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Research Article

COMPARISON OF BODY MASS INDEX AND BLOOD PRESSURE HIP CIRCUMFERENCE AND WAIST CIRCUMFERENCE AMONG HEALTHY VOLUNTEERS AT SELECTED INSTITUTIONS IN MANGALORE

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ABSTRACT

Background: Improvement in technology has led to significant changes in human lifestyle. As a result the life has become easier and these days people are more prone to heart diseases and other health problems. Sedentary lifestyle and dietary changes contribute to the increased incidence of obesity, hypertension and other vascular diseases. This leads to increased mortality and morbidity rate. The WHO has given more prominence to the prevention and management of non-communicable diseases like obesity and hypertension from the year 2008. Hypertension is a "silent killer" as early stages of this disease has no clinical manifestations. Overweight and obesity will increase the risk of high BP.

Aim: Comparison of body mass index and blood pressure hip circumference and waist circumference among healthy volunteers at selected institutions in Mangalore.

Materials and Methods: A quantitative approach with non-experimental descriptive co-relational design was used for this study. 160 samples were selected by non-probability purposive sampling technique. Blood pressure, height, weight and body mass index of the subjects were monitored. The samples were composed of males and female healthy volunteers, who were again classified based on body mass index as underweight, normal weight, overweight and obese. Data was collected by using demographic proforma, clinical proforma and sphygmomanometer. The data was analyzed using descriptive and inferential statistics. **Results**. The result of the study showed that both systolic blood pressure and diastolic blood pressure is higher among males (121.97) than females (81.68). Another finding revealed that overall mean body mass index (24.33) of the female subject was higher. The mean body mass index value of the male subject was lesser than females. The result showed that there was a positive correlation between systolic blood pressure and body mass index in males (r=0.23) and females (r=0.35). There was a positive correlation between diastolic blood pressure and body mass index in males (r=0.30) and females(r=0.44). The investigators also found that there was an association between systolic blood pressure and age in both males ($\chi 2 = 9.42$) and females ($\chi 2 = 9$). There was also an association between diastolic blood pressure and age in both males ($\chi 2=9.39$) and females ($\chi 2 = 18.37$). An association was also seen between systolic blood pressure and stress ($\chi 2=8.07$) and diastolic blood pressure and stress ($\chi 2=8.07$).The study also found that there was no association between body mass index with selected demographic variables such as gender, type of food consumption, habits and nature of work.

INTRODUCTION

Technology has made life easier; it has made people more prone to heart diseases and other health problems. Before the industrial revolution, most of the people made their living through some sort of manual labour. Walking was the major means of transportation, laundry was scrubbed and wrung by hands, stairs were climbed, carpets were beaten, and butter was churned[1].

With the arrival of automation, life became less strenuous. Most manual labour was either replaced or assisted by machinery. Automobile, washing machines, elevators, grinders and vacuum cleaners became common place. Modern convenience made physical activity unnecessary. Along with the changes in life style, a change in the diet also took place. Fried foods like potato chips, hamburgers and fast food items became the staple diet. Machines were built to homogenize milk, process cheese, churn butter and make ice cream. The combination of sedentary life style and rich diet led to an increase in clogged blood vessels and other vascular diseases.

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People became much fond of high fat content of ice-creams, cheese and butter. Heart diseases, obesity and hypertension became common.

Overweight and obesity increases the risk of high blood pressure. Obesity has reached epidemic proportion in India in the 21st century; with morbid obesity affecting 5% of the country's population[1].The increased incidence of obesity is most likely related to life style changes, dietary habits and physical inactivity. The age adjusted prevalence of overweight and obesity is 16.3% and that of obesity is 5.1% [1].Obesity is the major cause for developing problems like coronary heart disease, high blood pressure, stroke, type II diabetes mellitus, cancer and reproductive problems. Life style related factors such as obesity, drinking habits, diet and physical inactivity are well established determinants of high blood pressure[2]

Objectives of the Study

METHODOLOGY

Research Approach

A quantitative approach was adopted for the study as it was intended to compare the body mass index and blood pressure hip circumference and waist circumference among healthy volunteers

Research Design

Non-experimental descriptive co-relational design was used for this study.

Study Setting

The study was conducted in the selected institutions in Mangalore.

Study Population

The population of the study included male and female healthy volunteers between the age group of 20-60 years, who were again classified based on body mass index as underweight, ideal, overweight and obese.

Sample and Sample Size

160 healthy volunteers of which 71 males and 89 females who fulfilled the criteria, were selected as sample..

