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President's Message

Physiology behind motivation

It is a pleasure to give a President's message at the end of the calendar year as well as at the end of my tenure as the President of the PSSL. Physiology is a subject learnt in Medicine. Not only a subject in medicine, it is the basis for the practice of many branches of Medicine. It appears that physiological principles can be used beyond Medicine.

In the last President's message titled "Beyond Search, Teach and Serve" I tried to argue that motivation and mobilization is important to bridge the gaps between knowledge and practice by taking type 2 diabetes mellitus as an example.

Motivation is a neural function as learnt in neurophysiology. Motivation is used in many other fields which include education, marketing, managing and banking. In those disciplines psychology is the basis for motivation such as educational psychology, marketing psychology etc. According to psychologists one important theory related to motivation is Maslow's hierarchy of needs.

Maslow's hierarchy of needs is described in ascending order as physiological needs, safety, social needs, esteem and self-actualization. The most basic category is the physiological needs. Once physiological needs are satisfied then individuals look for a higher level of the hierarchy such as safety. In this scenario, it does not explain the role of physiology in motivation.

This theory is used in many fields to get maximum productivity by identifying the needs of workers and needs of consumers. The maximum services or work is obtained from worker by providing their needs. On the other hand, needs of the consumers is fulfilled to get maximum sales of products.

Motivation in neurophysiology is related to learning and memory. During learning, information is gathered and stored as memory. Behavior is altered depending on learning. Learnt information is stored in certain areas of the brain. When some areas of the brain are stimulated certain behavioral patterns can be observed in animal models. Animals feel pleasure or satisfaction when certain areas of the brain are stimulated. Those areas are named as rewards system or reward areas. Similarly, there are other areas in the brain when stimulated the animal gets terrified and develop sense of fear. Those areas are collectively known as punishment system or punishment areas.

As stated above, memory is related to motivation. Memory is classified in different ways. One classification depends on the duration of memory that lasts in the brain. When memory is classified according to duration, there are two levels; short-term memory and long-term memory. When an event associated with an emotion, it goes to long-term memory. When there are negative emotions long-term memory is stronger than for positive emotions. Punishments are associated with negative emotions while rewards are associated with positive emotions.

This physiology knowledge can be practiced to get favorable behavioral change to reach the goals. Singapore and Dubai have used punishments rather than rewards to keep the city clean and they were successful. In certain other situations rewards were used with success.

One can explain physiologically that punishments are more powerful in changing the expected behavior than rewards. The decision to use punishment or reward has to be taken carefully because in certain situations it may give negative results, especially in children. If punishment is used always children may become adamant and develop negativism.

Finally, one can explain physiologically the advantages of rewards and punishment to get the expected outcome.

Cardiopulmonary Exercise Testing- a novel method of clinical assessment

Test of Cardiopulmonary function (CPET) during exercise has been used for over 50 years . However, its versatility and clinical use for patients with cardio vascular and pulmonary disease has emerged only recently. The clinical use of CPET has been enhanced further with the development of technology over the years. The addition of ventilatory gas exchange measurements during exercise testing provides a wide array of unique, clinically useful information that had been poorly utilized by the practicing clinician. Therefore CPET is now being recognised as a valuable testing method that can provide important results for patients with cardiovascular and pulmonary disease. This brief overview would provide the physiologic basis for functional exercise testing, methodological considerations, and some of its clinical applications.

CPET has long been used in the assessment of athletic performance. In sports medicine research, it provides valuable inputs to trainers and sports personnel as an effective test of endurance. Now, CPET offers the clinician the ability to obtain a wealth of information beyond standard exercise electrocardiography test. Thus when appropriately used, it can assist in the management of complex cardiovascular diseases, pulmonary diseases and other disorders.

During exercise, the cardiovascular system and the respiratory system function optimally to provide O_2 to the tissues and remove the CO_2 produced by the tissues. The CPET provides an assessment of the integrative responses of the cardiovascular, pulmonary, haematopoietic, neuropsychological, and skeletal muscle systems during exercise. It is a low risk, non invasive test that measures the coordinated function of the above organ systems during an exercise protocol. Further it allows accurate, dynamic assessment of cardiac and pulmonary performance during exercise in a variety of settings. In the process of measuring dynamic gas exchange during graded exercise, CPET can identify potential deficiencies within these systems. These deficits are often not seen when the resting cardiac and pulmonary functions are assessed.

Modern CPET systems allow for the analysis of gas exchange at rest, during exercise, and during recovery and provide breath-by-breath measures of oxygen uptake ($\dot{V}O_2$), carbon dioxide output ($\dot{V}CO_2$) and ventilation ($\dot{V}E$). These advanced computerized systems provide both simple and complex analysis of data that are easy to retrieve and store. The data can be integrated with standard variables measured during exercise testing, such as heart rate, blood pressure, work rate, and electrocardiography findings. The above data when combined with the patient's symptoms provide a comprehensive assessment of exercise tolerance and exercise responses. CPET can even be performed with simultaneous imaging investigations to further the diagnostic assessment. Thus its use and versatility as an investigation tool is now further enhanced to meet the clinical needs.

The variables that can be assessed during CPET testing are many. It includes cardiovascular pulmonary and metabolic variables. The test is useful as the subject has to undergo only one test to obtain a very broad over view of the function of the cardiovascular and respiratory system functioning together in this setting.

