ORIGINAL RESEARCH PAPER
Volume - 10 | Issue - 02 | February - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A STUDY OF RELATIONSHIP OF ANTHROPOMETRIC INDICES WITH BLOOD PRESSURE AND BLOOD GLUCOSE LEVEL IN ADULT POPULATION AT PMCH, PATNA

Physiology

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ABSTRACT

Diabetes is the 5th or 6th leading cause of death worldwide (as per International Diabetes Federation 2009). The crude prevalence of diabetes (type 1 and 2) in adults 20-79 years of age was estimated to be 6.6% (285 million) in 216 IDF member countries in 2010 (as per International Diabetes Federation 2009). By 2030, this figure is expected to rise to 7.8% (438 million), with the largest increase in regions where economies are developing further. They further emphasized that if the levels of obesity continue to increase, the prevalence of diabetes may be even greater than that reported in the IDF 2009 report. Hypertension is considered as the primary risk factor for stroke, ischaemic heart disease (Nakamura et al 2008) and cardiovascular disease (CVD) mortality (Martiniuk et al 2007; He et al 2009). Recently, it was estimated that 7.6 million premature deaths per year may be attributed to high blood pressure (Lawes et al 2008), that is 13.5% of the total global deaths. About 26.4% or 972 million of the world adult population had hypertension in 2000 of which 333 million were in economically developed countries and 639 million in economically developing countries (Kaarney et al 2005), figures predicted to increase by 60% to 1.56 billion in 2025.

KEYWORDS

INTRODUCTION

"Health is wealth and a healthy mind lives in a healthy body"

But, today "Obesity" is perhaps the most prevalent form of malnutrition. Obesity may be defined as an abnormal growth of the adipose tissue due to an enlargement of fat cell size (hypertrophic obesity) or an increase in fat cell number (hyperplastic obesity) or a combination of both.

The distribution of fat induced by the weight gain affects the risk associated with obesity and the kind of disease that results. It is useful therefore to be able to distinguish between those at increased risk as a result of "abdominal fat distribution" or "android obesity" from those with the less serious "gynoid" fat distribution in which fat is more evenly and peripherally distributed around the body.

As a chronic disease, prevalent in both developed and developing countries and affecting children as well as adults, it is now so common that it is replacing the more traditional public health concerns including undernutrition. It is one of the most significant contributors to ill health.

It is extremely difficult to assess the size of the problem and compare the prevalence rates in different countries as no exact figures are known and also because the definitions of obesity are not standardized. However it has been estimated to affect 20-40% of the adults and 10-20% of children and adolescents in developed countries.

Obesity has reached epidemic proportions in India in the 21st century, with morbid obesity affecting 5% of the country's population. Moreover, there are not much studies concerning these in our area. According to NIHS data, obesity in males is 8.5% and in females is 10.5% in Bihar.

Obesity is an excess fat accumulation in the body that is one of the major modifiable risk factors for type 2 diabetes, hypertension and many other chronic conditions. The World Health Organisation (WHO) estimates that there are more than 1 billion overweight adults worldwide and at least 300 million that are clinically obese (WHO consultation 2000), figures that are estimated to increase further by 2015. Increased urbanization, westernization, rapid economic development and unhealthy lifestyles have contributed to the rapid increase in obesity. Consequently, the prevalence of obesity related metabolic disorders such as type 2 diabetes and many others are increasing at an alarming rate and projected to increase further.

Clinical intervention trials have clearly shown that weight reduction with healthy diets and physical activity can benefit individuals at increased risk for diabetes and hypertension. Thus, an appropriate definition of obesity and its predictive value in relation to diabetes and hypertension are necessary in intervention strategies.

Commonly used anthropometric measures such as body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR), hip circumference (HC), and waist-to-stature (WSR) have been proposed to define obesity in epidemiological studies. However, there is a controversy regarding which of these anthropometric measures best define obesity and conveys the highest risk for type 2 diabetes and hypertension.

At the same time, in a developing country as ours, knowledge regarding the relationship between these anthropometric indices and various chronic diseases as Hypertension and Diabetes are not yet well known. So there is a need to establish, as well as spread such message in general population, so that by keeping record of these easily measurable anthropometric indices, one can take suitable preventive steps and delay or deny the development of such chronic diseases in their healthy lives.

AIMS OF THE STUDY

Relationship of various anthropometric indices with blood pressure and blood glucose level were established using different datas and suitable statistical analysis.