Criteria for Sample Selection

Exclusion Criteria

Those who had health problems.

Inclusion Criteria

Healthy Volunteers between the Age Group of 20-60 Years
Both male and female were included

Table 1 Description of demographic characteristics of subjects

n=160

Sl no.	Characteristics	Male (n=71)		Female (n=89)	
		Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
1	**Gender (in years)**				
	20-30	21	29.57	25	28.08
	31- 40	19	26.76	24	26.99
	41-50	18	25.35	21	23.59
	51-60	13	18.30	19	21.34
2	**Type of food consumption**				
	Vegetarian	1	1.40	0	0
	Mixed	70	98.60	89	100
3	**Habits**				
	Alcoholism	24	33.80	0	0
	Smoking	20	28.16	0	0
	Chewing tobacco	1	1.40	2	2.25
	Nil	24	33.80	87	97.75
	Both	2	2.81	0	0
4	**Nature of work**				
	Sedentary	35	49.29	60	67.14
	Moderate	30	42.25	29	32.58
	Heavy	6	8.45	0	0
5	**Family history of hypertension**				
	Present	9	12.67	16	17.97
	Absent	62	87.32	73	82.02
6	**Exercise**				
	Regular	4	5.63	3	3.37
	At times	6	8.45	4	4.49
	Rarely	18	25.35	4	4.49
	Not at all	43	60.56	78	87.64
7	**Stress**				
	Rare	38	53.51	42	47.19
	Sometimes	29	40.84	44	49.43
	Often	2	2.82	2	2.25
	Almost every day	2	2.82	1	1.12

Sampling Technique

The samples who met the inclusion criteria during the data collection were selected using non-probability purposive sampling technique

Procedure for Data collection

Clinical parameters like blood pressure, height, weight and body mass index of the subjects were monitored. Data was collected by using demographic proforma, clinical proforma and sphygmomanometer. The data was analyzed using descriptive and inferential statistics.

RESULTS

Background Variables

- The systolic blood pressure and diastolic blood pressure is higher among males (121.97) than females (81.68).
- The overall mean body mass index (24.33) of the female subject was in higher normal level. The mean body mass index value of the male subject was lesser than females.
- There was a positive correlation between systolic blood pressure and body mass index in males (r=0.23) and females (r=0.35). There was a positive correlation between diastolic blood pressure and body mass index in males (r=0.30) and females(r=0.44).
- The investigators also found that there was an association between systolic blood pressure and age in both males
- (χ2 = 9.42) and females (χ2 = 9).
- There was also an association between diastolic blood pressure and age in both males (χ2=9.39) and females (χ2 = 18.37).
- An association was also seen between systolic blood pressure and stress (χ2=8.07) and diastolic blood pressure and stress (χ2=8.07).The study also found that there was no association between body mass index with selected demographic variables such as gender, type of food consumption, habits and nature of

Table 2 Description of systolic blood pressure among male and female subjects

n=160

Characteristics	Systolic blood pressure					
	Males (n=71)			Females (n=89)		
	N	Mean	S.D	n	mean	S.D
Age						
20-30	21	118.67	9.92	25	114.84	10.91
31-40	19	122.62	9.44	24	120.77	8.62
41-50	18	123.85	8.97	21	121.54	8.98
51-60	13	124.44	10.96	19	122.14	8.92
Overall	71	122.39	9.7	89	119.82	10.18

Table 2 shows that the mean systolic blood pressure was less among the age group of 20 to 30 years in both males and females. The mean systolic blood pressure was higher among the age group of 51 to 60 years in both males and females. Overall mean systolic blood pressure among men, irrespective of age was 122.39 and females 119.82.

Table 3 Description of diastolic blood pressure among male and female subjects

Characteristics	Diastolic blood pressure					
	Males (n=71)			Females (n=89)		
	n	Mean	S.D	n	Mean	S.D
Age						
20-30	21	81.33	9.91	25	77.42	9.29
31-40	19	85.33	10.74	24	83.07	9.47
41-50	18	85.76	11.01	21	83.30	9.26
51-60	13	87.22	12.27	19	84.28	8.51
Overall	71	84.91	10.98	89	82.01	9.46

Table 3 shows that the mean diastolic blood pressure was less among the age group of 20 to 30 years in both males and females. The mean diastolic blood pressure was higher among the age group of 51 to 60 years in both males and females. Overall mean diastolic blood pressure among men, irrespective of age was 84.91 and females 82.01.

