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Original Article

Effect of sedentary life style on anthropometric and cardiovascular parameters

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ABSTRACT

Aims: Increasing sedentary lifestyle combined with the growing use of technology in daily life is causing higher levels of physical inactivity among persons of all ages, both in developed and developing countries. Sedentary lifestyle leads to a widening physical activity gap, an imbalance between the need and realization of physical activity that is necessary for the attainment and maintenance of good health and functional capacity. Therefore, this study was undertaken to analyze the differences in certain anthropometric and cardiovascular parameters in sedentary and non-sedentary female subjects in the age group of 25-55 years. Methods: Total 105 healthy females subjects were selected randomly from the general population of Davangere city. Out of which 47 were sedentary and 58 were non-sedentary subjects. Anthropometric parameters such as weight, height, body mass index, waist circumference, hip circumference, waist to hip ratio were assessed. Cardiovascular parameters such as pulse rate, blood pressure were also assessed. Results: In our study, there was statistically significant increase in anthropometric and cardiovascular parameters in sedentary subjects compared to non-sedentary subjects. Conclusion: This review provides clear evidence that low levels of physical activity are associated with an increased risk of weight gain and significant increase in blood pressure. Although our study is by no means exhaustive, it provides a glimpse into the variety of adaptations /alterations in anthropometric parameters that occurs due to sedentary life style, even in the absence of overt disease.

1. Introduction

Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle, and adipose (fat) tissue. The lack of physical activity is a major underlying cause of death, disease, and disability. Preliminary data from a WHO study on risk factors suggest that inactivity, or sedentary lifestyle, is one of the 10 leading global causes of death and disability. More than two million deaths each year are attributable to physical inactivity. In countries around the world between 60% and 85% of adults are simply not active enough to benefit their health. Sedentary lifestyles increase all causes of mortality, double the risk of cardiovascular diseases, diabetes, and obesity, and substantially increase the risks of colon cancer, high blood pressure, osteoporosis, depression and anxiety [1]. The etiology of overweight and obesity is clearly multifactorial, but ultimately it is determined by the long-term balance between energy intake and expenditure. This review will consider the effects on body weight and the risk of obesity of sedentary lifestyles, within the context of dietary habits [2].

A sedentary life style includes less than 150 minutes of moderate physical activity or less than 60 minutes of vigorous physical activity per week [3]. Obesity can be defined as a state of excess adipose tissue mass [4]. Currently over weight and obesity are classified by Body Mass Index (BMI) (weight in kilogram/square of the height in meter-kg/m2). In adults, overweight is defined as BMI of 25.0 to 29.9 kg/m2; obesity is defined as BMI ≥30 m2 [5].

The results of extensive research programs lead to the conclusion that physical activity increases longevity, to a large extent protect against development of the major non-communicable diseases such as coronary heart disease, hypertension, stroke, non-insulin diabetes mellitus, osteoporosis and colon cancer[6]. Hypertensive heart disease was present in

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light workers five times more frequent than in heavy workers and obese individuals tend to be more inactive physically[7]. There is increased risk of metabolic complications for men with waist circumference ≥ 102 cms and women with a waist circumference ≥ 88 cms [8].

Physical activity may be a critical target for the specific prevention of visceral fat accumulation and corresponding health risk in obese subjects [9]. Visceral fat is more metabolically active than subcutaneous fat and hence may be more deleterious to health [10]. Avoiding a sedentary lifestyle during adulthood not only prevents cardiovascular disease independent of other risk factors but also substantially expands the total life expectancy and the cardiovascular disease-free life expectancy for men and women [11].

Because of increased morbidity, mortality and diseases due to physical inactivity and obesity, we need to create awareness about the risk factors, complications and preventive measures among the respondent of the study groups. Hence, the present comparative study of anthropometric and cardiovascular parameters of sedentary and non-sedentary subjects was

2. Materials and Methods

The present study was conducted in the department of Physiology, J.J.M. Medical College, Davangere. The study was undertaken to analyze the differences in certain parameters in healthy sedentary and non-sedentary subjects in the age group of 25 - 55 years.

47 sedentary subjects and 58 healthy non-sedentary female subjects were selected from the general population of Davangere city randomly. For the purpose of analysis subjects were divided into three groups depending upon the age.

