This can be seen from the research of Roth and Stamatakis (2010), which stated that individuals informed of public health guidelines are more likely to adhere to them. It was speculated that knowing health guidelines helps set a goal for individuals to reach. Understanding the benefits of exercise also causes cognitive dissonance in individuals, as they reevaluate their previous attitudes towards exercise (Festinger, 1957). Perceived benefits will increase in people and the population's behaviour will follow suit.

While education has potential in helping shape the population's attitude, there are factors that should be considered. Attitudes in general tend to cement around secondary school (Cavill, Kahlmeier, and Racioppi, 2006). Cultivation of positive attitudes towards exercise should then be focused on those in primary and early secondary. Campaigns targeted at those age groups typically yield the most cost effective results. Targeting the family unit can prove to be beneficial (Moore et al., 1991). As parents become physically active, their children may follow suit due to the aspect of constant exposure to positive exercise attitudes. Parents also serve as social reference points for children, as children tend to infer what is socially acceptable and beneficial from them.

## The Importance of Nature

In recent years, research on the individual's propensity to exercise has shifted from the prospect of nature to nurture. The concept of genes interacting with one another, pleiotropy, to form complex physical traits and personalities exhibited by the individual has been noted to be of significance (de Geus and de Moor, 2011). Research showed that attitudes, which was thought to be solely affected by nurture, can be inherited, as is the case with religious, and political attitudes (Eaves and Hatemi, 2008; Hatemi, et al., 2010). With that in mind, nature can be utilised to form exercise adherence.

Genetically acquired physical attributes do shape a person's outlook towards exercise. These attributes tend to be linked to genes affecting heart rate, cholesterol levels and blood pressure (Bouchard and Rankinen, 2001). Certain genetic predispositions allow individuals to excel at faster rates in certain exercise activities, allowing the individual to reap rewards quicker (Brutsaert and Parra, 2006). This can include weight loss exercises or competitive sports (Hainer et al., 2008). The increased frequency of benefits alter attitudes

towards said exercise activities in a positive manner. Evidence of such genes existing can be seen in studies done on families, where children of athletic parents are significantly more likely to adopt exercise behaviours in comparison to their sedentary counterparts (Moore, et al., 1991). While the argument of attitude cultivation through nurture via familial background may exist, studies on twins display support for the former hypothesis (Huppertz, et al., 2014). Monozygotic twins were shown to have significantly similar attitudes towards exercise in comparison to their dizygotic, and regular sibling counterparts. The existence of such data supports the concept of genetic influence overpowering those of the environment.

Personalities do impact exercise maintenance in non-direct manners. Characteristics such as Extraversion, Conscientiousness and Neuroticism from the Big Five Personality Traits, do significantly impact the individual in terms of attitude formation and exercise behaviour maintenance (Matthews, Deary, and Whiteman, 2003). People who are considered extroverted are able to find other benefits from exercise, such as socialisation and exploring new aspects or activities. People who are consciented are more prone to exercising due to focus on body image. The objective of a socially desirable or acceptable body figure serves as a strong motivation. This translates to higher perceived benefits for the individual. These two personality factors help increase the perceived benefits, potentially enough to overcome the barriers individuals may experience. Neurotics however, would be less inclined to exercise due to fears of embarrassment (Rhodes and Smith, 2006). The concern affects the attitude of the individual, causing them the barriers of behavioural entry and maintenance to increase. When trying to promote exercise adherence, it is best to understand the personality of the individual and attempt to introduce exercise adherence in the most effective way possible.

## Directions for Research

Overall, nature and nurture have impacts on exercise adherence. With nurture, attitudes are influenced by social class, ethnicity and education received. On the side of nature, physical attributes of one's body and their personalities heavily shape environmental influences which affect their attitudes in turn. In order to help promote exercise adherence, campaigns and programmes developed must account for nurture, with nature strongly taken into account.

With that in mind, research can be done with regard to catered educational and exercise programmes. Educational material on exercise and its regimes can be modified to

suit individuals with differing upbringing and personalities. Exercise regimes or activities can be selected and introduced to individuals, alongside benefits that appeals to them. It is expected that exercise adoption and adherence will occur. Adoption and adherence can be tested by interviewing the individual and comparing health results before and after the experiment time frame alongside self reports by the participants. While prior research has suggested and implied the success of such methods (Roth and Stamatakis, 2010), to knowledge, no longitudinal study has been performed on this field.