Gas Exchange Physiology in Health and Disease

The ability to perform physical exercise is critically related to the cardiovascular system's ability to supply oxygen(O_2) to the muscles and the respiratory system's ability to remove the carbon dioxide (CO_2) formed by the tissues. Both O_2 and CO_2 are transported along the blood stream and delivered to the lungs. Several processes are essential for the above mechanisms to happen, such as adequate pulmonary ventilation, efficient diffusion of gases at the alveolar capillary membrane, carriage of oxygenated blood to the tissues and removal of tissue CO_2, the exchange of gases at the tissue level. The above processes require both external and internal respiration to function effectively.

As CPET investigates the mechanisms responsible for external and internal respiration by exercise, it frequently reveals abnormalities that are not usually apparent at rest. The increase in oxygen uptake by the working muscles is provided mostly by an increase in cardiac output, which may increase up to 6 times that at rest. The blood flow is redistributed away from non - active tissues (eg. splanchnic and renal) to the skeletal muscles, which further facilitates greater O_2 delivery. In the lungs, the blood flow increases by an increase in the right ventricular output and by vasodilation of the pulmonary vessels. At the muscle level, the tissues extract a greater amount of O_2 from the blood, resulting in a widening of the arteriovenous oxygen (a–v O_2) difference. The respiratory system also increases its work by several methods. Among normal subjects, minute ventilation ($\dot{V}$ E) increases in proportion to the increase in work rate initially. During inspiration only part of the tidal volume of air reaches the alveoli, to be involved in gas exchange. During exercise, the 'ventilatory dead space'(VD), (ie. the air that remains in the respiratory passages not participating in gas exchange) too is increased due to dilatation of respiratory passages. However the increase in the tidal volume maintains adequate alveolar ventilation, and facilitates gas exchange to establish a well matched normal ventilation-perfusion ratio.

Many disease states can alter the matching of ventilation to perfusion. In many forms of pulmonary disease, a higher than normal dead space limits the exercise capacity. This occurs due to a decrease in the healthy lung tissue that can be involved in gas exchange. The increase in $\dot{V}$E during exercise must be matched by an increase in blood flow; that is, cardiac output must increase to match ventilation to maintain necessary gas exchange.

One of the hallmarks of chronic heart failure is an impaired cardiac output in response to exercise; this may lead to a mismatching of ventilation to perfusion, in which ventilation must increase disproportionately to the metabolic needs to compensate for inadequate perfusion. The degree to which ventilation is abnormally increased during exercise is directly related to the severity of disease and is a strong marker of prognosis.

Assessment of exercise capacity is typically performed on a motorized treadmill or a stationary cycle ergometer. Treadmill exercise is generally the preferred modality in many exercise laboratories. An untrained subject will usually terminate cycle exercise because of quadriceps fatigue at a $\dot{V}$O2 that is on average 10% - 20% below their treadmill peak$\dot{V}O_2$. Cycle ergometry also requires subject cooperation in maintaining a pedal speed at the desired level, usually ~60 rpm. However most modern ergometers have electronic braking apparatus to maintain a steady work rate at variable speeds Cycle ergometry is often the preferred mode with subjects having a gait or balance instability, severe obesity, or orthopedic limitations or when simultaneous cardiac imaging is planned. Many types of protocols are used in various settings however the protocol should be tailored to produce a fatigue-limited exercise duration of 8 to 12 minutes.

A final CPET report should include; the reason for the test and what type of type of test was completed (eg, modality, protocol); summarize the patient's base line data and clinical and physiological responses to exercise (eg, duration, symptoms, reason for stopping); and avoid the use of terms positive or negative. The report should conclude with a list of final impressions or recommendations that concisely and specifically respond to the reason the test was ordered.

Several important variables derived from CPET provide useful diagnostic and prognostic information.*Work rate* is derived in METs (metabolic equivalents); *Metabolic exchange*is derived by Maximum aerobic capacity ($\dot{V}O_2$max), Peak $\dot{V}O_2$, ventilatory threshold (VT), Respiratory exchange ratio (RER), anaerobic threshold (AT), and blood lactate levels, *Cardiovascular responses* are derived by heart rate changes, blood pressure responses, and Electrocardiographic changes, *ventilatory responses* are derived by total minute ventilation, breathing pattern, ventilatory reserve, ventilatory timing, pulmonary function tests, and derived variable such as ($\dot{V}E/\dot{V}CO_2$ slope,$\dot{V}E$/MVV),*peripheral gas exchange* is determined by the variables such as (Cardiac Output, Heart Rate- $\dot{V}O_2$ relationship and oxygen saturation), are some the most commonly used parameters in clinical practise.

Maximal Aerobic Capacity; ($\dot{V}O_2$max) or Peak $\dot{V}O_2$,

$\dot{V}O_2$maxis an important measurement as it defines the limits of the cardiopulmonary system. It is defined by the Fick equation as the product of cardiac output and arteriovenous oxygen difference [C(a-v)O_2] at peak exercise. The measurement of $\dot{V}$O2max implies that the maximal physiological limit of an individual has been reached (i.e. *Maximal aerobic capacity*). achieve a maximal physiological response to exercise. In people with compromised cardiac and respiratory function the peak $\dot{V}O_2$ is assessed instead of the $\dot{V}O_2$max as the disease prevents them from attaining the maximum aerobic capacity,

Peak Respiratory Exchange Ratio

The respiratory exchange ratio (RER), is defined as the ratio between$\dot{V}CO_2$ and $\dot{V}O_2$. It is obtained exclusively from ventilatory expired gas analysis. It is a very good indicator of subject effort. Achievement of at least 85% of the age-predicted maximal heart rate indicates sufficient subject effort during a CPET. Peak RER is consistent in apparently healthy subjects and all patient populations, and is an accurate and reliable gauge of subject effort.