Table 4 Description of body mass index among male and female subjects

Characteristics	Body mass index					
	Males (n=71)			Females (n=89)		
	N	Mean	S.D	n	mean	S.D
Age						
20-30	21	23.20	5.09	25	24.38	6.01
31-40	19	23.69	6.45	24	24.29	7.56
41-50	18	25.00	6.87	21	25.07	6.56
51-60	13	20.41	6.32	19	23.48	4.68
Overall	71	23.07	6.19	89	24.30	6.36

Table 4 shows that the average mean body mass index was higher among the age group of 41 to 50 years in both males and females. The average mean body mass index was less among the age group of 51 to 60 years in both males and females. Overall mean body mass index among men irrespective of age was 23.07 and females 24.30.

Table 6 shows that the computed overall correlation value (r=0.290, df=158) was significant at 0.01 level. Hence the systolic blood pressure of the subjects positively correlates with body mass index of the subjects. The computed correlation value for males (r=0.23, df =69) was significant at 0.05 level. Hence the systolic blood pressure of the male subjects was positively correlated with body mass index. The computed correlation value for females (r=0.35, df=87) was significant at 0.01 level. Therefore the systolic blood pressure of the female subjects was positively correlated with body mass index. Hence null hypothesis can be rejected.

Descriptions of anthropometric characteristics, resting blood pressure and pulse pressure of male subjects. Data are expressed as means ± SD.

n=71

S.No	Variables	Under Weight n=19	Normal Weight n=22	Over Weight n=22	Obese n=8	P- Value
1	Age	30.84 ±11.95	41.04 ±16.41	37.81± 13.73	33.25 ± 8.71	0.111
2	Height	1.58 ± 8.31	1.59 ± 13.44	1.60 ± 10.13	1.59 ± 10.54	0.975
3	Weight	41.52 ± 5.84	54.77 ± 10.08	68.18 ± 8.55	79.18 ± 9.62	<0.001
4	Hip Circumference	79 ± 5.67	90.68 ± 6.65	99.5 ± 9.89	109.01 ± 8.88	<0.001
5	Waist Circumference	68.31 ± 7.81	81.54 ± 9.6	94.5 ± 6.94	107.5 ± 18.7	<0.001
6	Systolic BP	112.11 ± 10.84	118.18 ± 9.57	121.82 ± 7.32	126.25 ± 9.16	<0.001
7	Diastolic BP	77.36 ± 9.91	79.09 ± 8.67	83.18 ± 7.16	86.25 ± 13.02	<0.001
8	Pulse Pressure	34.73 ± 5.12	39.09 ± 10.09	38.63 ± 4.67	40.00 ± 9.25	<0.05
9	BMI	16.51 ± 1.15	21.48 ± 1.60	26.63 ± 1.18	32.48 ± 3.56	0.194

Descriptions of anthropometric characteristics, resting blood pressure, and pulse pressure of female subjects. Data are expressed as means ± SD.

n=89

S.No	Variables	Under Weight n=26	Normal Weight n=17	Over Weight n=30	Obese n=16	P- Value
1	Age	44.08± 11.16	41.23 ± 10.17	45.56 ± 11.21	42.93 ± 11.17	0.974
2	Height	1.57 ± 9.20	1.66 ± 9.42	1.63 ± 6.48	1.61 ± 9.45	0.022
3	Weight	43.68 ± 7.52	60.94 ± 7.69	71.3 ± 7.68	83.00 ± 11.69	<0.001
4	Hip Circumference	83.64 ± 6.51	91.88 ± 5.32	101.4 ± 5.72	107.69 ± 11.81	<0.001
5	Waist Circumference	71.84 ± 6.69	86.82 ± 7.82	93.4 ± 8.4	101.31 ± 15.38	<0.001
6	Systolic BP	120.40 ± 12.4	123.53 ± 7.01	123.67 ± 9.64	127.38 ± 7.27	<0.05
7	Diastolic BP	82.4 ± 10.51	83.52 ± 9.96	85 ± 10.08	92.5 ± 11.83	<0.024
8	Pulse Pressure	38 ± 12.9	40 ± 9.35	38.66 ± 7.3	31.87 ± 15.15	0.158
9	BMI	17.05 ± 1.06	21.71 ± 1.42	26.74 ± 1.17	33.89 ± 5.05	<0.001

Correlation between body mass index and various parameters in under-weight (UW), normal weight (NW), overweight (OW) and(OB) Obese subjects. Data are expressed as Pearson correlation coefficient. Sample size (n) is indicated within brackets.