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# EARLY SCREENING AND HEALTH PROMOTION OF SARCOPENIA FOR COMMUNITY-DWELLING ELDERLY

Hwan-Wun Liu[1] and Yu-Zu Wu[2]

[1]Graduate Institute of Medical Science, [2]Deapartment of Physical Therapy, Tzu Chi University, Hualien, Taiwan, ROC

**INTRODUCTION**: The population of Taiwan is being aged rapidly. This is an unavoidable thorny issue, and the aging rate of Hualien County's population is much faster than the average rate in Taiwan. An aging body with sarcopenia may deprive the independence of daily life, reduce the quality of life and lead to disability. Hence, early screening of sarcopenia is the most important for improving the health status of the elderly.

**METHODS**: This study recruited both women and men over 50-years-old (aboriginal people over 50 years old are considered as the elderly in Taiwan) from five communities in Hualien County, and the elderly with pre-clinical sarcopenia were identified by muscle strength, 10-meters walking test, five-time sit-to-stand (FTSTS), timed up and go test (TUG).

**RESULTS**: According to the recommended criteria of the Asian Sarcopenia Working Group, among 115 subjects (27 males and 88 females) evaluated, 35 (30.4%) revealed lower handgrip strength (male < 26 kg, female < 18 kg), 3 (2.6%) revealed slow walking speed (< 0.8 m/s), and 20 (17.4%) revealed both lower handgrip strength and slow walking speed.

**DISCUSSION**: Demographical analysis found that lower grip strength appeared early in younger population, and slow walking speed found later in older population. There is a high positive correlation between walking speed and stride length ($r = 0.93$, $p<0.05$), a moderate negative correlation between walking speed and FTSTS as well as TUG ($r = -0.67$ and $-0.69$, $p<0.05$, respectively), and a low positively correlation ($r = 0.478$, $p<0.05$) between walking speed and handgrip strength.

**CONCLUSION**: Although the muscle mass of those elderly with lower grip strength or/and slow walking speed need to be further tested to confirm the diagnosis of sarcopenia. The results indicated that lower handgrip strength and slow walk speed are effective in screening pre-clinical sarcopenia for further physical intervention.

**KEYWORDS**: Elderly, sarcopenia, screening, community

# CROSS EXAMINATION OF HEART RATE RETURN WITH HIGH PRE-EXERCISE HEART RATE DURING EXERCISE

H.K. Wong, C.P. Lee, K.H. Heng, Nanirin N., Alice L. *Email: ethan.exerciseclinic@gmail.com Contact: +6 014 905 8303*

## Abstract

## Introduction

Cardiovascular disease (CVD) remains the world top killer for more than 10 years, there were 26.6% mortality rate globally in 2015 alone. One of the reasons is the unpredictable cardiovascular events (CVE), the sudden death caused by arrhythmia. As exercise is a proven method to reduce risk of developing CVD, however with inappropriate cooling down during exercise might increases the susceptibility of arrhythmia which ruined the purpose of exercise [(1)]. Reports showed within CVE's victims, young adults and elderly are included. Although, the exact reason of sudden death during exercise remains uncertain, there are few risk factors proven to correlate with CVE during exercise.

Young victims possess hypertrophic cardiomyopathy and congenital coronary anomalies which they mostly unaware of it until the CVE occurred when there is an exertion in the physical activity they participated. Whereas elderly usually have coronary artery atherosclerosis [(2)].

With these conditions, blood pooling is also proven as an effect of not executing cooling down. Exercise with moderate to strenuous intensity, the heart rate could rise up to 150 over beats which depend on the individual age and intensity level and the cardiac output is elevated. If the individual stop exercise abruptly, the heart is forced to slow down tremendously catecholamine continues to elevate while the serum potassium begins to be re-absorbed back to the muscle thus causing hypokalaemia [(3)]. The fitter the individual the faster it drops [(4)]. The polarized figure of heart rate changes, cause the venous return greatly reduced. Disrupt the blood supply to heart and allow the heart go into a "vulnerable period". Thus, a proper cooling down is necessary to avoid CVE.