Anerobic Threshold

It is also known as the lactate threshold or ventilatory threshold. It indicates the onset of metabolic acidosis by a rise in arterial lactate during exercise. The AT is referred

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Setting Exercise Intensity

Introduction:

Exercise intensity can be defined as a specific level of maintenance of muscular activity, quantified in terms of power (energy expenditure per unit of time), force sustained or velocity of progression (McArdle *et al.*, 2012). The actual intensity set for an individual athlete is one of the most important variables used to enhance aerobic performance. A number of methods are used to determine exerciseintensity required forthe desired physiological adaptation:

- % Maximum Heart Rate (HR)
- % Heart rate reserve (Karvonen method)
- Rate of Perceived Exertion (RPE)
- % Maximal Oxygen Uptake ($VO2_{max}$)
- Lactate threshold
- Metabolic Equivalents(METs)

Equipment availability, cost, time available and the subject population all dictate which method might be most appropriate. Importantly though, training zones should be individualised and set as a relative level (i.e. % of VO_{2max}) rather than an absolute level (e.g.. 150 Watts) for the athlete.

Setting intensity:

Direct HR assessment is accurate but not always possible in an exercise setting. Therefore, predicting an individual's HR is a time-efficient and cost-effective substitute since there is a linear relationship between HR, increasing workload and oxygen consumption. Two of the frequently used equations are:

- Age predicted : estimated HR_{max} = 220 - age (years)
- Heart rate reserve (or Karvonen method): HR_{rest} + intensity% (HR_{max} - HR_{rest}).

These methods simply require the athlete to have access to a HR monitor whilst training to allow them to maintain the required workloads.

However progression (or increasing the difficulty) is essential to ensure further gains are made.

Two more complex and expensive methods are:

- % $VO2_{max}$
- Lactate threshold

These techniques are more complex in nature and require laboratory facilities to determine the required intensity level for individual athletes. They do however give the physiologist greater detail and can provide information on a number of components including:

- Oxygen consumption (VO_2)
- VO_2 to HR response
- VO_2 to Work Rate (WR) response
- VO_{2max}
- Ventilation (VE) and ventilatory equivalents: V_E/VO_2 and V_E/VCO_2
- Lactate threshold
- Ventilatory threshold

The VO_{2max} for an athlete is set and specific for a given procedure (i.e. running, cycling, rowing), because it is dependent on the muscle mass utilised for a given activity.Values can be reported in either absolute terms $l{\cdot}min^{-1}$(irrespective of body mass) or relative $ml{\cdot}kg{\cdot}min^{-1}$(accounting for body mass). The use of relative values allows comparison across athletes and sports. Values for young reasonably active adults:

Males = 3 to 5 $L{\cdot}min^{-1}$: 45 to 55 $mL{\cdot}kg{\cdot}min^{-1}$
Females = 2 to 3 $L{\cdot}min^{-1}$: 35 to 45 $mL{\cdot}kg{\cdot}min^{-1}$

For the elite athlete, values are dependent on sport and/or position played. The British Association of Sport and Exercise Sciences (BASES, 1997) recommended the following criteria for establishing maximal oxygen uptake:

1. Final HR within 10 beats of age predicted maximum (220- age ± 10bpm)
2. RPE 19 or 20 on the Borg 6 – 20 scale.
3. Respiratory Exchange Ratio (RER) 1.1 – 1.15

4. Post exercise (4- 5 mins) Blood Lactate (Bla) >8mmol/L.
5. Plateau O_2 consumption (defined as an increase of less than 2 $ml \cdot kg \cdot min^{-1}$ or 3% with an increased intensity. If no plateau the term VO_2 peak is to be used.

Lactate threshold:

As exercise increases, rates of breathing (VE) increase in direct proportion to the work undertaken up to the ventilatory breakpoint, after this point breathing increases disproportionately as the body attempts to clear CO_2 and reduce acidity. This mechanism can be used to identify changes in acidity that occur during a maximal test. A VO_{2max} test would be conducted but immediately prior to the increase in work load, the HR and lactate levels of a subject would be noted. Raw data would then be plotted in excel andconverted into a figure as follows:

Table 1: Raw data

Workrate	Hr (28 Oct)	BLa (28 Oct)
125	127	1
150	143	1.4
175	159	2.2
200	168	4.1
225	180	7.7
250	189	12.3