MATERIALS AND METHODS

Subjects for this study were selected using Simple random sampling from among the staff members and the population residing around Patna, Bihar. Present study was done at Department of Physiology, Patna Medical College, Patna, Bihar from March 2017 to August 2017. All the readings and measurements were taken by either visiting them at their residence or by requesting them to come to the Department of Physiology, at a suitable time and date. Informed consent was taken and Questions regarding food habits and lifestyle were done. Subjects were made aware of any abnormal findings, if detected so, while conducting the study.

INCLUSION CRITERIA

1. Male and female subjects irrespective of age, caste and religion
2. Subjects who were free from any co-morbid conditions like renal and liver diseases, autoimmune and endocrine diseases, severe anemia and allergic conditions requiring steroid treatment.

EXCLUSION CRITERIA

1. Pregnant and lactating Females.
2. Subjects who were unable to stand erect.
3. Subjects suffering from diseases which can affect the weight , blood pressure and blood glucose levels like renal and liver diseases, autoimmune and endocrine diseases, severe anemia and allergic conditions requiring steroid treatment were excluded.

MATERIALS /INSTRUMENTS USED

1. **For weight :** A portable digital weighing scale .
2. **For blood pressure:** mercury-in-glass sphygmomanometer (DIAMOND make) calibrated in mmHg (0-300) and Stethoscope (LITTMANN'S Cardiology 3).
3. **For random blood sugar:** A Glucometer (ACCU-CHEK Active)
4. **For Waist and Hip circumference:** A tailor's inelastic measure tape graduated in centimeters (0-150)
5. **For Height:** a steel measuring tape graduated in centimeters (0-500)

MEASUREMENT OF ANTHROPOMETRIC INDICES:

BODY WEIGHT

- Body weight has been measured without shoes in light clothing (to the nearest 0.5 kg).
- Subject should be standing motionless on the digital weighing scale in such a way that body weight should be distributed equally on each leg.
- Weighing machine was standardized everyday with a weight of 50 kg.

Fig. weight measurement on digital scale

BODY HEIGHT

- Height has been measured without shoes with the subject standing in an erect posture, shoulders in relaxed position and arms hanging freely.
- The head was positioned so that the top of the external auditory meatus was in level with the inferior margin of the bony orbit (Frankfurt plane) using tape meter.

WAIST CIRCUMFERENCE

- Waist circumference has been measured as per recommendation of WHO STEPS for surveillance(2008) protocol.
- It was measured at approximate midpoint between the lower margin of last palpable rib and the top of the iliac crest, using a stretch resistant tape.
- ❖ Cut offs used for WC were ≥ 90cm in males and ≥ 80cm in females (as per recommendation given in the report of WHO expert consultation,Geneva 8-11 Dec. 2008, for Asian population)

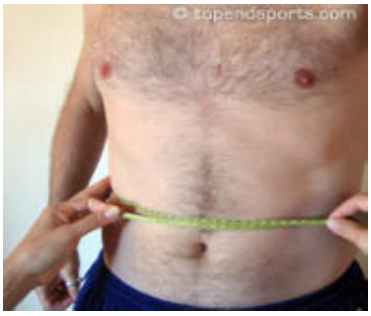


Fig. Measuring waist circumference

HIP CIRCUMFERENCE

- Hip circumference has been measured around the widest portion of the buttocks
- The tape was parallel to the floor.

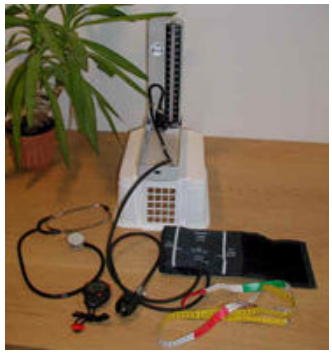
Fig. Measuring hip circumference

For **waist and hip circumference measurements**, the subjects were instructed to stand with feet close together, arms at their sides and body weight evenly distributed across the feet, and wear light clothing. They were instructed to be relaxed and take a few deep breaths to minimize the inward pull of the abdominal contents and the measurement has been taken at the end of a normal expiration. Both measurements have been taken with a stretch-resistant tape that is wrapped snugly around the subject without compressing the skin.

The measurements were repeated twice and if the measurements were within 1 cm of one another, the average was calculated. If the difference between the two measurements exceeded 1 cm, the two measurements were repeated.

MEASUREMENT OF BLOOD PRESSURE

The auscultatory method of Blood Pressure measurement with a properly calibrated and validated sphygmomanometer has been used.