## Discussion

Cooling down session is the least studied compared to other phases of exercise such as warming up, resting heart rate and target heart rate training (THR). The THR is well established as the heart rate marker to achieve exercise benefits, the Heart Rate Return (HRrtn) is the marker use to pinpoint the ideal heart rate to stop exercise without feeling discomfort and possible death [(5)].

The study of cooling down by using HRrtn as marker to determine exercise cessation involves 30 subjects age between 38-62 years old of different gender. These physically inactive subjects have a high pre-exercise heart rate (pre-eHR) of above 100 bpm and were monitored and trained at 65% of maximum heart rate (MHR).

It has demonstrated pre-eHR which is higher than 100 bpm affect the value of HRrtn and the time taken to achieve it. This essentially reduce the difference between THR and HRrtn, thus shorten the time taken to achieve HRrtn.

## Result

Through average of 20 sessions of cardio training, the subjects resting heart rate have reduced to less than 100 bpm and maintained for the last 3-4 consecutive training sessions, an indication of improved their cardiovascular fitness.

## Conclusion

Individuals with high pre-eHR (>100bpm) are recommended to cool down for 5 minutes instead of stop upon achieving HRrtn. With correct dosage of exercise, pre-eHR could be reduced to a normal range. After subjects' heart rate returns to normal, HRrtn is applicable. Our future study will involve the serum level of potassium.

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# EFFECTS OF DIFFERENT METHOD TO RETURN POST EXERCISE HEART RATE TO BASE LINE HEART RATE AFTER SUBMAXIMAL EXERCISE

N. Iffah, Durashini, Chan Q. E. & N. Ashikin

**Introduction:** After exercise our heart rate to return to pre-exercise value are not well understood (Imai et al., 1994). Heart rate decline is a result of rapid restoration of vagal tone after the stop of exercise (Imai et al., 1994; Perini et al., 1993). According to Takahashi et al., 2000, study showed different effect of body posture after exercise. So this study is to compare heart rate return (HRrtn) in relation to different recovery protocol that is sitting and lying. This study also to identify Heart rate and heart rate recovery indices for each recovery condition. In this study we measure resting heart rate (rhr), target heart rate (thr), heart rate return (HRrtn) and heart rate recovery (hrr). **Subject:** All subject used are random sample. We have 39 adult at age arrange 18 years old to 24years old which 26 are females and 11 are males. 13 of the adult is currently at active activity level, another 13 adults currently at moderately active activity level and 13 adults more currently at inactive activity level. **Method :** Measurements were undertaken in a quiet room to avoid stress on the patient. client will be asked to walk on a treadmill. The walk starts off slowly, then the speed and incline increases at set times. It is very important that you walk as long as possible because the test is effort-dependent. Subject will be trained at 55% – 65% target heart rate. Every 5 minutes exercise therapy will take down heart rate . At the minute of 25 the exercise therapy will cut half of the speed and incline. At the minutes of 26 the exercise therapy will take down the heart rate to see the heart rate recovery. At the minutes of 27,the the exercise therapy will take the heart rate and stop the treadmill. Exercise therapy will take heart rate at minute of 28, 29 and 30. Then continue taking each 5 minute until subject achieve resting heart rate back. **Result :** The study showed no significant difference in the measurement of resting heart rate during sitting in an inactive person ($p > 0.05$), moderately active ($p > 0.05$) and active ($p > 0.05$), where as in lying; inactive person ($p > 0.05$), moderately active ($p > 0.05$) and active person ($p > 0.05$). **Conclusion:** In conclusion, this study found that subject are not honest in answering physical activity level questionnaire that lead into accepting the null hypothesis. Secondly most of the test are been done after the gym classes that lead the subject fatigue during the test. In a nut shell, for future study this study suggest that limitation in this study need to be looked up for a better result.