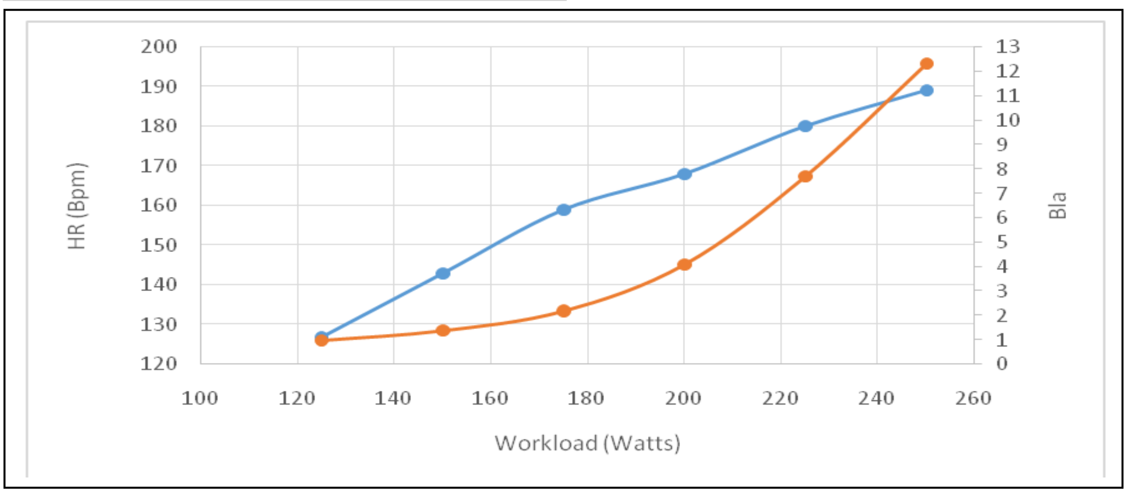

Figure 1: Example of HR/Lactate plot

Finally the lactate threshold point, (which is 2 Mmol or 1 above resting values)would be identified and through using eitherHR or workload to train the athlete. The test is then repeated in 4 to 6 weeks to identify the changes in both lactate and HR.

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An extended abstract of the lecture delivered by Mr Robert Cramb (BSc, MSc, PG Cert HE) Durham University, UK, at the Regional Meeting of the PSSL, Eastern University, Batticaloa, 10th March 2017

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Exercise Referral Systems for the management of chronic NCDs: how can we motivate patients to be active?

Why is support for exercise needed for chronic NCD patients?

At population level, inactivity rates are relatively low in Sri Lanka when compared internationally (estimated at 11-31.8%: Ranasinghe et al., 2013). However, inactivity risk is not universal, with demographic and social risk factors for inactivity (and its associated diseases) including urban residency, being female, having higher education and skilled/professional jobs, and co-morbidities including a chronic NCD. It is this latter group that are of particular concern, given the multiple physical and psychological health benefits, including on condition management and outcomes, that being active can provide.

Research examining perceptions of physical activity in patient groups commonly identifies an awareness of its importance but a lack of confidence in knowledge of how to be active (e.g., type, duration, frequency etc: Ranasinghe et al., 2015). As such, we need to do more to target the knowledge and motivational barriers to being active experienced by these patients.

What are exercise referral schemes and how can they help?

Exercise referral schemes are structured support for exercise uptake. UK guidelines recommend scheme provision for those who are inactive, with a range of conditions (e.g., CHD, DM, lower back pain, mild to moderate depression) or risk factors (e.g., pre-diabetics, older adults at risk of falling). Patients are referred into the scheme via primary care, by a consultant, a physiotherapist or can self-refer. Typically, schemes last approximately 16 weeks, and include consultations with an exercise professional, to tailor a programme and provide goal setting and motivational support. Supervised and subsidized group-based classes and/or gym access form a key component of most schemes.

Who do schemes work for, and crucially, who do they not work well for?

So far, evidence has demonstrated that schemes are effective at increasing physical activity levels, but with two caveats. First, that this increase is evidenced reliably in the short-term only. Longer-term follow-ups (e.g., 12 months) do not consistently evidence maintained higher activity levels. Second, effects are only apparent for those who adhere, and adherence is a big challenge. Drop out from such schemes can be as high as 50% (e.g., Kelly et al., 2016).

Schemes seem better suited to certain population sub-groups. They've been demonstrated to work for older as opposed to younger adults, those with CHD risk or undergoing treatment, and women in particular. Schemes do not work well for those referred through a mental health pathway, younger adults, or those with complex barriers to engagement (e.g., deprivation, access to transport, reduced social support, low or poor quality motivation).

What are the challenges of these schemes in practice, and how can we take things forward?

In practice, schemes struggle to overcome the array of barriers faced by patients. They work well for those who are older and who are motivated to change behaviour. Targeting schemes at individuals likely to benefit, and identifying other approaches for patients in more complex circumstances, might lead to greater scheme effectiveness.

Clinicians need improved advice, access to disease-specific guidelines, referral options and support for prescribing physical activity for patients. Partnerships between researchers in multiple disciplines (e.g., physiology, medicine, health psychology) are also needed – to identify exercise programmes that provide clinical and physiological benefits and yet are engaging and motivating for patients to complete.

There is nothing worse than having the 'perfect' programme on paper that patients can't or won't engage in! If we're going to tackle inactivity in patient groups, and in society more widely, these are some of the challenges we'll need to overcome.

An extended abstract of the lecture delivered by Prof. Emily J. Oliver (PhD., CPsychol, AFBPsS, SFHEA), Durham University, UK, at the Regional Meeting of the PSSL, Eastern University, Batticaloa, Friday 10th March 2017

