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Comparative Study of Metabolic Syndrome in Different Levels of Physical Activity in Subjects With Sedentary Job Profile

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ABSTRACT

BACKGROUND: Metabolic syndrome is prevalent worldwide. The metabolic syndrome and its components are closely associated with lifestyle factors, including low physical activity (PA) levels. Scanty information is available about Information Technology (IT) professionals who have reduce physical activity at work and at leisure time. So, in this study we aimed to determine association between physical activity and Metabolic syndrome considering IT professionals as subject.

METHODS: A cross sectional, comparative study was conducted in the Department of Physiology, BJGMC, Pune from September 2012 to 2014. One hundred and fifty male subjects in the age group 25 to 50 years were selected randomly from Information Technology (IT) companies. Leisure time Physical activity was assessed by a questionnaire. Waist circumference, systolic and diastolic blood pressure, Serum Triglyceride, Serum High density lipoprotein cholesterol, fasting plasma glucose levels were estimated.

RESULTS: A large number i.e. 84 of subjects were insufficiently active. Statistically significant negative associations were reported between levels of physical activity and the components of metabolic syndrome ($p<0.001$). On the basis of Updated NCEP ATP III criteria 24 (16%) had metabolic syndrome. The percentage distribution observed in the insufficiently active, moderately active and active group were 18 (21.42 %), 6 (12.76%) and 0 (0%) respectively.

CONCLUSION: Low physical activity is associated with increased risk of developing metabolic syndrome. So regular physical activity and lifestyle modifications may be beneficial in avoiding the risk of Metabolic syndrome and its consequences. Professionals with sedentary job profiles should be encouraged to do physical activity and adapt healthy lifestyle. Also appropriate diagnostic test should be carried out of the employees.

KEYWORDS Metabolic syndrome, Physical activity, IT Professionals.

INTRODUCTION

In recent years, the burden of lifestyle related diseases is increasing globally. One such disease is Metabolic syndrome.[1,2] Metabolic syndrome, characterized by central obesity, dyslipidemia, hyperglycemia and hypertension is currently a major global public health challenge because it involves a serious risk of cardiovascular disease and type 2 Diabetes mellitus.[3,4] It is a common metabolic disorder as a result of combination of sedentary lifestyle, unhealthy diet and genetic predisposition.[5]

The metabolic syndrome and its components are closely associated with lifestyle

factors, including low physical activity (PA) levels.[6] Reduced physical activity at work and at leisure may be the major causative components in this development.[7,8] Prevalence of metabolic syndrome is high among Asians including Indians, and is rising. Reported prevalence of metabolic syndrome in some regions of the India ranges from 23.2 to 41.1 percent.[9]

Various studies are carried out considering different population at risk to develop metabolic syndrome. Information technology (IT) professionals can also be considered at risk. These professionals can be assumed to be at risk because of their sedentary job profile, job stress and lifestyle modernization. Also scanty information is available about the study of metabolic syndrome in these employees. Hence IT professionals were taken as subjects in the present study. By identifying people with metabolic syndrome, irrespective of the definition used[10], individuals who are at increased long term risk of type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD) can be identified, and this provides opportunity for prevention through lifestyle intervention i.e. mainly Physical activity and diet modification.[11,12]

With the above background, it was decided to study whether there is any difference in the means of components of Metabolic syndrome and occurrence of Metabolic syndrome with different levels of physical activity amongst subjects of IT.

MATERIAL AND METHODS

This study was a cross sectional, comparative study. A synopsis of the study protocol was approved by the Institutional Ethics Committee. The study was conducted in the Department of Physiology, BJGMC, Pune from September 2012 to 2014.

One hundred and fifty male subjects in the age group 25 to 50 years were selected randomly from a well known Information Technology (IT) company in Pune. Volunteers willing to participate were selected based on certain inclusion and exclusion criteria.

Inclusion Criteria:

Information technology (IT) company employees, Male subjects, Age group 25-50 years, Duration since working >3 years, Apparently healthy subjects.

Exclusion Criteria:

Known case of Diabetes Mellitus, Hypertension, Endocrine disorders; severely disabled; Persons with debilitating disease and chronic illness.

After inclusion in the study, a written informed consent was obtained from all the subjects. Then the detailed history was noted from all the subjects. History taking included all present and past illnesses of the subject. A standard questionnaire i.e. Godin Shephard leisure time physical activity questionnaire, [13, 14] to evaluate physical activity was standardized and volunteers were asked to fill it. The subjects were divided into three groups according to the score of physical activity. The insufficiently active were found to be 84, moderately active 47 and active 19.

