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"CORRELATION BETWEEN BODY MASS INDEX, WAIST HIP RATIO AND BODY FAT PERCENTAGE WITH BLOOD PRESSURE IN SEDENTARY FEMALES"

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ABSTRACT

Introduction:- Sedentary lifestyle is a major cause of disease, morbidity and death.

Regular physical activity reduces the blood pressure in those with high blood pressure levels. Physical activity also reduces the body fat, which is associated with high blood pressure.

The resting rate of sympathetic nerve discharge to skeletal muscle is directly correlated with Body Mass Index (BMI) and Percent of Body Fat (BF%). Abdominal fat than gluteal distribution of fat increases susceptibility to health hazards including cardiovascular diseases and diabetes mellitus. Therefore distribution fat should be analyzed independent of overall obesity by obtaining Waist Hip Ratio

Material and methods:-100 sedentary and 100 non-sedentary healthy subjects were selected from the general population randomly. Subjects with BMI ≥30 (kg/m^2) in the age group 25-55 years were classified as obese. BMI 18.50-24.99 (kg/m^2) in the age group of 25-55 years were included as non-obese subjects. The study was undertaken to analyze the differences in parameters such as Body Mass Index (BMI), Waist-Hip-Ratio (WHR) and Body Fat Percentage (BF%) in healthy sedentary and non-sedentary subjects in the age group of 25 - 55 years and their correlation with blood pressure was done

Results:-There was increased in BMI, WHR and BF% in sedentary subjects compared to non-sedentary subjects and there was positive correlation of these parameters with blood pressure

Conclusion:- Sedentary lifestyle was associated with increase in Body Mass Index, Waist Hip Ratio, Blood pressure and Body fat percentage and fat mass. There was a positive correlation of BMI, WHR, BF%, FM with Blood Pressure

KEYWORDS : Body fat, BMI, Sedentary life, WHR

INTRODUCTION

In physical inactivity there is an imbalance between energy intake and loss which leads to obesity. Sedentary lifestyle is a major cause of disease, morbidity and mortality.

Regular physical activity can decrease the blood pressure in those with high blood pressure levels. Physical activity also reduces the body fat, which is associated with high blood pressure.

The effect of different patterns of body fat distribution on mortality confirms earlier clinical observations that an abdominal fat than gluteal distribution of fat increases susceptibility to health hazards including cardiovascular diseases and diabetes mellitus. Therefore distribution fat should be analyzed independent of overall obesity by clinically obtaining WHR.[1]

The adipose tissue not only the stores fat but also acts as an endocrine organ, synthesizing and releasing into the blood stream a wide variety of peptides and non-peptide compounds which may play a major role in cardiovascular homeostasis. Adipose tissue is a significant source of Tumor Necrosis Factor-alpha (TNF-α), Interleukin-6, Plasminogen activator inhibitor – 1, Leptin, Angiotensinogen and Insulin like growth factor-1 (IGF-1).[2]

Body fat percentage and sympathetic nerve activity in healthy subjects were studied and it was found that resting rate of sympathetic nerve discharge to skeletal muscle was directly correlated with BMI and percent of body fat. In addition to body fat, muscle sympathetic nerve activity was correlated with age, plasma insulin concentration, and plasma lactate concentration. These four co-variants accounted for 58 % of the muscle sympathetic activity. It is concluded that in healthy humans, body fat is a major determinant of the resting rate of muscle sympathetic discharge. Overweight is associated with sympathetic activation could represent one potential mechanism contributing to the increased incidence of cardiovascular diseases in overweight subjects.[3]

Blood pressure and fat percentage in children and adolescents were assessed and showed that heart rate was increased, which suggests that some degree of increased sympathetic activity. BMI was consistently associated with increase in SBP and DBP in all age groups.[4]

25% for men and33% for women bf% are suitable cut off values for defining obesity.[5]

OBJECTIVES

To asses certain anthropometric, fat parameters and blood pressure of appropriately matched controls (Non- sedentary subjects).