# COMBINED EFFECT OF PLANT BASED PROTEIN SUPPLEMENTATION WITH RESISTANCE TRAINING ON ISOKINETIC MUSCULAR STRENGTH AND PROTEIN CATABOLISM MARKERS IN ADULT MALES

[1]Azaizirawati Binti Ahmad, [1]Marilyn Ong Li Yin & [1]Foong Kiew Ooi

[1]*Exercise and Sports Science Programme, School of Health Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kota Bharu, Kelantan Malaysia*

**INTRODUCTION**: Nowadays, protein supplements are widely used as it is believed that combining the consumption of protein supplements with exercise will promote gains in lean mass and improved physical performance (Erdman et al. 2007; Lieberman, 2010) whereas resistance training exercise has gained recognition in term of the physiological adaptation and health benefits that occur related with the exercise (Phillips, 2016). Plant-based protein like soy has been used as a protein milk substitute and it is also contains is flavone glycosides which are beneficial for health (Sacks et al. 2006). The purpose of this study was to investigate the combined effect of plant-based protein supplementation which consists of soy and pea protein with resistance training on muscular strength and protein catabolism in adult males.

**METHODS**: Twenty eight sedentary adults males were randomly assigned into four groups: plant-based protein combined resistance training (PBPEX), plant-based protein alone (PBP), resistance training alone (EX) or control (C). Muscular strength was determined by using isokinetic dynamometer and blood samples were analysed for protein catabolism markers. Participants in PBPEX and PBP groups consumed 16g plant-based protein consists of soy and pea protein while participants in EX and C groups consumed 16g placebo consists of maltodextrin. Participants in PBPEX and EX groups performed three sets of 4-6 repetitions, 3 times per week for 8 weeks, of supervised resistance training that consisted of seven types of total body exercises at 60-70% intensity of one repetition maximum (1-RM). All data were analysed by using repeated measures.

**RESULTS**: PBPEX could significantly increase ($p<0.01$) more isokinetic muscular strength parameter, i.e knee and shoulder flexion peak torque compared to EX groups. For protein catabolism measures, PBP showed significantly higher level ($p<0.05$) in serum urea and blood urea nitrogen (BUN) than PBPEX, EX and C groups respectively.

**DISCUSSION:** Combination of plant-based protein and resistance training showed greater beneficial effects on enhancing muscular strength than resistance training alone. For protein catabolism, plant-based protein combined with resistance training seems to have potential in attenuating the increase of protein catabolism induced by plant-based protein alone.

**CONCLUSION:** Ccombinations of plant-based protein supplementation and resistance training elicited greater beneficial effects on muscular strength than resistance training alone and plant-based protein supplementation alone. Therefore, combined plant-based protein with resistance training may be recommended as a guideline in planning exercise and nutritional programme for sedentary male adults.

Keywords: Isokinetic muscular peak torque; serum urea; blood urea nitrogen (BUN)

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# MEMORY ABILITY AND QURAN MEMORISATION SKILLS IMPROVED AFTER 6-WEEKS OF COGNITIVE-ENGAGING GROUP EXERCISES IN ADOLESCENT GIRLS.

Nur Najwa **Mohd Alias**[1], Saedah **Ali**[2] and Vina **Tan** Phei Sean[1]

[1] Exercise and Sports Science, School of Health Sciences, Health Campus, Universiti Sains Malaysia, Kubang Kerian, 16150, Kelantan.

[2] Department of Anaesthesiology, School of Medical Sciences, Health Campus, Universiti Sains Malaysia, Kubang Kerian, 16150, Kelantan.

**Introduction**: Benefits of exercise on cognitive abilities may stem from the improved blood circulation, increased brain connections and higher brain activity. In this study, we examined the effects of cognitive-engaging group exercises on memory ability and Quran memorisation in adolescent girls.

**Methods**: Twenty-nine adolescent girls (13.5±0.5 years) who were Quran memorisers, *huffaz*, from a private Islamic secondary school volunteered for this within-subject, intervention study. We assessed memory ability and Quran memorisation skill using Rey Auditory Verbal Learning Test (RAVLT) and Quran verbal recital (*tasmi'*), respectively. *Tasmi'* was evaluated by the number of remembered verses (RV) and errors made (EM). Tests were conducted at baseline ($T_0$) and repeated two weeks later at pre-intervention ($T_1$) and at post-intervention ($T_2$). All participants followed a supervised circuit training programme for six weeks that consisted of eight sets of cognitively engaging, moderate-to-vigorous intensity exercises (60%-70% $HR_{max}$). Exercises were conducted 3x/week, 30-40 min per session and with 5-6 girls in a group.