All the selected subjects were requested to come at 8.00 AM. They were instructed to take the dinner at 9-10 pm and remain fasting overnight till blood samples were collected in the next day morning.

Then anthropometric parameters i.e. height, weight, waist circumference were measured. Pulse was recorded manually. Blood pressure was recorded manually by sphygmomanometer Diamond, India. Fasting blood samples about 5 ml were collected in the morning between 8-9 am by venepuncture and used for estimating biochemical parameters using kits. Liquixx HDL cholesterol kit was used for estimation of Sr. HDL cholesterol by phosphotungstic acid, end point method and Triglyceride DES kit was used for estimating Sr. TG levels by GPO – POD method. Pathozyme kit was used for estimation of fasting plasma glucose.

The National Cholesterol Education Program Adult Treatment Panel (NCEP ATP III) criteria with revision in 2005 by the American Heart Association/National Heart , Lung and Blood Institute i.e. Updated ATP III criteria was used for the diagnosis of metabolic syndrome.[15,16]

We evaluated the physical activity by Godin-Shephard leisure-time physical activity questionnaire which was validated by Miller DJ. The questionnaire allows the assessment of self - reported leisure - time physical activity.13,14 A score of <14 units indicates an insufficient level of activity with low health benefits; 14–23 indicates moderate activity with some health benefits; ≥24 indicates sufficient activity with substantial health benefits. The subjects were categorized accordingly into three groups i.e. insufficiently active group, moderately active group and active group. 84 subjects were insufficiently active, 47 were moderately active and 19 were active.

STATISTICAL ANALYSIS:
The data was entered in Microsoft Excel Sheet. Mean and standard deviation were calculated. Statistical analysis was done using Graphpad prism 5 software. Comparison of individual component of metabolic syndrome in the three groups was done by ANOVA (Analysis of variance) test followed by Bonferroni's post-hoc test and p value < 0.05 was considered as statistically significant. The statistical analysis was then depicted by using appropriate tables and graphs.

RESULTS
Table no. 1 shows demographic profile in which the difference in the BMI was statistically significant among the three groups. Table no.2 depicts comparison of mean values of components of metabolic syndrome among insufficiently active, moderately active and active groups (ANOVA). The results showed that insufficiently active group had higher waist circumference, systolic blood pressure, diastolic blood pressure, Sr.triglyceride and Sr.HDL levels and also fasting plasma glucose levels while the active group had lowest. The difference in the components of metabolic syndrome was statistically highly significant among the three groups ($p<0.001$). Table no.3 shows comparisons of components of Metabolic syndrome among insufficiently active, moderately active and active subjects using Post Hoc Bonferroni's multiple comparison test. This table revealed that the insufficiently active group had higher WC, SBP, DBP, FPG, Sr.TG, Sr.HDL-C as compared to active group and the differences were statistically highly significant ($p<0.001$). Also the components of metabolic syndrome were higher in insufficiently active group as compared to moderately active group and the differences were statistically significant. Table no.4 shows percentage distribution of metabolic syndrome in the study group. We observed that out of total 150 subjects in the study group 24 (16%) had metabolic syndrome. The percentage distribution observed in the insufficiently active, moderately active and active group were 18 (21.42 %), 6 (12.76%) and 0 (0%) respectively. Graph1 shows bar diagram of comparisons of mean values of Fasting plasma glucose among insufficiently active, moderately active and active groups. Graph 2 shows Bar Diagram showing comparison of mean values of Systolic blood pressure among insufficiently active, moderately active and active groups

DISCUSSION:
The present study indicates a difference in means in components of metabolic syndrome and also difference in occurrence of metabolic syndrome amongst IT professionals. (Table no. 2,3) And this results are in accordance with **Dhawan J et al, Carroll S et al, Forrest KY et al.** Present study revealed that the waist circumference was higher in insufficiently active group as compared to moderately active and active group.

Regular physical activity has been associated with reduction in fat mass and thus contributes to weight reduction and weight maintenance, by increasing the non resting energy expenditure.[18] Properly designed programs of physical activity may preserve or even increase lean muscle mass during weight loss. As the insufficiently active group had low physical activity which is associated with accumulation of body fat, they had increased waist circumference as compared to moderately active and active group.

