EFFECTS OF PHYSICAL ACTIVITY ON BODY COMPOSITION IN WOMEN WITH OR WITHOUT DIABETES

R.G.L. Rathnayake[1], P.P.R. Perera[1] and U.P.K. Hettiaratchi&*[1]
[1]Faculty of Medical Sciences, University of Sri Jayewardenepura
*Corresponding author (email: usha@sjp.ac.lk)

Introduction

Evidence from previous studies has shown that physical inactivity increases risk of type 2 diabetes mellitus (T2DM) and other non-communicable diseases including coronary heart diseases and some cancers [1]. According to Lee *et al*, physical inactivity is responsible for 3.9% of disease burden in South-East Asia. On the other hand, physical inactivity was the cause responsible for 9% of premature mortality occurred in year 2008 (>5.3 million deaths among 57 million deaths) [1].

The physical activities can be categorized into occupational, sport, household and other activities. Exercise is a subset of physical activity which is a planned, structured and repetitive process which improves and maintains physical fitness. IPAQ short form is designed for population surveillance of physical activity among adults (15-69 years). Short version questionnaire includes questions regarding walking, moderate intensity activities and vigorous-intensity activities, and then the physical activity is measured by a score. Based on Metabolic equivalent (METs), level of physical activity can be divided into 3 categories, as inactive, minimally active and health-enhancing physical activity (HEPA active).

Physical activity is recognized as a contributing factor for overall reduction of disease burden and in order to achieve this benefit, it is recommended to engage in physical activities with moderate intensity for at least half an hour per day for most days of the week. Engaging in additional vigorous physical activities will further improve health benefits.

When obesity and associated metabolic diseases are concerned, measures of obesity including body mass index (BMI), waist circumference (WC) and waist-hip ratio (WHR) play important roles in risk assessment. People with metabolic syndrome are having significantly higher BMI values compared to people without metabolic syndrome. Half unit increment in BMI increase the risk of having metabolic syndrome in obese and overweight people [2]. Fasting blood sugar level (FBS), Total cholesterol, serum triglycerides and serum HDL cholesterol levels are significantly associated with the BMI, WC and WHR in Sri Lankan population [3] as well as in other populations as well.

Hypertension, dyslipidemia, diabetes and CHD are strongly associated with percent body fat. Percentage body fat directly and significantly associated with serum total cholesterol, triglyceride, LDL-cholesterol, fasting blood sugar, systolic blood pressure and inversely related to HDL-cholesterol.

Reduced physical activity (sedentary lifestyle) and obesity are connected to the development of metabolic diseases. Thus, the objective of this study was to compare the markers of body composition among female type 2 diabetic subjects and non-diabetic subjects, and to determine how level of physical activity can affect these parameters.

Materials and Methods

Twenty seven clinically diagnosed type 2 diabetic female subjects and 27 non-diabetic female subjects living in Elehera divisional secretariat area were recruited for the study. Both cases and controls were matched for their age (age range 25-50 years) but not for variables affecting the level of physical activity.

Level of physical activity was determined using the international physical activity questionnaire (IPAQ) short version. IPAQ is a publically available, open access questionnaire and available in different forms.

Ten hour fasting blood samples were collected for FBS assay and Fasting insulin (FI) assay using glucose oxidase method and Enzyme linked immune-sorbent assay (ELISA). Insulin resistance was calculated using Homeostasis-model assessment-insulin resistance calculation (HOMA-IR) (HOMA-IR = Fasting insulin x Fasting glucose / 405).

Height, weight, WC and hip circumference (HC) were measured according to national cholesterol education program- adult treatment panel III (NCEP-ATPIII) anthropometric procedure manual. All the measurements were taken following the above mentioned protocol, protecting the privacy of the patients.

Body fat percentage (BF %) whole body subcutaneous fat % and visceral fat level were assessed using bio impedance analysis technique, using Bio impedance analyzer (BIA) (OMRON HBF-362).

Statistical analysis was performed using "IBM SPSS Statistic 23" software package. The data analysis was done in two ways. First measured parameters were analyzed dividing the population as type 2 diabetic subjects and non-diabetic subjects. Secondly, the whole population was divided into two groups based on their level of physical activity (PA). For the easiness of data calculation and interpretation with regard to PA, one group consisted of subjects with inactive and minimally active physical activity level and the other group consisted of subjects with HEPA level. Since there is a non-normal distribution of data, median MET-minutes will be given instead of mean values in the results. Differences of means between two groups were assessed using the independent sample t test. Mann-Whitney U test was applied for non-normally distributed variables.

Ethical approval for the study was obtained from the ethics review committee, Faculty of Medical Sciences, University of Sri Jayewardenepura. Written consent was obtained from each subject prior to the study.