Group – I (26-35 years):—13 sedentary, 15 non-sedentary subjects
Group – II (36-45 years):—19 sedentary, 14 non-sedentary subjects
Group – III (46-55 years):— 15 sedentary, 29 non-sedentary subjects.

Healthy females with BMI ≥30 (kg/m2) in the age group 25-55 years were classified as obese. Healthy females with BMI 18.50-24.99 (kg/m2) in the age group of 25-55 years were included as non-obese subjects.

- Subjects suffering from endocrinal disorders
- Hypertensive individuals
- Pregnant and lactating women
- Subjects with endovascular and cardiovascular diseases were excluded from the study.

All the subjects gave consent after explaining the procedure of the non-invasive technique to them. A brief personal history, childhood obesity, detailed history of exercise and a clinical examination of all the systems were done to exclude medical problems and to prevent confounding of results. Anthropometric parameters were measured in the morning session. Physical Parameters such as weight in kilogram, height in centimeters, waist, hip and mid arm circumference in centimeters were measured.

The circumference technique measures body shape using a flexible plastic measuring tape, subjects were required to wear minimal thin cloth, the measurement is typically conducted in the morning before eating and after emptying the bladder. Subjects were measured in standing position and they were asked to breathe normally and gently which prevents the subject from contracting their abdominal muscles.

Height was measured in centimeters with the standard position of the subject. It was measured by a plastic measuring tape after marking the subject to stand straight against an even wall. A sliding wooden head piece was used for accurate work[12]. Height was recorded nearest to 0.5cms. Body weight of all the subjects was measured by using standardized weighing machine, which was calibrated in kilograms. Weight was taken to the nearest 0.5 kg. The body mass index was derived by Quetlet's index from body weight (kg) / Height (m^2) [13].

Waist circumference was measured to the nearest centimeter with a plastic tape measure while the subjects were in the standing position at the end of gentle expiration. The following anatomical landmarks were used: laterally, midway between the lowest portion of the rib cage and iliac crest, and anteriorly midway between the xiphoid process of the sternum and the umbilicus [14]. Nearest to 0.5 cms circumference was taken.

Hip circumference was measured in centimeters (cms) in standing position with a plastic tape at the largest horizontal circumference around the buttocks [15]. Nearest to 0.5cms circumference was taken. After completing the measurements, the waist circumference was divided by the hip circumference to determine the waist to hip ratio [16].

Blood Pressure measurement (BP in mm Hg) was recorded with a mercury sphygmomanometer, in supine position in the right upper limb by auscultatory method. Similarly, three readings were taken at an interval of 15 minutes each and an average of the three values calculated. Pulse Pressure (PP) was calculated by Systolic Blood Pressure (SBP) minus Diastolic Blood Pressure (DBP). The Mean Arterial Pressure (MAP) was calculated by (MAP=DBP+1/3 PP).

Pulse rate/min was recorded by palpating the radial artery on the right side and counting was done for full one minute. The result for each parameter was compared between the sedentary and non-sedentary groups and was statistically analyzed.

2.1. Statistical Analysis

The results were given as Mean ± Standard Deviation. Comparisons were made between sedentary and non-sedentary subjects separately for different age groups. Student's t-test (Unpaired) was used for comparisons between the groups. A p-value of 0.05 or less was considered as statistical significance.

3. Results

Our study documents that there was statistically significant increase in all the anthropometric parameters in sedentary subjects except height in sedentary subjects (Table 1).

Table1. Comparison of anthropometric parameters between sedentary and non- sedentary subjects.

Anthropometric	Sedentary	Non-sedentary	Significance	
Parameters	Mean ± SD	Mean ± SD	t	P
Weight(kg)	63.36 ± 8.54	57.43 ± 6.35	9.03	< 0.001,HS
Height (cms)	155.19 ± 4.45	157.29 ± 2.06	0.025	> 0.01,NS
BMI (kg/m2)	26.32 ± 3.32	23.21 ± 2.06	5.72	< 0.001,HS
WC (cms)	90.53 ± 97.46	82.37 ± 68	2.54	0.05,S
HC (cms)	97.46 ± 6.27	96.36 ± 5.36	9.17	< 0.001,HS
WHR	0.93 ± 0.03	0.91 ± 0.031	2.59	0.05,S
MAC(cms)	27.90 ± 2.22	26.1± 1.3	1.8	< 0.01,S

All values are expressed as Mean ± SD.
Analysis for all parameters done by unpaired't' test.
HS -Highly Significant, S- Significant, NS- Not Significant.