The probable reason for lower mean values of blood pressure in moderately active and active subjects as compared to insufficiently active subjects can be given by theories that suggest that there is peripheral vasodilatation. The medium term and long term effect of physical activity would be the altered insulin level with consequent reduction in the retention of renal sodium and basal sympathetic tone. It also suggests a reduction in the level of catecholamines and the release of vasodilator substances in the circulation by skeletal muscle.[19] We observed that insufficiently active group had higher mean value of blood pressure, the possible reason for which could be that increased fat is linked with rise in non-esterified/ free fatty acid in blood which is thought to lead to hypertension.[16,20] Fatty acids themselves can cause relative vasoconstriction.[21] Increased renal sodium retention in obesity has been hypothesized to be associated with increased sympathetic nervous system and renin-angiotensin system activity as well as insulin resistance and hyperinsulinaemia.[22] Increased sodium retention causes a compensatory increase in fluid volume and initiates the rise in BP.

The moderately active and active subjects had lower fasting plasma glucose levels as compared to insufficiently active subjects. The probable explanation for this is that, it has been shown that physical training improves skeletal muscle insulin sensitivity and reduces insulin resistance.[23] During a single prolonged session of physical activity contracting skeletal muscles appear to have a synergistic effect with insulin in increasing glucose uptake into the cells. This effect appears to be related to both increased blood flow in the muscle and enhanced glucose transport into the muscle cell. This enhancement persist for 24 hours or more as glycogen levels in the muscle are being replenished. This observation suggest that many of the effects of regular physical activity are due to overlapping effects of individual physical activity sessions.[24] The probable explanation why fasting plasma glucose was higher in insufficiently active group may be that due to increased fat mass there is rise in free fatty acid in blood which is associated with resistance to insulin mediated glucose uptake and metabolism in muscle and an increase in glucose production and release by the liver.[25] In the present study lower serum triglyceride and higher serum HDL cholesterol values were seen in moderately active and active subjects as compared

to insufficiently active subjects. There is good evidence that regular physical activity lowers the concentration of triglycerides and raises the concentration of HDL cholesterol in human. The mechanism of the exercise induced changes in serum lipids is not clear. The probable explanation could be that the alterations are seen due to weight reduction, but it is not solely responsible. One explanation for the changes may be the activation of lipoprotein lipase, the enzyme responsible for catabolism of serum triglyceride. Furthermore, physical exercise increases activity of lipoprotein lipase in the skeletal muscle and in the adipose tissue. Chronic training may also lead to decreased production of very low density lipoprotein (VLDL) and to activation of the enzyme lecithin-cholesterol acyltransferase (LCAT) involved in transfer of unesterified cholesterol from cells to nascent HDL.[26] On the other hand the possible explanation for higher mean serum triglyceride levels and low serum HDL-C levels in insufficiently active subjects may be that according to studies increased fat mass is linked with rise in free fatty acid in blood which is thought to lead to insulin resistance and also dyslipidemia.[16,20] Due to insulin resistance there is increased flux of the free fatty acids to the liver which inturn increases triglyceride synthesis. In the presence of hypertriglyceridemia, a decrease HDL- C results from decrease in the cholesterol ester content of the lipoprotein core with variable increase in triglyceride making the particle small and dense, a function in part of cholesteryl ester transfer protein. This change in lipoprotein composition also results in an increased clearance of HDL from the circulation. So HDL-C concentration decreases.

We observed that out of total 150 subjects in the study group, 24 (16%) had metabolic syndrome. The percentage distribution observed in the insufficiently active, moderately active and active group were 18 (21.42 %), 6 (12.76%) and 0 (0%) respectively. Hence, the study demonstrated difference between levels of physical activity and occurrence of Metabolic syndrome.

To summarize, when the different levels of physical activity and individual components of metabolic syndrome was studied separately in our study in the IT Professionals we observed that high blood pressure, high plasma glucose, increased abdominal obesity, high Sr.TGs and low Sr.HDL-C were found in insufficiently active people. Current findings suggest creating awareness among the IT professionals who have sedentary job profile to include physical activity everyday as per WHO recommendations.

CONCLUSION :

To conclude, metabolic syndrome involves risk for development of cardiovascular diseases and type 2 diabetes mellitus. Low physical activity is associated with increased risk of developing metabolic syndrome. So regular physical activity and lifestyle modifications may be beneficial in avoiding the risk of metabolic syndrome and its consequences. Appropriate diagnostic tests must be carried out at regular intervals of IT employees so that it aids in early detection of employees at risk and accordingly appropriate interventions are taken.