Results and Discussion

Mean age of the non-diabetic subjects was 39 years and diabetic subjects 43 years.

METs values between non-diabetic and T2DM females were 3360.0 and 3954.0 respectively and this difference was not statistically significant. FBS, IR, WC, Waist-hip ratio (WHR) and waist-thigh ratio (WTR) demonstrated a significant difference between the T2DM and non-diabetic groups (Table 1). Median METs value of inactive/ minimally active group was 1680.0 and in HEPA active group it was 4399.5. Measured anthropometric parameters didn't show any significant differences between two groups. But BF% and whole body subcutaneous fat% were significantly different between two groups (Table 1).

Table 1. Mean values of anthropometric and body fat assessment of diabetic/non-diabetic females and inactive/minimally active and HEPA active subjects.

Measurement	Diabetic (±SD) (n = 27)	Non-diabetic (SD) (n = 27)	p value	Inactive/ minimally active group (n = 18)	HEPA active group (n = 36)	P value
FBS (mg/dl)	135.6 (±50.6)	86.0 (±16.3)	0.00	104.5 (±43.5)	114.0 (±45.8)	0.47
FI (µIU/mL)	13.1 (±5.0)	11.0 (±5.3)	0.15	13.3 (±4.8)	11.5 (±5.3)	0.24
Insulin resistance	4.4 (±2.2)	2.5 (±2.0)	0.00	3.6 (±2.2)	3.4 (±2.4)	0.78
WC (cm)	87.1 (±6.7)	80.9 (±8.2)	0.00	86.4 (±7.7)	82.8 (±8.0)	0.12
HC (cm)	95.5 (±6.7)	93.9 (±6.5)	0.24	96.8 (±7.4)	93.2 (±6.0)	0.06
Visceral fat level	7.4 (±2.3)	6.3 (±3.6)	0.17	7.7 (±3.0)	6.4 (±3.0)	0.12
BMI	25.2 (±2.6)	23.5 (±3.8)	0.07	25.5 (±3.5)	23.8 (±3.2)	0.09
Waist-to-hip ratio	0.91 (±0.05)	0.87 (±0.07)	0.00	0.89 (±0.08)	0.88 (±0.06)	0.70
Waist-to-thigh ratio	1.91 (±0.1)	1.81 (±0.21)	0.03	1.85 (±0.14)	1.88 (±0.19)	0.61
Body fat %	34.5 (±2.6)	33.0 (±4.4)	0.10	35.2 (±3.2)	33.0 (±3.70	0.03
Whole body subcutaneous fat %	29.7 (±2.8)	27.6 (±4.4)	0.04	30.4 (±3.5)	27.8 (±3.7)	0.02

According to the findings of this study, only two risk indicators (Body fat % and Whole body subcutaneous fat %) have shown significant difference between inactive/minimally active group and HEPA active group. since measures of body fat

level are superior to conventional anthropometric parameters, it is possible that physical activity may have an effect on minimizing risk factors associated with increased body fat level.

Although Body fat % and whole body subcutaneous fat % mean values are significantly different between the two groups based on physical activity, anthropometric parameters are above the risk cut-off of both groups.

The level of physical activity of current study population was less when compared to level of physical activity of the rural female population of Sri Lanka diabetes and cardiovascular study population (Mean MET minutes per week in rural population = 4588) [4]. On the other hand, the total population has shown statistically significant differences in BMI, WC, HC, WHR and fasting blood glucose levels when the whole population was divided into three groups based on the level of physical activity (inactive, moderately active and highly active)[5]. The BIA analyzer which was used in this study was not validated for South Asian populations. Further, effect of food intake wasn't taken into consideration in data analysis and these two facts can be indicated as a limitation of the study.

Conclusions and Recommendations
High level of physical activity is associated with low body fat levels among female subjects with or without diabetes. This data further enlightens the beneficial effects of physical activity on reduction of body fat levels. However, not only the routine physical activity but also adopting regular exercise regimen to life style would improve the health states of overweight and obese female adults of the country.

Acknowledgement

References
[1] I.-M. Lee *et al.*, "Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy," *The lancet,* vol. 380, pp. 219-229, 2012.

[2] R. H. Eckel, S. M. Grundy, and P. Z. Zimmet, "The metabolic syndrome," *The Lancet,* vol. 365, pp. 1415-1428, 2005.

[3] P. Katulanda et al., "Derivation of anthropometric cut-off levels to define CVD risk in Sri Lankan adults," *British Journal of Nutrition,* vol. 105, p. 1084, 2011.

[4] P. Katuland et al., "Physical activity patterns and correlates among adults from a developing country: the Sri Lanka Diabetes and Cardiovascular Study," *Public health nutrition,* vol. 16, pp. 1684-1692, 2013.