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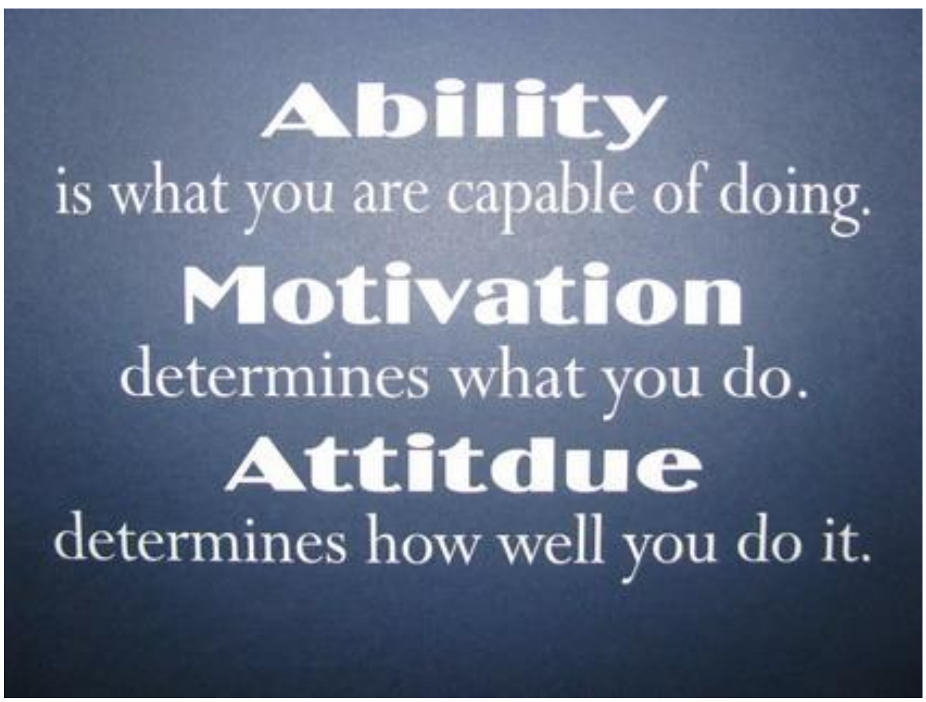

The physiological effects of Yoga in diabetes mellitus

Diabetes mellitus (DM) has become a leading public health problem primarily due to dramatic increase in the obesity population and adoption of a western life style. Currently, mortality and morbidity due to DM is rising due to increasing risk of macrovascular complications (coronary heart disease, peripheral vascular disease,stroke)& microvascular complications (retinitis, diabetic neuropathy, nephropathy). Race, age and genetic factors are non modifiable risk factors for DM whereas physical inactivity and overnutrition leading to obesity are recognized as modifiable risk factors for DM. Chronic stress, impaired sleep and smoking are other life style related factors. Since life style factors account for mortality and morbidity of DM, adjustment of life style plays a crucial role in prevention of acute complications and minimizing the risk for long term complications. The primary goal of management of diabetes mellitus is to achieve glycemic control. Further more effective management should reduce the cardiovascular disease risk & microvascular complications. Therefore identifying sustainable life style interventions are important in the management of DM. An intervention such as yoga which has mental and spiritual aspects in addition to the physical activity component is appropriate in the sense that it unites the mind and the body.

The practice of yoga is expanding globally in developing as well as developed countries. More than a physical exercise it unites consciousness with the universal spirit in an individual. In Sanscrit '*yoga*' means unite. Primary goal of yoga is quieting the mind to foster the union of the mind, body and spirit. In most parts of the world yoga has been recognized as a form of therapy. Type 2 DM is amongst the range of diseases that are benefitted by yoga. Yoga comprises of physical postures ('*Asana*' **Figure 1**), breath control ('*Pranayama*' **Figure 2**), and meditation (**Figure 3)**.

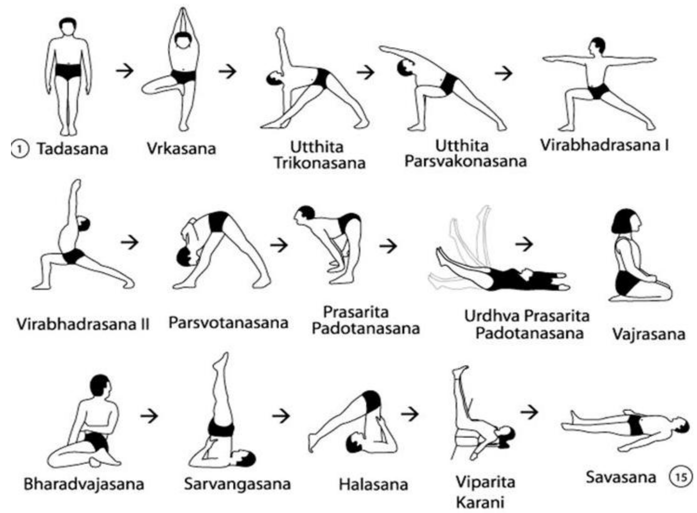

Figure 1: *Asana*

Although many investigations related to yogic practices have been carried out in the recent past, the mechanisms for the beneficial effects of yoga have not been completely understood yet. Amongst the different types of yoga '*hatha yoga*' includes physical exercises. In this type of yoga different postures called '*asanas*' are adopted. When adopting these postures body parts are aligned appropriately. If a body part is incorrectly aligned certain body parts will be over stretched. In yoga transition of one *asana* to the other is often combined with inspiration or expiration and the breath should be slow and deep. Thus the individual should be mindful about breathing and body movements.

Figure 2: *Pranayama*

In a previous study in postmenopausal women practicing yoga for 16 weeks, body weight, percentage of body fat, lean body mass, body mass index, waist circumference, and visceral fat had significantly decreased and high-density lipoproteins, cholesterol and adiponectin had significantly increased.[1] A significant reduction in the waist hip ratio and BMI in diabetics who were practicing yoga were observed in randomized clinical trials.[2,3] These studies imply that yoga exercises reduce the body fat resulting in improvement in the anthropometric parameters including body weight. BMI, waist circumference and waist hip ratio.

