PHYSIOLOGY RESEARCH DIVISION

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The division has involved in research projects on non-communicable diseases, aging and environmental health. The division has provided academic services such as teaching of post graduate students attending Universities of Medicine.

RESEARCH PROJECTS

1. NON-COMMUNICABLE DISEASES

1.1. OBESITY

1.1.1. Body fat composition, leptin sensitivity and insulin sensitivity in obese adults

Obesity is a world-wide epidemic considered to be the fifth leading cause of global deaths. Obesity is caused by an energy imbalance between calories consumed and calories expended. Both leptin and insulin hormones are concerned with energy metabolism. Leptin resistance is a hallmark of obesity, but its clinical measurement is elusive. Insulin resistance is a risk factor for type 2 diabetic. Thus, the present study was aimed to find out the body fat composition, leptin sensitivity and insulin sensitivity in obese adults in compared to non-obese adults. Anthropometric parameters such as body mass index (BMI), waist and hip circumference, waist-hip ratio (WHR), body fat mass percent and biochemical parameters such as serum leptin level, resting energy expenditure, fasting plasma glucose level and serum insulin level of (42) non-obese (n = 42) and obese (n = 44) adults were determined. Adults with BMI between 18.5 and 22.9 kg/m^2 were taken as non-obese and those with BMI $\geq$ 25 kg/m^2 as obese. In this study, resting energy expenditure to leptin ratio (REE : Leptin) was used to assess the leptin sensitivity in adults and insulin sensitivity was calculated by using fasting plasma glucose level and serum insulin level and expressed as quantitative insulin sensitivity check index (QUICKI). It was found that the anthropometric parameters were significantly higher in obese adults (mean age 37.98 ± 8.32 years) than in non-obese adults (mean age 33.9 ± 7.89 years). Although serum leptin level and resting energy expenditure were significantly higher in obese adults, the leptin sensitivity index (REE : Leptin) of the obese adults [116.76 (77.28-202.94) (median and interquartile range (IQR)] was significantly ($p < 0.001$) lower than that of the non-obese adults [265.66 (166.3-489.71) (median and IQR)]. This finding pointed out that the higher the BMI, the lower the leptin sensitivity. In the present study, both fasting blood glucose and serum insulin levels were significantly higher in the obese adults, resulting in decreased insulin sensitivity in the obese adults in compared to the non-obese adults (0.35 ± 0.03 (mean ± SD) versus 0.33 ± 0.03). These findings pointed out that β-cells work more to compensate for the decreased insulin sensitivity and thus maintaining the plasma glucose level within normal range. Glucose tolerance might probably be preserved as long as the β-cell can compensate for decreased insulin sensitivity by appropriately increasing insulin secretion. On the other hand, QUICKI value ≤ 0.33 was regarded as insulin resistance. If so, 17 (36%) out of 42 non-obese adults and 33 (75%) obese adults had insulin resistance. The present findings support the concept that obesity is associated with hyperinsulinemia and decreased insulin sensitivity. Thus, the majority of the obese adults were found to be at higher risk to develop type 2diabetes.

1.1.2. Influence of electrical ionic field exposure on red cell deformability, resting metabolic rate and insulin sensitivity in obese adult females

Erythrocyte membrane glycosylation reduces negative surface electric charge that contributes to cellular rigidity, reducing red cell deformability in obesity and diabetic patients. Pulsed electrostatic field generator can reduce erythrocyte membrane glycosylation by generating negative charges. The aim of the study was to find out the influence of electrical ionic field exposure on red cell deformability (RCD), resting metabolic rate (RMR), arterial blood pressures and insulin sensitivity in obese adult females. A total of 23 adult women (mean age = 39.04±7.83yr) with mean body mass index (BMI) (28.86±2.12 kg/m^2) and waist circumference (WC) (>80 cm) participated in this study. Red cell deformability was assessed by filtration method and red cell deformability index (RCDI) was expressed by filtration rate/min. Arterial blood pressure was measured by indirect method using mercury sphygmomanometer. Fasting blood glucose (FBG) and serum insulin level were determined by oxidase method and enzyme linked immunosorbant assay (ELISA) method respectively, and RMR was assessed by indirect calorimetry method. Insulin sensitivity was expressed as quantitative insulin sensitivity check index (QUICKI) value. Exposure to electrical ionic field was done by using pulsed electrostatic field generator (30 minutes/day) for 14 consecutive working days. After 14-day exposure, there was no significant change in anthropometric measures, RCDI, RMR, serum insulin, and QUICKI. However, significant changes were found in FBG (85.79 ± 10.05 to 91.19 ±11.26 mg/dL, p<0.02) and DBP (76.09 ± 10.49 to 71.96 ±8.74 mmHg, p<0.01). SBP was reduced (119.26 ± 12.93 to 114.39 ± 9.94 mmHg, p = 0.057) but only marginally significant. This finding pointed out that there was a relationship between increased concentration of glucose and the increase in the electrical properties but mechanism could not be explained. In conclusion, this short duration of electrical ionic field exposure was linked with improvement in peripheral vascular resistance and increase FBG, but still within normal range.