There was statistically significant increase in BMI, WHR and MAC in sedentary subjects in Group-II and in Group-III when compared with non-sedentary subjects in the same age group. In Group-I there was slight increase in mean BMI, WHR and MAC in sedentary subjects compared to non-sedentary subjects though statistically was not significant. (Table 2).

Table2. Comparison of age related changes in anthropometry between sedentary and non - sedentary subjects

Anthropometric Parameters	Group	Sedentary Mean ± SD	Non-sedentary Mean ± SD	Significance	
				t	P
BMI (kg/m2)	Group-1	23.71 ± 3.00	22.62 ± 2.3	0.89	0.39,NS
	Group-11	27.33 ± 2.53	23.43 ± 2.9	4.10	< 0.001,HS
	Group-111	27.12 ± 2.52	23.52 ± 1.4	5.13	< 0.001,HS
WHR	Group-1	0.93 ± 0.04	0.90 ± 0.03	1.78	0.09,NS
	Group-11	0.94 ± 0.04	0.91 ± 0.03	2.25	0.05,S
	Group-111	0.95 ± 0.02	0.92 ± 0.02	2.00	0.05,S
MAC(cms)	Group-1	26.23 ± 2.64	26.33 ± 1.74	0.04	0.97,NS
	Group-11	28.62 ± 1.72	26.12 ± 1.32	4.79	< 0.001,HS
	Group-111	28.42 ± 1.73	25.94 ± 1.12	5.02	< 0.001,HS

All values are expressed as Mean ± SD.
Analysis for all parameters done by unpaired't' test.
HS-Highly significant, S- Significant, NS- Not significant.

There was statistically significant increase in the pulse rate in sedentary subjects as compared non-sedentary subjects and also in all the age groups (Table 3, 4).

There was statistically significant increase in systolic and diastolic blood pressure in sedentary subjects when compared to non-sedentary subjects. In all the age groups mean SBP (mmHg) in sedentary subjects were statistically increased when compared to non-sedentary subjects. There was a statistically significant increase in DBP in sedentary subjects in Group-II and Group-III when compared to non-sedentary subjects of the same age groups. The mean DBP in Group-I was slightly increased in sedentary subjects compared to non-sedentary subjects of the same age group but it was not statistically significant (Table 3, 4).

Table 4: Comparison of cardiovascular parameters between sedentary and non-sedentary subjects.

Group		PR/min	SBP (mmHg)	DBP (mmHg)	PP (mmHg)	MAP (mmHg)
Sedentary		82.3± 4.3	129.0 ± 11.2	83.2 ± 8.4	45.9 ± 5.0	98.4 ± 9.1
Non-sedentary		74.9 ± 3.6	121.0 ± 8.9	76.6 ± 6.3	44.4 ± 5.9	91.4 ± 6.7
Significance	t	9.70	4.11	4.58	1.37	4.56
	P	< 0.001,HS	< 0.001,HS	< 0.001,HS	0.17,NS	< 0.001,HS

All values are expressed as Mean ± SD.
Analysis for all parameters done by unpaired't' test.
HS-Highly Significant, S- Significant, NS- Not Significant.

Table 4. Comparison of age related changes in cardiovascular parameters in sedentary and non-sedentary subjects.

Parameter		Group	Sedentary Mean ± SD	Non-sedentary Mean ± SD	Significance
PR/min	Group 1	84.0 ± 4.3	73.9 ± 4.4	6.12	0.01,S
	Group 11	81.7 ± 4.7	74.1 ± 3.5	5.25	0.01,S
	Group 111	81.6 ± 3.4	75.8 ± 2.9	5.64	0.01,S
SBP (mmHg)	Group 1	123.5 ± 12.3	112.5 ± 8.4	2.72	0.01,S
	Group 11	127.5 ± 11.5	119.9 ± 7.8	2.26	0.01,S
	Group 111	135.7 ± 5.4	125.9 ± 6.0	5.55	< 0.001,HS
DBP (mmHg)	Group 1	79.4 ± 9.3	73.3 ± 7.3	1.90	0.07, NS
	Group 11	82.0 ± 9.3	72.9 ± 6.1	3.41	< 0.01,S
	Group 111	87.9 ± 2.8	80.1 ± 3.4	8.12	< 0.001,HS

All values are expressed as Mean ± SD.
Analysis for all parameters done by unpaired' test.
HS-Highly Significant, S- Significant, NS- Not Significant.