To compare the results of the sedentary and non-sedentary groups and to study the effect of sedentary life style on anthropometric, fat parameters and blood pressure

MATERIALS AND METHODS

The present study was conducted in the department of Physiology.100 health sedentary females and 100 non-sedentary subjects were selected from the general population randomly. Subjects with BMI ≥30 (kg/m^2) in the age group 25-55 years were classified as obese. BMI 18.50-24.99 (kg/m^2) in the age group of 25-55 years were included as non-obese subjects. The study was undertaken to analyze the differences in parameters such as Body Mass Index (BMI), Waist-Hip-Ratio (WHR) and Body Fat Percentage (BF%) in healthy sedentary and non-sedentary subjects in the age group of 25 - 55 years and their correlation with blood pressure was done.

The exclusion criteria in this study were

- Subjects suffering from endocrinal disorders

- Hypertensive individuals
- Pregnant and lactating women
- Subjects with renovascular and cardiovascular diseases
- Age less than 25 and more than 55 yrs.

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 and cardiovascular 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. Cardiovascular parameters such as blood pressure which is measured with Sphygmomanometer and pulse rate was counted for one minute by palpating the radial artery on the right side. All the personal information like age, sex and a brief history were entered in the patient information chart giving a separate ID for each subject.

Method of collecting data:-
The study protocol was briefed to the subjects prior to the procedure. All the subjects were given written consent after explaining the importance of the study. The following parameters were recorded in the selected subjects.

1.Physical Anthropometry.
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 breath normally and gently which prevents the subject from contracting their abdominal muscles.

A. Height (Ht) :- 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.[6] Height was recorded nearest to 0.5 cms.

B. Weight (Wt) :- Body weight of was measured by using standardize weighing machine, which was calibrated in kilograms. Weight was taken to the nearest 0.5 kg.

C. Body Mass Index (BMI) :- The body mass index was derived by Quetlet's index from body weight (kg) / Height (m^2)[7].

2. Body Fat Percentage (BF %) :- Body fat percentage was calculated by using formula :

BF% = 1.2 X BMI + 0.23 X Age ─ 10.8 x Sex – 5 (Where, Male = 1 and Female = 0)[8].

3. 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 calculate by (MAP=DBP+1/3 PP).

Statistical Analysis : The results were given as Mean ± Standard Deviation and range values.

Comparisons were made between sedentary and non-sedentary subjects Students t-test (Unpaired) was used for comparisons between the groups. Correlation analysis was done for assessing relationship between different anthropometric and blood pressure parameters by Pearson's correlation coefficient. A p-value of 0.05 or less was considered as statistical significance.

RESULTS

Anthropometric and fat parameters.
There was statistically significant increase in BMI, WHR and BF% in sedentary subjects when compared to non-sedentary subjects (Table-1)

Systolic blood pressure (mmHg):
There was statistically significant increase in systolic blood pressure in sedentary subjects when compared to non-sedentary subjects.(P < 0.001) (Table-2)

Diastolic blood pressure (mmHg) :
There was statistically significant increase in diastolic blood pressure in sedentary subjects when compared to non-sedentary male subjects. (P < 0.001) (Table-2)

Correlation of BMI, WHR and BF% with Blood Pressure.
On comparing various cardiovascular parameters in sedentary subjects, increase in BMI was associated with increase in PR, SBP, DBP which was statistically significant. The degree of rise in SBP was more than rise in DBP. (positive correlation) (Table.3)

Table-1: Comparison of Anthropometric parameters and Body Fat Percentage Between Sedentary and Non-Sedentary Subjects

Group		BMI (kg/m^2)		WHR		BF%	
	n	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD
Sedentary	47	18.6-33.3	26.3 ± 3.3	0.84-0.99	0.93 ± 0.03	23.1-45.3	35.3 ± 5.1
Non-sedentary	58	14.2-38.7	23.3 ± 2.1	0.82-1.05	0.91 ± 0.03	21.7-42.4	31.0 ± 4.2
Mean difference		3.0		0.02		4.3	
Significance	t	5.72		2.59		4.75	
	p	**< 0.001, HS**		**< 0.05, S**		**< 0.001, HS**	

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

Table-2: Comparison of Blood Pressure between Sedentary and Non Sedentary Subjects