BMI	Age	Ht	Wt	Hip Circum ference	Waist Circum ference	Systolic BP	Diastolic BP	Pulse Pressure
UW Male (19)	-0.269	0.336	0.713	0.257	0.684	0.290	0.160	0.304
UW Female(26)	0.215	-0.032	0.257	0.322	0.491	0.287	0.120	0.170
NW Male(22)	-0.212	0.008	0.402	0.219	0.464	-0.026	0.135	-0.139
NW Female(17)	-0.061	-0.064	0.451	0.445	0.488	-0.232	-0.166	-0.005
OW Male(22)	-0.325	-0.199	0.130	0.343	0.507	0.142	0.087	0.090
OW Female(30)	0.1576	0.429	0.734	0.541	0.356	0.233	0.146	0.106
OB Male(8)	0.097	-0.256	-0.124	0.854	0.903	0.078	-0.073	0.180
OB Female(16)	-0.306	-0.010	-0.563	-0.479	-0.501	-0.056	0.384	-0.327

Table 6 Correlation between body mass index and systolic blood pressure of the subjects

Characteristics	Males (71)			Females (89)		
	Mean	S.D	R	Mean	S.D	r
Systolic BP	122.39	9.7	+0.15	119.82	10.18	+0.45
BMI	23.07	5.42		24.30	6.36	

*****significant at 0.05 level; ******significant at 0.01 level

H_{02}: There will be no significant correlation between diastolic blood pressure and body mass index of healthy volunteers.

Table 7 Correlation between diastolic blood pressure and body mass index of subjects

Characteristics	Males (71)			Females (89)		
	Mean	S.D	r	Mean	S.D	r
Diastolic BP	84.91	10.98	+0.34	80.7	9.46	+0.32
BMI	23.07	5.42		24.30	6.36	

*significant at 0.05 level; **significant at 0.01 level

Table 7 shows that the computed overall correlation value (r=0.35, df= 158) was significant at 0.01 level. Hence the diastolic blood pressure of the subjects was positively correlated with body mass index of the subjects.

The computed correlation value for males (r=0.30, df=69) was significant at 0.01 level. Hence the diastolic blood pressure of the male subjects was positively correlated with body mass index of the subjects.

The computed correlated value for females (r=0.44, df =87) was significant at 0.01 level. Hence the diastolic blood pressure of the female subjects was positively correlated with body mass index of the subjects. Hence null hypothesis can be rejected.

DISCUSSION

The investigators found that both systolic blood pressure and diastolic blood pressure was higher among males than females.

A similar finding was seen in another study where the male subject had significantly higher systolic blood pressure and diastolic blood pressure than the female subjects. The study revealed that the overall mean body mass index of the female subjects was higher normal. The mean body mass index value of the male subjects was lesser than female. A study on blood pressure and body mass index pattern of students in Nigerian University got similar results where the prevalence of obesity and under nutrition was higher in female subjects The investigators found that there was a positive correlation between systolic blood pressure and body mass index in males (r=0.23) and females (r=0.35). There was a positive correlation between diastolic blood pressure and body mass index in males (r=0.30) and females (r=0.44). The study finding is supported by Oghagbon's study on blood pressure and body mass index pattern of students in Nigerian University and another study on association between body mass index, blood pressure and age. The computed correlation value for male subjects (r=0.2) was significant at 0.05 level and for female subjects (r=0.32) was significant at 0.01 level. Hence the systolic blood pressure of both genders was positively correlated with age. The computed correlation value (r=0.32) for female subjects was significant at 0.01 level, which implied that diastolic blood pressure of the female subjects was positively correlated with age.

The above finding was also seen in another study on age and sex related changes in blood pressure and body mass index. The study found that the systolic blood pressure increased with age group

The computed correlation value between age and body mass index of the male subjects (r= -0.80) and female subjects (r= -0.001) implied that there was negative correlation between age and body mass index in both genders.

The study finding was consistent with an earlier finding where there was a poor correlation between the age and body mass index for both sexes[18].The investigators found that there was an association between systolic blood pressure and age in both males ($\chi 2=9.42$) and females ($\chi 2=9$). There was also an association between diastolic blood pressure and age in both males ($\chi 2=9.39$) and females ($\chi 2=18.37$). The association was also seen between systolic blood pressure with stress ($\chi 2=8.07$) and diastolic blood pressure with stress ($\chi 2=8.07$) in males.

A similar finding was seen in Jacquelyn's study where single nucleotide polymorphism (SNP) was significantly associated with systolic blood pressure adjusted for age ,age and body mass index. This SNP did not deviate from the Hardly Weinberg equilibrium with p value of 0.772[10].

CONCLUSION

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