4. Discussion

Many studies have shown the health burden of a sedentary lifestyle. This is an analysis and discussion of the anthropometric and cardiovascular parameters assessed in sedentary and non-sedentary female subjects in the age group of 25-55 years.

The differences in the mean value of each parameter for each subgroup was analyzed and discussed. In our study BMI was increased in sedentary subjects when compared to non-sedentary subjects and it was statistically significant.

Recent studies in adolescents and adults have demonstrated significant relationship between physical inactivity and other adverse health practices, such as consumption of less-healthy foods or increased fat intake. Inactive individuals tend to consume more quantities of dietary fat. These data suggest that inactivity tends to cluster with other health behaviors that have adverse effect on the quantity and location of body fat deposition which results in obesity [17]. Modern life style associated with easy access to food, lack of exercise, sedentary life style, calories dense food, and excessive television viewing is among the identified contributes to the obesity epidemics [18].

In our study the mean WHR in sedentary female subjects was increased by 0.04 which was statistically significant this may be due to lack of physical exercise leading to an increased deposition of fat in the abdomen in sedentary subjects. Abdominal obesity is defined as waist circumference >102 cms in men and > 88 cms in women. Metabolic syndrome is a cluster of metabolic abnormalities including abdominal obesity, insulin resistance, dyslipidaemia, and abnormal blood pressure [19].

Physical inactivity decreases the production of Nitric Oxide (NO) by the abnormal endothelium, which leads to changes in vessel diameter leads to vascular structural changes which result in hypertension [20]. The reason for the association between increased body weight and elevated blood pressure is unclear. One possibility is that obesity is associated with higher circulating levels of insulin (a consequence of insulin resistance) and consequently with enhanced renal retention of sodium, resulting in increased blood pressure [21]. Sedentary normotensive have 20–50% higher risk of developing hypertension than individuals who are undertaken physical exercise regularly [22]. Systolic blood pressure increased by 6 mmHg and diastolic blood pressure

by 4 mmHg for a 10% gain in body fat. Weight loss of 1 kg produced a 20% decrease in both systolic and diastolic blood pressure in hypertensive patients even when the sodium intake was kept constant. The most characteristic lipid disorder in obesity was elevated total cholesterol and triglycerides, high LDL cholesterol and low HDL cholesterol. For every 1 kg of weight loss, there was corresponding reduction by about 1% in total cholesterol and LDL, a rise by 1% in HDL and a reduction by 3% in triglycerides [23].

Visceral fat although influenced by calorie intake to a certain extent, visceral fat accumulation is a mechanism which is determined also by estrogen deficiency (post menopausal hypertension) or enhanced corticoid influences. It is hypothesized that excess catecholamine triggers various adverse processes which, if persist, can lead or aggravate hypertension and insulin resistance. Visceral fat but not peripheral fat mass was correlated with atherogenic effect [24].

5. Conclusion

The conclusions of our study are:

- Sedentary lifestyle was associated with increase in anthropometric parameters such as BMI, WHR and MAC.
- Cardiovascular parameters such as pulse rate, systolic blood pressure and diastolic blood pressure were increased in sedentary subjects.
- It was also noticed in our study that anthropometric and cardiovascular parameters were increased in sedentary subjects but there was statistically significant increase after the age of 35 years.
- A better understanding of ethnic/racial differences in the development and progression of various complications in sedentary lifestyle is needed. Hormonal assay and lipid profile estimation along with fat parameters would have given a better understanding about sedentary life style and its consequences. We need to evaluate the strategies and efficacy of physical activity in various diseases.
- Those who are sedentary, an exercise program are an excellent way to significantly improve their health. Maintaining a healthy lifestyle, including exercise, will result in increased energy levels throughout working period. The benefits of regular physical activity are numerous, people who exercise live longer and healthier.

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