Figure 3: Yogic meditation

Another benefit of yoga is to reduce oxidative stress. Oxidative stress is caused by free radicals. Free radicals comprises of one or more unpaired electrons which are unstable and reactive. The free radicals induce cell damage due to oxidation of cell components.[4] They produce oxidative damage to DNA, carbohydrates, proteins and lipids.[5] In diabetes Islets of Langerhan can be affected by the free radicals because it has a lower level of intrinsic antioxidant defense. Thus oxidative stress is the root cause of insulin resistance and β-cell dysfunction in diabetes mellitus.[6] Oxidative stress gives rise to insulin resistance in adipose tissue and other peripheral tissue. It is reported that adipocytes in the visceral fat tissue generate reactive oxygen species. Hence Obesity is the key factor leading to insulin resistance. Hyperglycaemia in DM leads to formation of free radicals due to autoxidation, non-enzymatic glycation of proteins and lipids and by activation of the sorbitol pathway. Furthermore oxidative stress results in complications of diabetes such as atherosclerosis, microvascular complications, and neuropathy.[7] Thus oxidative stress plays a vital role in the pathogenesis of diabetes mellitus and occurrence of diabetic complications.[8]

Normally by the protective effect of antioxidants the actions of free radicals are counteracted. Superoxide dismutase, glutathione, glutathione peroxidase, catalase, vitamin A, vitamin C and E are some of the antioxidants. Normally there is a balance between oxidants (free radicals) and antioxidants and the imbalance will lead to tissue damage. Free radical activates different signaling pathways in the cell and produces cell death and alter gene expression.[9]

A controlled clinical trial has confirmed that yoga has therapeutic role in reducing oxidative stress in type 2 diabetes. Patients with type 2 diabetes mellitus were assigned to an intervention group who practice yoga for 3 months and a control group without yoga and a significant increase in the glutathione and vitamin C levels were seen in the intervention group.[10] Increase in the superoxide dismutase levels in type 2 diabetes mellitus patients who were on regular anti-diabetic therapy practicing a yoga program comprising of various *Asanas* (isometric type exercises) and *pranayamas* (breathing exercises) were noted.[11] By increasing the antioxidant level insulin sensitivity is improved by practicing yoga.

Practicing yoga including *asanas* and *pranayamas* for 45 days has shown a significant reduction in total cholesterol (TC), triglycerides (TG) and low density lipoprotein (LDL) from the base line values.[12] The reasons for the improvements in the lipid profile may be due to increase in the insulin sensitivity leading to stimulation of lipoprotein lipase activity.

Manipulation of breathing plays a vital role in achieving the goals of yoga. This is called *pranayama*. The meaning of the word *pranayama* is controlling life force (prana : life force, ayama : control). *Pranayama* is the key element in achieving a healthy human body. This unique practice in yoga is beneficial in cardiopulmonary diseases, autonomic nervous system imbalances and psycho-somatic disorders. Inspiration, breath holding in inspiration, expiration, breath holding in expiration are the important aspects of *pranayama*.

A regular 40 day yoga asana regime significantly improved the FEV1/FVC% in type 2 diabetes mellitus patients.[13] This may be due to increase in the power of respiratory muscles, efficient ventilation using diaphragmatic and abdominal muscles, calming effect of the mind by reducing the stresses and minimizing the bronchocontrictor effect. There was a significant improvement in the cardiac autonomic functions including reduction in the heart rate in those type 2 DM patients who practiced a pranayama program.[14]

It is postulated that yoga reduces the activation of the hypothalamo pituitary adrenal (HPA)axis and sympathoadrenal system[15]. This leads to reduction of the catecholamine and cortisol levels while practicing yoga.[16,17] This is another mechanism for increasing insulin sensitivity.

Furthermore the risk of cardiovascular diseases are reduced by reducing the activation of the HPA axis and sympathoadrenal system.[18] This implies that practicing yoga has many benefits in type 2 DM including glycemic control, improving the lipid profiles, body composition and blood pressure.[2,3]

Yogic practices changes the balance of the autonomic nervous system by shifting the sympathetic output to parasympathetic output causing changes in the cardiovagal function.[19] These may be the reasons for the reduction in the resting heart rate and increased baroreceptor sensitivity.[20] Lengthening the diastolic filling time, reduction in the myocardial oxygen consumption and myocardial perfusion are advantages of having a slow heart rate when performing yoga.

Practicing yoga may activate specific brain structures related to attention and mood which will lead to changes in the autonomic balance, mood, memory and inflammatory response.[21] It can be hypothesized that parasympethetic activation following vagal stimulation may reduce stress and elevate the mood.

The spiritual aspect of yoga is meditation. In meditation the stress reaches a low level. In meditation mind is focused to the present moment. Increase in stress hormones such as cortisol, epinephrine and norepinephrine aggravates hyperglycemia. Concentrating about the breath is part of yoga and this is one form of meditation. It is reported that practicing meditation reduces the risk of developing diabetes and controls blood glucose levels in diabetics by reducing the stress levels.[22] Yogic meditative practices regulates inflammation, oxidative stress, energy metabolism and insulin secretion. By regulating these elements, control of blood glucose, elevation of mood and enhancement of sleep and autonomic function and reduction of blood pressure will be achieved.[23,24] Yoga has a potential benefit in changing the risk indices of insulin resistance such as glucose tolerance and insulin sensitivity, lipid profiles, anthropometric characteristics, blood pressure, oxidative stress, coagulation profiles, sympathetic activation and pulmonary function in DM.[25] In conclusion yoga can be included with the conventional treatment to prevent acute complications and to minimize the risk for long term complications in DM.