**Results:** Study outcomes between $T_0$ to $T_1$ showed a learning adaptation for RAVLT but no improvements in *tasmi'* or number of errors in Quran memorisation. When we compared $T_1$ to $T_2$, participants had significantly increased their RAVLT scores (+3.5%, p=0.001), *tasmi'* RV (+14.5%, p=0.032) and reduced *tasmi'* EM (-35.8%, p=0.014).

**Discussion:** This study adds to the current literature on exercise and cognitive function in adolescents. We showed that cognitively-engaging group exercises benefitted adolescent girls' memory and more practically, useful in Quran memorisation. From meta-analyses, there were conflicting results on the benefits of exercise on cognition (Donnelly et al., 2016; Verburgh et al., 2014). Despite our within-subject study design, our specific exercise intervention focused on aerobic and coordinative exercises, which could be the key in achieving enhanced memory ability (Diamond, 2015).

**Conclusion**: Cognitively-engaging, moderate-intensity group exercises may assist in memory ability and Quran memorisation in adolescent girls.

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# PHYSIOLOGICAL PROFILE AND BONE HEALTH STATUS OF MALAY MALE STATE LEVEL BOXING, MUAY THAI AND SILAT ATHLETES

[1]Muhammad Amrun Haziq Abidin, [1]Foong Kiew Ooi & [1]Chee Keong Chen

[1]*Exercise and Sports Science Programme, School of Health Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia*

**INTRODUCTION**: Boxing, Muay Thai and silat are martial arts that involve different types of fighting skills. To date, little is known about the physical fitness components and bone health status among boxing, Muay Thai and silat athletes. This study was carried out to determine the differences in physiological profile and bone health status of Malay male state level boxing, Muay Thai and silat athletes.

**METHODS**: A total of 40 participants (mean age: 16.7 ± 1.5 years old) were divided into four groups, i.e. sedentary control, boxing, Muay Thai and silat groups with 10 participants per group. Participants' lung capacity, estimated maximal oxygen uptake ($VO_{2max}$), anaerobic capacities, isokinetic muscular strength and power, hand grip strength, back and leg strength, standing long jump explosive power, Illinois agility, standing Stork balance and flexibility were measured. Bone sonometer was used to measure bone speed of sound (SOS) of participants' tibia and radius dominant and non-dominant legs and arms.

**RESULTS**: The results of the present study showed that boxing athletes exhibited statistically significant greater arm isokinetic muscular strength and power than silat athletes, and higher arm isokinetic muscular power than Muay Thai athletes. Boxing athletes also showed statistically significant higher estimated $VO_{2max}$ compared to silat athletes. Moreover, Muay Thai group exhibited statistically significant greater radius bone SOS values of non-dominant arm compared to sedentary controls.

**DISCUSSION**: This study found that boxing athletes exhibited greater arm isokinetic muscular strength and power than silat athletes, and also greater arm isokinetic muscular power than Muay Thai athletes. Boxing athletes also showed better aerobic fitness compared to silat athletes. It is speculated that the significant differences observed in muscular performance and aerobic capacity could be due to differences in the style of fights and also match fitness requirements of these three types of martial arts (Aziz *et al*., 2002; Khanna and Manna, 2006; Myers *et al*., 2013).

**CONCLUSION**: The findings obtained from this present study can be used as guidelines to facilitate the development of specific training programmes for boxing, Muay Thai and silat athletes.

Keywords: aerobic and anaerobic capacities, isokinetic muscular strength and power, bone speed of sound (SOS), martial arts

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# THE EFFECT OF MODERATE-INTENSITY AEROBIC EXERCISE TRAINING ON WOMEN WITH SYSTEMIC LUPUS ERYTHEMATOSUS

Kuei-Ying Su[1,2*], Victoria P. Y. Kao[1,2], Chai-Sheng Pai[1], Huei-Jhen Wen[2], Yu-Jen Pan[1], Shih-Tzu Tsai[1]

*[1]Division of Rheumatology and Immunology, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan; [2]School of Medicine, Tzu Chi University, Hualien, Taiwan*

**Introduction:** Systemic lupus erythematosus (SLE) is a systemic autoimmune disease characterized by multi-organ injury and chronic inflammation. Although exercise has become an adjuvant therapy for other rheumatic diseases such as ankylosing spondylitis and rheumatoid arthritis[1], it is still unclear whether regular exercise worsens inflammatory status and disease activities in SLE patients[2,3]. This study aims to evaluate the influence of chronic moderate-intensity aerobic exercise training on women with SLE.