- Subjects were made to sit comfortably in a chair for at least 5 minutes with arm supported at heart level.
- The appropriate sized riva-rocci cuff (bladder length 80% and width at least 40% of arm circumference) was used to ensure accuracy.
- The systolic B.P. was defined as appearance of the first sound (kortokoff phase 1).
- The diastolic B.P. was defined as disappearance of the sound (kortokoff phase 5).
- Two readings were taken at interval of 5 minutes and the lower reading among them was recorded as the subjective B.P.
- Before measuring the B.P. the subjects were questioned about drinking tea or coffee, smoking, physical activity and a full bladder.
- HYPERTENSION was defined as SBP ≥ 140mm Hg or DBP ≥ 90mm Hg as per recommendation of Seventh Report of Joint National Committee on Prevention, Detection, Evaluation and Treatment of High blood pressure (JNC 7).

MEASUREMENT OF BLOOD GLUCOSE LEVEL:

For measuring blood glucose level using Accu-chek Active blood glucose meter, following steps are to be followed –

1. Insert a new test strip into the meter until it clicks into place.
2. The orange pad should face up and the arrows should point toward the meter. The meter will automatically turn on.
3. Verify that the code number on display matches code number on test strip container, then test strip and flashing blood drop symbols

will appear on the display.
4. Use the lancing device to prick the side of a fingertip. Gently squeeze the fingertip to produce a small drop of blood.
5. Touch the blood drop to the center of the square orange pad until an hourglass appears.
6. Results will then appear in the display.


Out-of-meter dosing –
1. Once the test strip and flashing blood drop symbols are displayed, remove the test strip from meter.
2. Apply blood to the test strip and reinsert it into the meter within approximately 20 seconds.
3. Results will then appear in the display

❖ Random Blood Glucose level ≥ 140-200 was considered to be in **Impaired range** and ≥ 200 was considered to be in **Diabetic range.**

CALCULATIONS:

BODY MASS INDEX

BMI was used to assess how much an individual's body weight departs from what is normal or desirable for a person of his or her height. BMI is a height-weight system of measurement that applies to both sexes. Literature support the use of BMI as it has been validated against measures of body density.

BMI (Weight/Height^2 in kgm^2) was calculated using the given formula and compared to the universal standard for classification of overweight and obesity.

BMI ≥ 25 was taken as cut off to define obesity as per recommendation of WHO, the International Obesity Task Force and the International Association for the Study of Obesity for Asian and Pacific Island populations.

WAIST TO HIP CIRCUMFERENCE RATIO :

The waist and hip circumference were measured to the nearest 0.5cm, and WHR was calculated by dividing the waist circumference over hip circumference. The results obtained were compared to the standard values as suggested by WHO in the year 1998.

❖ Cut offs used for WHR were ≥ 0.9 in males and ≥ 0.85 in females (as per recommendation given in the report of WHO expert consultation,Geneva 8-11 Dec. 2008, for Asian population)

WAIST TO STATURE RATIO

The Height measured in meters were converted to centimeters and WSR was calculated by dividing waist circumference (WC) and height (S) correct to two places of decimal.

WHR = Waist circumference / Hip circumference

WSR = Waist circumference / Height

❖ Cut offs used for WSR were ≥ 0.50 for both sexes (as per recommendation given in the report of WHO expert consultation, Geneva 8-11 Dec. 2008, for Asian population)

MEAN ARTERIAL PRESSURE

The **mean arterial pressure (MAP)** is a term used in medicine to describe an average blood pressure in an individual. It is defined as the average arterial pressure during a single cardiac cycle.

At normal resting heart rates MAP can be approximated using the more easily measured systolic and diastolic pressures, SP and DP :

At high heart rates MAP is more closely approximated by the arithmetic mean of systolic and diastolic pressures because of the change in shape of the arterial pressure pulse.

CLINICAL SIGNIFICANCE

MAP is considered to be the perfusion pressure seen by organs in the body. It is believed that a MAP that is greater than 60mmHg is enough to sustain the organs of the average person. MAP is normally between 70 to 110mmHg. If the MAP falls below this number for an appreciable time, vital organs will not get enough Oxygen perfusion, and will become ischemic.

RESULTS AND DISCUSSION

A study was done on 130 subjects with an aim to establish the relationship between various Anthropometric indices and the blood pressure and blood glucose level in adult population. Various findings are shown below in the form of Tables and Graphs along with the suitable statistical analysis.