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Contributed by Prof. Priyadharshika Hettiarchchi (MBBS, MPhil, PhD) Associate Professor, Department of Physiology, Faculty of Medical Sciences, University of Sri Jayewardenepura.

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Keeping fit in your silver years

I had a wonderful opportunity to be there for the 102nd birthday of one of my patients at Monash Health, Melbourne Australia. When asked about the secret behind her successful life she said "I played tennis till 98 years of age". She was still active and was only being treated for a chest infection. Physical fitness is a rare gift at that age yet it's not an enigma.

It's never too late to start exercise as the benefits of exercise are evident at any age. The benefits of exercise are in three folds. Apart from physical and psychological benefits exercise improves longevity. There is ample evidence in literature about benefits of exercise in old age. Cardiovascular benefits are lowering of blood pressure, improvement in cardiac output and improvement in lipid profile. Metabolic benefits are multiple such as improvement of glycemic control and reduction of bone loss. It has been shown that exercise boosts psychological health specially self-confidence.

The three components of exercises that would benefit elders are aerobic exercise, strength training, and balance and flexibility training. Warming up and cooling down maneuvers such as slow walking or rhythmic movements of hands and legs for 10 minutes minimize the risk of hypotension. Among many other benefits as described above the contribution to falls prevention and enhancement of spiritual health plays a center stage.

In Sri Lankan context with the demographic transition that we are experiencing healthy aging is of utmost importance as it is expected by year 2041 that one in fourth will be more than 65 years of age. Regular moderate physical exercises which are tailor made for individual level of physical fitness is recommended as a fool proof mechanism which ensures healthy ageing.

It is not an easy task to motivate elders to participate in physical exercises but health care professionals will have to play a major role in this endeavor. I believe the exercise prescription for elders in Sri Lanka will also have to be tailor made to the cultural and social context. For example we have to be sensitive to their preferences and social background and giving simple exercises modified to the environment that they live in would be more beneficial and likely to get their full cooperation and compliance.

The driving force for a positive behavioral change is always the correct attitude change. "Old age is not just for reminiscing good times and thinking about diseases and death but for experiencing new dimensions in life and enjoying them as well".

Contributed by Dr. Chamila Dalpatadu (MBBS, MD), Consultant Physician, Senior Lecturer in Physiology, Faculty of Medicine, University of Colombo.

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Upcoming events

Pre-Congress Workshop

Annual Scientific Sessions – 2017 of The Physiological Society of Sri Lanka

Exercise is Medicine

14th November 2017

Galle Medical Association Lecture Theater, Teaching Hospital Karapitiya Organized by The Physiology Society of Sri Lanka (PSSL) and Galle Medical Association (GMA)

Time	Topic	Speaker
8.30 - 9.00 am	Registration	
9.00 – 9.05 am	Welcome address	President- GMA
9.05 – 9.15 am	Introduction	President - PSSL
9.15 – 10. 00 am	Bone & Muscles - Assessment of Physical Performances	Prof. R.S.J Lenora Professor in Physiology Department of Physiology Faculty of Medicine University of Ruhuna
10.00 – 10.30 am	The linkage between Ayurveda and molecular biology in cardio-respiratory control	Prof Yoshihiro Ishikawa MD, PhD, FACP, FACC, FESC, FRSM Professor and Chair Cardiovascular Research Institute Yokohama City University School of Medicine
10.30- 10.45 am	Tea	
10.45 – 11.15 am	Exercise prescription in Health & Disease Session 1	Dr Himan De Silva and Dr Sanka Thebuwanaarachchi Olympic sports physicians Sports & Exercise Medicine Unit Teaching Hospital Karapitiya
11.15 – 1.00 pm	Exercise prescription in Health & Disease Session 2	Dr Himan De Silva and Dr Sanka Thebuwanaarachchi Olympic sports physicians Sports & Exercise Medicine Unit Teaching Hospital Karapitiya
1.00 – 1.05pm	Closing remarks	Secretary - PSSL

Registration Fee – Rs. 500.00

Annual Scientific Sessions - 2017
of
The Physiological Society of Sri Lanka

24th & 25th November 2017

Inauguration and the K N Seneviratne Oration

24th November 2017

New Building Lecture Theatre

Faculty of Medicine, University of Colombo

1800 Ceremonial Procession

1805 National Anthem

1810 Lighting of the traditional oil lamp

1815 Welcome address by Prof. KG Somasiri -President, PSSL

1820 Address by the Guest of Honor by Prof Jennifer Perera

1830 Address by the Chief Guest –Dr Palitha Abeykoon

1845 Launching the PSSL website

1850 Presentation of the Awards and felicitation of senior Physiologists

Felicitation of Senior Physiologists

Professor KN Seneviratne Memorial Research Award - 2017

Professor KN Seneviratne Memorial Award for Physiology - 2017

Acknowledgement of Students Achievement at International Physiology Quiz

1935 Introduction of the orator by President, PSSL

1940 K N Seneviratne Oration

One Animal Model-Many Experiments: Use of Animal Models in Physiology Experiments

Prof. Sampath Gunawardena

Professor in Physiology , Department of Physiology, Faculty of Medicine, University of Ruhuna