**Materials and Methods:** Female SLE patients without regular exercise were screened at outpatient clinic in Hualien Tzu Chi Hospital, and were recruited into this project. Patients were allocated non-randomized, based on patients' willingness, into either exercise or control group. Patients in exercise group undergo a 12-week course of home-based, moderate-intensity aerobic exercise, while patients in the control group remain their usual sedentary lifestyle. Patients of the control group, after completion their post-test, are allowed to enter the exercise group. Exercise program includes warm-up session, 4 sets (about 30 minutes long) of moderate-intensity exercise session, stretching session, and a final relaxation session. Participants conduct this exercise program 5 days per week and report to us their maximum heart rates. Prior and post the 12-week course of intervention, we evaluate patients' body mass index (BMI), 2-km brisk walking test for cardiopulmonary function, SLE disease activity index (SLEDAI) via SELENA-SLEDAI, EEG expression for executive control test, body composition by dual-energy X-ray absorptiometry (DXA), routine blood tests, as well as pro- and anti-inflammatory cytokines by ELISA. Statistical analysis is performed using paired student's t-test. Results are presented as mean ± SD.

**Results:** Total 34 SLE patients were enrolled; each group includes 17 SLE patients. Demographic data of the 34 patients showed that, in control and exercise groups respectively, the mean age was 38.11 ± 12.28 years and 40.88 ± 11.82 years, BMI 23.10 ±

4.30 kg/m$^2$ and 23.94 ± 6.92 kg/m$^2$, percentage of fat in total body mass 34.87 ± 6.90% and 34.79 ± 5.36%, and SLEDAI scores 5.07 ± 5.93 and 4.29 ± 4.69. At the time of abstract submission, 28 patients have completed both pre-test and post-test and the results from which were analyzed. In the exercise group, 2-km brisk walking time decreased significantly after the 12-week intervention (pre: 19.64 ± 2.19 min, post: 18.90 ± 2.28 min, $p$ = 0.0003, n = 15), while those in the control group showed no difference (pre: 19.19 ± 1.58, post: 19.02 ± 1.74, $p$ = 0.519, n = 13). Fitness index (FI) of these physically inactive SLE patients was under average level (<90), and was improved after 12-week exercise program (80.14 ± 23.71 and 85.54 ± 23.58 for before and after exercise intervention, $p$ = 0.004, n = 15). SLEDAI scores of the exercise group showed an improvement trend after exercise intervention (pre: 4.47 ± 4.85, post: 3.53 ± 4.16, $p$ = 0.219), whereas those of the control group showed an up-trend after the experiment (pre: 5.31 ± 6.10, post: 6.38 ± 6.16, $p$ = 0.063). There were no obvious differences between pre-test and post-test in the following parameters: BMI, weight, percentages of lean and fat body mass, complete blood counts, erythrocyte sedimentation rate, anti-dsDNA antibodies, complement 3 and complement 4, regardless of exercise intervention.

**Discussion:** Disease flares commonly cause physical inactivity is patients with systemic rheumatic disease, thus result in low cardiopulmonary function[4]. The 12-week moderate-intensity aerobic exercise training improves SLE patients' cardiopulmonary capacity and does not induce their disease flare.

**Conclusions:** To improve SLE patients' fitness, the home-based moderate-intensity aerobic exercise seems to be a safe and feasible solution. Regular exercise is encouraged when SLE disease is controlled.

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# ASSOCIATION OF MUSCLE CONTRACTION AND BONE MINERAL DENSITY (BMD) IN ATHLETES

**Norsuriani Samsudin**
Department of Exercise and Sports Science,
School of Health Science
University Sains Malaysia
*Email: norsurianisamsudin@gmail.com*