Groups		SBP (mm of Hg)		DBP (mm of Hg)		PP (mm of Hg)		MAP (mm of Hg)	
	n	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD
Sedentary	47	100-140	129.0 ±11.2	60-90	83.2 ± 8.4	38-56	45.9 ± 5.0	73.3-06.7	98.4 ± 9.1
Non-sedentary	58	100-136	121.0 ± 8.9	60-88	76.6 ± 6.3	30-60	44.4 ± 5.9	73.3-02.0	91.4 ± 6.7
Mean difference		8.0		6.6		1.5		7.0	
Significance	t	4.11		4.58		1.37		4.56	
	p	**< 0.001, HS**		**< 0.001, HS**		**0.17, NS**		**< 0.001, HS**	

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

Table-3: Correlation between BMI, WHR, BF% with Blood Pressure in Sedentary and Non-Sedentary Subjects

Correlation between	Sedentary		Non-sedentary	
	r-value	p-value	r-value	p-value
BMI α SBP	+ 0.59	< 0.001, HS	+ 0.26	< 0.05, S
BMI α DBP	+ 0.50	< 0.001, HS	+ 0.17	0.21, NS
WHR α SBP	+ 0.32	< 0.05, S	+ 0.09	0.52, NS
WHR α DBP	+ 0.30	< 0.05, S	+ 0.07	0.57, NS
BF% α SBP	+ 0.59	< 0.001, HS	+ 0.39	< 0.01, S
BF% α DBP	+ 0.64	< 0.001, HS	+ 0.14	0.31, NS

Pearson's correlation coefficient.

CONCLUSION

Sedentary lifestyle was associated with increase in Body Mass Index, Waist Hip Ratio, Blood pressure and Body fat percentage and fat mass. There was a positive correlation of BMI, WHR, BF%, FM with Blood Pressure

DISCUSSION

This is an analysis and discussion of the anthropometric and blood pressure parameters assessed in sedentary and non-sedentary subjects in the age group of 25-55 years. The differences in the Mean value of each parameter will be analyzed and discussed.

In our study BMI was increased in sedentary subjects by 3 kg/m^2 and it was statistically significant. BMI has positive correlation with blood pressure parameters.

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.[9]

Modern life style associated with easy access to food, lack of exercise, sedentary life style, calories dense food, and excessive television viewing are among the identified contributes to the obesity epidemics[10].

Similar findings were reported by multiple studies, Kopelman PG et al.[11], Scherrer U et al.[12], Jobb SA et al.[13] Amith Bandyipadhyay.[14], Antoni CL et al.[15] and BMI has positive correlation with cardiovascular parameters.

In our study the Mean WHR in sedentary subjects by 0.02 which was statistically significant and has positive correlation with blood pressure parameters in sedentary subjects. 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[16].

Similar findings were reported by multiple studies, Sieldell JC.[17] Criss AS et al.[18] Komiya H et al.[19]

In our study there was a statistically increase in both systolic and diastolic blood pressure in sedentary subjects when compared to non-sedentary subjects. The Mean SBP was increased by 7.9 mm of Hg. and the Mean DBP was increased by 6.6 mm of Hg. It must be noted that the rise of SBP is more compared to DBP. 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 results in hypertension[20]

The mean BF% in sedentary subjects was increased by 4.3% There was a positive correlation in increasing BF% causing further consistently increases in SBP, DBP, in sedentary subjects. The methodology adopted to determine the body fat percentage in the present study was based on BMI by using Deurenberg's equation where as, most of the reports on body fat percentage were based on the use of techniques like bioelectrical impedence, hydrodensitometry, X-ray absorptiometry and skin fold thickness.

Similar findings were reported by multiple studies, Heinz R, et al.[21] Poirier, P et al.[22], Proceedings of Nutritional Society [23], Nippon Eiseiga Zasshi[24], Criss AS et al[25] , Vippaldadhiam H, et al.[26], Komiya H et al.[27], Amith Bandyipadhyay.[28], Jung R.[29]

Sedentary lifestyle was associated with increase in Body Mass Index, Waist Hip Ratio, Blood pressure and Body fat percentage and fat mass. There was a positive correlation of BMI, WHR, BF%, FM with Blood Pressure.

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