Table 1: Demographic Profile of subjects :

Parameter	Insufficiently active n = 84 (Mean ± SD)	Moderately active n = 47 (Mean ± SD)	Active n = 19 (Mean ± SD)	p- value
Age (years)	32.85 ± 3.48	33.80 ± 4.16	32.36 ± 4.09	> 0.05
Body mass Index (BMI) (kg/m^2)	24.08 ± 2.47	23.01 ± 2.37	21.36 ± 1.40	< 0.001**

Non-significant at p>0.05 Highly significant at p < 0.001**

Table 2 : Comparison of mean values of components of Metabolic syndrome among insufficiently active, moderately active and active groups (ANOVA)

Parameter	Insufficiently Active n = 84 (Mean ± SD)	Moderately Active n = 47 (Mean ± SD)	Active n =19 (Mean ± SD)	p Value
Waist circumference [WC] (cm)	85.41 ± 5.18	83.08 ± 4.88	81.39 ± 3.23	< 0.001*
Systolic Blood Pressure [SBP] (mm of Hg)	123.38 ± 7.72	118.97 ± 8.18	113.78 ± 7.26	< 0.001**
Diastolic Blood Pressure [DBP] (mm of Hg)	78.95 ± 8.32	75.40 ± 7.11	72.21 ± 6.06	< 0.001**
Serum Triglycerides [Sr.TG] (mg/dL)	151.30 ± 22.41	142.31 ± 17.49	132.89 ± 15.28	< 0.001**
High Density Lipoprotein cholesterol [HDL-C] (mg/dL)	41.31 ± 4.88	44.04 ± 6.09	47.36 ± 7.92	< 0.001**
Fasting plasma glucose (FPG) (mg/dL)	93.63 ± 6.84	90.21 ± 6.60	88.05 ± 6.53	< 0.001**

Non-significant at p>0.05 Highly significant at p < 0.001**

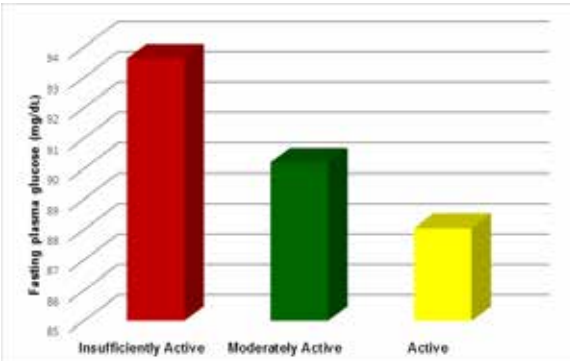
TABLE 3 : Comparison of mean values of components of Metabolic syndrome among insufficiently active, moderately active and active subjects using Post Hoc Bonferroni's multiple comparison test

Parameter	t value and p value	Insufficiently Active Vs Moderately active	Insufficiently Active Vs Active	Moderately Active Vs Active
WC (cm)	t value	2.61	3.23	1.27
	p value	< 0.05*	< 0.001**	>0.05
SBP (mm of Hg)	t value	3.09	4.83	2.44
	p value	< 0.001**	< 0.001**	<0.05*
DBP (mm of Hg)	t value	2.52	3.44	1.52
	p value	< 0.05*	< 0.001**	>0.05
Sr.TG (mg/dl)	t value	2.44	3.58	1.71
	p value	< 0.05*	< 0.001**	>0.05
Sr.HDL(mg/dl)	t value	2.57	4.15	2.15
	p value	< 0.05*	< 0.001**	>0.05
FPS (mg/dl)	t value	2.78	3.26	1.18
	p value	< 0.05*	< 0.001**	>0.05

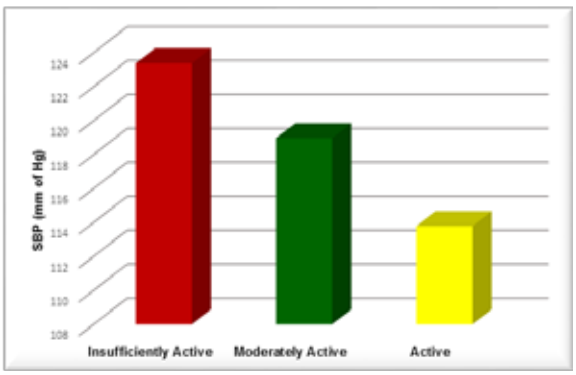
Table 4: Percentage Distribution of Metabolic Syndrome in study group

	Insufficiently Active n = 84	Moderately Active n= 47	Active n=19	Total n=150
Metabolic syndrome	18 (21.42 %)	6 (12.76%)	0 (0%)	24 (16%)

Graph 1: Bar Diagram showing comparison of mean values of fasting plasma glucose among insufficiently active, moderately active and active groups



Graph 2: Bar Diagram showing comparison of mean values of Systolic blood pressure among insufficiently active, moderately active and active groups



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