1.2. AGING

1.2.1. Physical fitness of the elderly people from Home for the Aged (Hninzigone), Yangon (2016)

It is well established that most body functions are affected by aging. Despite the aging process, maintaining independence is a major goal for older adults. Physical fitness is the ability to perform daily tasks with energy and having less chance to develop chronic diseases. The senior fitness test was developed to be a suitable physical fitness battery to test older individuals. Thus, a cross-sectional descriptive study was conducted to assess physical fitness in 145 elderly; 52 men (mean age: 81.23±6.36 years) and 93 women (mean age: 79.03±5.27 years), volunteered from the Home for the Aged (Hninzigone), Yangon by using the Senior Fitness Test. The test consists of six measures of physical fitness: (1) 30-second chair stand test, (2) 30-second arm curl test, (3) chair sit and reach test, (4) back scratch test, (5) 8-foot up and go test and (6) 2-minute step test. In this study, although the elderly men and women had no significant difference in body mass index (BMI) (23.19 ± 6.46 kg/m^2 vs. 22.98 ± 4.24 kg/m^2, p =0.83), elderly women had significantly higher body fat percent (24.23 ± 7.6% vs. 20.11 ± 6.46%, p = 0.001) than elderly men. In this study, the elderly men and women were divided into five groups: (1) 70-74 years; (2) 75-79 years; (3) 80-84 years; (4) 85-89 years; (5) more than 90 years, respectively. The highest BMI value was seen in 70-74 year age group (24.18 ± 4.55 kg/m^2). Lower BMI values were seen in the age group of 85 years and above. In this study, the higher the age, the lower the BMI and body fat mass percent were seen. The reduction in BMI might be due to the loss of muscle mass and fat tissue in waist and hips. Reducing body fat could lead to better physical fitness and working capacity. In the present study, all the elderly had completed the six fitness tests. Elderly men had better performance in chair stand test (strength test) and 2 minute step test (aerobic endurance test) but elderly women had better performance in 8–foot up and go test (dynamic balance). This might be due to the fact that elderly men had more lean body mass than women. There were no statistically significant difference (p > 0.05) in arm curl test, back scratch test and 2-minute step test in all age groups. The subjects aged 70-74 significantly (p < 0.05) differed in the chair stand test and 8-foot up and go test compared to 80-84 years of age and they also significantly (p < 0.05) differed in the chair sit and reach test in compared to subjects aged 85-89 years of age. The results showed statistically significant reduction of muscle strength, dynamic balance and flexibility in elderly older than 80 years. Decrease in muscle strength during the aging process is the result of significant loss of muscle mass, which may cause the decrease in physical activity and impaired dynamic balance may also increase the risk of falls and injuries in older people. Thus, physical activity intervention and monitoring of physical fitness should be done regularly in elderly people.

2. ENVIRONMENTAL HEALTH

2.1. Blood lead level, plasma malondialdehyde level and vibration perception threshold in non-exposed subjects and lead-exposed battery workers

Lead is toxic to multiple organ systems and long-term exposure can result in lead neuropathy, typically motor neuropathy. Peripheral sensory neuropathy caused by lead exposure is still controversial. The aim of this study was to find out the relationship among blood lead level, plasma malondialdehyde (MDA) level and peripheral sensory neuropathy in lead-exposed battery workers. This cross-sectional study included 28 non-exposed subjects and 28 lead-exposed battery workers in small-scale battery workplaces in Insein and North Okkalapa Townships. The blood lead level was determined by graphite furnace atomic absorption spectrometry. The function of large myelinated peripheral sensory nerve fibers was assessed by vibration perception threshold (VPT). In this study, mean blood lead level of the lead-exposed battery workers was 4.25 ± 3.87 µg/dL and that of the non-exposed subjects was 2.14 ± 1.02 µg/dL. The mean blood lead level of the lead-exposed battery workers was significantly higher than that of the non-exposed subjects (p=0.007). In addition, 92.85% of lead-exposed battery workers had a blood lead level lower than reference blood lead level (10µg/dL) (Centre of Disease Control, 2012). Therefore, the lead-exposed battery workers had low level of lead exposure. The mean plasma MDA level of lead-exposed battery workers was significantly (p = 0.000) higher than that of the non-exposed subjects and their plasma MDA levels were 2.08 ± 0.94 µmol/L and 0.9 ± 0.43 µmol/L respectively. This finding indicated an increase in reactive oxygen species (ROS) formation occurred in the lead-exposed battery workers even at the low level of lead exposure. The mean VPT (hand) of the lead-exposed battery workers was 4.20 ± 2.29 Volts (V) and that for the non-exposed subjects was 2.66 ± 0.71V. The mean VPT (foot) of the lead-exposed battery workers was 8.36 ± 4.81 V and that for the non-exposed subjects was 4.93 ± 2.62 V. Both mean VPT (hand) and mean VPT (foot) of the lead-exposed battery workers were significantly higher than that of non-exposed subjects (p=0.002). These findings indicated that occupational lead exposure might possibly cause early impairment to the peripheral sensory nerve fiber function even at the low level exposure although there was no obvious symptomatic features in the lead-exposed battery workers by accessing subjective peripheral neuropathy screen questionnaire. Therefore, early functional impairment in large myelinated sensory fibers can occur even in neurologically symptom-free lead-exposed battery workers. In this study, there was no significant correlation among blood lead level, plasma MDA level and VPT (hand) and VPT (foot) in the lead-exposed battery workers. In conclusion, this study could point out that the slower sensory nerve conduction in lead-exposed battery workers might be due to lead-induced lipid peroxidation in large myelinated peripheral sensory nerves.

SERVICES PROVIDED

ACADEMIC

Sr. No.	Name	Course	Responsibility
1.	Dr. Khin Mi Mi Lay	1st year MMedSc (Physiology) Universities of Medicine	Lecturer/ co-examiner
		2nd year MMedSc (Physiology) Universities of Medicine PhD (Physiology) Universities of Medicine	Member of post graduate academic board of studies
2.	Dr. Thura Tun Oo	1st year MMedSc (Physiology) Universities of Medicine	Demonstration