This review article discusses the association of muscular contraction and bone mineral density in athletes. Generally, muscle and bone are intimately connected both functionally and physically. Muscle contractions can cause the largest physiological loads on bone, and there is a linear relationship between muscle forces and bone mineral density. Muscle contraction force acts directly and indirectly on bone is an important determinant of skeletal adaptation to exercise. Skeletal adaptations to loading also appear to be site-specific and anatomical distribution of loads may be as predictor of bone mineral density. During physical activity, mechanical forces are exerted on the bones by the contractile activity of muscles through tendon. The athletes subjected to high muscular forces acting on the skeleton subsequently, the athletes' bones may be exposed to high mechanical loadings, and hence will enhanced BMD at loaded sites. It is known that athletes subjected to high muscular forces acting on the skeleton and the athletes' bones exposed to high mechanical loadings, hence, the bone mineral density will be enhanced. Duncan *et al.* (2002), Andreoli *et al.* (2001) and Tsuji *et al.* (1995) studied about association between leg strength and BMD in young athletes with different type of sports. These studies found that moderate positive correlation ($p$ <0.05; r < 0.50) between knee extension strength and bone mineral density sites was measured by using Pearson correlation analysis. Collectively, the evidence showed that osteogenic effects of mechanical loading are dependent on the type, magnitude and rate of the applied load as well as the strain created by muscular contraction. Meanwhile, dynamic and high magnitude loading could elicits beneficial effects on bone health. Nevertheless, strenuous exercise is believed may elicit negative effects on bone properties. Therefore, different kind of physical loading and loading patterns from different types of physical activity acting on each site might have different effects on bone mineral density (BMD) and powerful osteogenic stimulus. Thus, this review article highlights the available studies of association muscular contraction and bone mineral density on different type of sports in athletes as well as studies that have been carried out to investigate its

effects of different loading patterns and strain created by muscular contraction on bone mineral density.

# EFFECTS OF *MORINGA OLEIFERA* SUPPLEMENTATION AND RESISTANCE EXERCISE ON IMMUNE CELLS AND BONE TURNOVER MARKERS AMONG SEDENTARY YOUNG MEN

[1]Maziana Abdul Muin, [1]Ayu Suzailiana Muhamad, [1]Foong Kiew Ooi & [1]Chee Keong Chen

[1]*Exercise and Sports Science Programme, School of Health Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia*

**INTRODUCTION**: *Moringa oleifera* (Mo) is a type of herb rich with vitamins and minerals that are beneficial for bone health (Brown *et al*., 2016). It was also reported that Mo poses anti-inflammatory, antimicrobial and antioxidant properties (Varmani & Garg, 2014). However, to our knowledge, no study has been carried out to investigate its possible benefits in combination with resistance exercise on immune cell responses and bone turnover markers among sedentary young men to date. Thus, this study aims to investigate the effects of 6 weeks of combined Mo supplementation and resistance exercise on immune cells and bone turnover markers in sedentary young men.

**METHODS**: Forty sedentary young men were recruited and assigned into four groups with 10 participants per group: placebo without exercise control (C), resistance exercise (Ex), Mo supplementation (MO) and combined resistance exercise with Mo supplementation (MOEx) groups. Participants in the Ex and MOEx groups performed resistance exercise 3 times per week for 6 weeks. Participants in the MO and MOEx groups consumed 4 capsules per day of Mo (300 mg of 100% Mo leaf powder per capsule) while participants in the C and Ex groups consumed 4 capsules per day of placebo (maltodextrin) for 6 weeks. Blood samples were collected at pre- and post-intervention period.

RESULTS: This study discovered that combination of resistance exercise and Mo did not significantly induce better effects on immune cells count and bone turnover markers concentration compared to control, resistance exercise alone, and Mo supplementation alone.

**DISCUSSION**: The non-significant effects of Mo on the measured parameters might be due to poor bioavailability of the Mo in human body and inadequate exercise duration and intensity and the dosage of supplementation prescribed to elicit beneficial effects on immune cells count and bone turnover markers among sedentary young men.

**CONCLUSION**: Despite numerous previous animal and *in vitro* positive findings (Patel *et al*., 2013; Lamou *et al*., 2016; Marupanthorn & Kedpanyapong, 2016), the present study

found that combination of Mo supplementation and resistance exercise did not significantly enhanced immune cells count and bone turnover markers among sedentary young men. Thus, more studies need to be carried out with consideration on the Mo bioavailability in human body and also the effective dose of Mo and longer study intervention to provide evidence of possible benefits of Mo on immune function and bone health.

Keywords: Cross-linked C-terminal telopeptide of collagen alpha-1; osteocalcin; alkaline phosphatase; white blood cells; lymphocytes

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