2025 Vote of Thanks by Dr Amaranath Karunanayake -Secretary, PSSL

2030 Reception

Annual Scientific Sessions - 25th November 2017

0800-0830	**Registration**
0830-0930	**Free paper session 1**
0930-1015	**Valentine Basnayake Oration** **Scientific Inquiry and Clinical Reasoning** Prof. P.T. Jayawickramarajah Professor and Consultant in Medical Education Senior Adviser, World Federation for Medical Education
1015-1045	**TEA**
1045-1100	**Presentation by the recipient of the K N Seneviratne Research Award-2016** **Metalloestrogen cadmium stimulates proliferation of stromal cells derived from the eutopic endometrium of women with endometriosis** Dr.Nalinda Silva Senior Lecturer in Physiology, Faculty of Medicine, University of Sri Jayawardenepura
1100-1130	**Plenary Lecture** **Approach to Malabsorption on a Physiological Basis** Dr. Pasan Hewawasam Senior Lecturer in Physiology, Faculty of Medicine, University of Ruhuna
1130-1230	**Symposium 1 – Pain** **Recent advances in understanding pain perception** Dr. Ranjith Pallegama Senior Lecturer in Physiology, Faculty of Dental Sciences, University of Peradeniya **Pathophysiology of Pain** Dr. Saman Nanayakkara Senior Lecturer in Anesthesiology, Faculty of Dental Sciences, University of Peradeniya
1230-1300	**Plenary Lecture** **Structure and function of the kidneys and their clinical assessment** Dr. Nalaka Herath Consultant Nephrologist , Teaching Hospital Karapitiya
1300-13.45	**LUNCH**
1345-1445	**Free paper session 2**
1445-1545	**Symposium 2 – Haematology** **Womb to room the physiological changes in haematology** Dr Chandana Wickramarathna Senior Lecturer/ Specialist in Hematology , Faculty of Medicine, University of Ruhuna **Application of physiological concepts in haematological practice** Dr R M P Manel Rathnayake, Senior Lecturer in Pathology, Faculty of Medicine Peradeniya
1545-1600	**Awards and Conclusion**
1600-1630	**TEA**
1630-1715	**A C E Koch Oration** **Modulation of excitation-contraction coupling in skeletal muscle** Prof Anthony Bakker School of Human Sciences, The University of Western Australia
1715	**Annual General Meeting of the Physiological Society of Sri Lanka**

Photo album

The regional meeting of the Physiological Society of Sri Lanka was successfully held on the 10th of March 2017 in Batticaloa with representation from all nine Faculties of Medicine.

The delegates from Colombo met at the Fort railway station and journeyed through the night to reach their destination on the morning of the event.

They were met at the Batticaloa train station by the President of the PSSL and were then taken to the meeting which was held at the Faculty of Health-Care Sciences of the Eastern University. The scientific programme started with a traditional eastern welcome and succulent local delicacies.

There was an update regarding the Physiology curriculum of the Faculty of Health-Care Sciences of the eastern university, guest lectures and a lecture demonstration on spirometry. An interesting lecture on the singing fish of Batticaloa inspired the visitors to experience this first hand. The informative scientific session, typically traditional cuisine of the Eastern Sri Lanka and the colourful entertainment of the cultural event was appreciated by the visitors.

After the scientific sessions came to an end, the visitors were taken on a tour of the city and the following day a visit to Pasikudah.

The visit to Batticaloa was a memorable experience with walks up to the famous Kallady bridge to watch catamaran fishing, night journey to ‘hear’ the singing fish and jaunts around the city sampling the authentic cuisine.

Achievements

It is a pleasure to announce that following members of the PSSL have received promotions as Professors in their respective Departments.

- Professor of Physiology

Professor Niranga Devenarayana, Department of Physiology, Faculty of Medicine, University of Kelaniya.

- Professor in Physiology

Professor Deepthi de Silva, Department of Physiology, Faculty of Medicine, University of Kelaniya

Professor R.S.J. Lenora, Department of Physiology, Faculty of Medicine, University of Ruhuna

Professor Sajjiv Ariyasinghe, Department of Basic Sciences, Faculty of Dental Sciences, University of Peradeniya, It is a delight to announce students from Colombo Medical Faculty winning the gold at the Inter Medical School Physiology Quiz held at University of Malaya, Kuala Lumpur, Malaysia. Students from Faculty of Medical Sciences, Sri Jayewardenapura won the 3rd place and while team from Medical Faculty, Kelaniya University ranked 5th place in this international Physiology quiz. Malaysia hosted the 15th Inter-Medical School Physiology Quiz (IMS PQ) on 16th and 17th August 2017. Over hundred teams from 20 countries including UK, Japan, Australia, Singapore, China, Thailand etc. competed for the Raman Challenge Trophy. We are proud of students representing state medical faculties, who made these achievements during troubled times.

Members of the Jayewardenepura Team:
K.M.T.P. Kulasinghe, H.D.K. De Silva, R.S. Wanigasuriya, N.A.C.W. Nissanka, D.N. Tharangi

The students who represented the University of Kelaniya were Ms. V.T. Martin, Ms. S.H. Dissanayake, Ms. F.N.M. Nasar, Mr. J.R.P. Samarathunga and Ms. J.A.P.H. Jayasinghe.Dr Dulani Kottahachchi, Senior Lecturer in Physiology, accompanied the team.

Members of the Kelaniya team: From left to right, Dr. Dulani Kottahachchi, Ms. V.T. Martin, Ms. S.H. Dissanayake, Ms. J.A.P.H. Jayasinghe, Ms. F.N.M. Nasar and Mr. J.R.P. Samarathunga