63 participants (48.46%) were male and 67 participants (51.54%) were female. 31 (23.85%) participants were vegeterians and 99 (76.15%) participants were non-vegeterians. 65 (50.00%) participants led an active life while 65(50.00%) participants led a sedentary life.

Age of the participants ranged from 20 to 75 years. About 72 % of the participants were in the age group of 40 to 59 years. Highest number of patients were in the age group of 50 to 59 years. Mean age was calculated to be 48.12 years +/- 10.16 SD. The lowest age was 20 years and the highest age was 72 years.

Prevalence of hypertension and hyperglycemia was more in male counterparts in each age group. Prevalence of hypertension and hyperglycemia increased with increasing age groups except in 50-59 yrs male for hypertension and in 60-75 yrs male for hyperglycemia.

Gender : 44% male and 29.85% female participants were hypertensive, whereas 23.81% male and 14.93% female were hyperglycemic.

Dietary habit : 41.94% veg. and 36.36% non-veg were hypertensive whereas 29.03% vegeterian and 17.17% non-vegeterian were hyperglycemic.

Lifestyle : 24.61% active and 50.76% sedentary participants were hypertensive whereas 10.76% active and 27.69% sedentary participants were hyperglycemic.

Relation of dietary habit with hypertension : As $p > 0.05$, the finding that more vegeterian (41.94%) were hypertensive as compared to their non-vegeterian (36.36%) counterparts, was **insignificant.**

Relation of lifestyle with hypertension : As $p < 0.05$, the finding that less participants leading an active lifestyle were hypertensive (24.61%) as compared to their counterparts leading a sedentary lifestyle (50.76%) was **significant.**

Relation of dietary habits with hyperglycemia : As $p>0.05$, the finding that more vegeterians (29.03%) were hyperglycemic as compared to their non-vegeterian (17.17%) counterparts was **insignificant.**

Relation of lifestyle with hyperglycemia : As $p<0.05$, the finding that less participants (10.76%) leading an active lifestyle were hyperglycemic as compared to their counterparts(27.69%) leading a sedentary lifestyle, was **significant.**

As the p value < 0.05, the finding that 35 among 49 hypertensives, i.e. 71.42% hypertensives had WC ≥ cut off level, was **significant.**

As the p value < 0.05, the finding that 21 among 49 hypertensives, i.e. 42.85 % hypertensives had BMI ≥ cut off level, was **significant.**

As the p value > 0.05, the finding that 42 among 49, i.e. 85.71% hypertensives had BMI ≥ cut off level, was **insignificant.**

As the p value < 0.05, the finding that 41 among 49, i.e. 83.67% hypertensives had WSR≥ cut off level, was **significant.**

As the p value < 0.05, the finding that 22 among 25, i.e. 88%

hyperglycemics had WC ≥ cut off level, was **significant.**

As the p value < 0.05, the finding that 15 among 25, i.e. 60% hyperglycemics had BMI ≥ cut off level, was **significant.**

As the p value < 0.05, the finding that 25 out of 25, i.e. 100% hyperglycemics had WHR ≥ cut off level, was **significant.**

As the p value < 0.05, the finding that 24 among 25, i.e. 96% hyperglycemics had WSR ≥ cut off level, is **significant.**

P value was < 0.05 (significant) in case of all indices except in case of WHR where it was >0.05 (insignificant).

As p value < 0.05, the finding that 42.42% menopausal female participants were hypertensive as compared to their pre-menopausal counterparts (17.65%), was **significant.**

As p value < 0.05, the finding that 27.27% menopausal female participants were hyperglycemic as compared to their pre-menopausal counterparts(2.94%), was **significant.**

As per the Pearson correlation coefficient, the anthro-pometric index more closely related with mean arterial pressure in decreasing order is as follows (value nearer to 1 is more closely related) : **BMI > WC > WSR > WHR.**

As per the Pearson correlation coefficient, the anthropometric index more closely related with hyperglycemia in decreasing order is as follows (value nearer to 1 is more closely related): **WC > WSR > BMI > WHR.**

CONCLUSION

Increasing urbanization and socio economic development all over the world is pushing the mankind towards physical inactivity, energy rich diet coupled with high level of mental stress. Every person rich or poor, urban or rural all are affected leading to an increase in the girth and adding kilos to the body structure. This has further led to increased incidence of lifestyle diseases like hypertension, diabetes mellitus, dyslipidemia and ischemic heart disease. The distribution of extra kilos in the form of body fat plays the whole orchestra.

Anthropometry provides the single most portable universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body.

Both hypertension and diabetes are heterogenous and multifactorial disorders. So, prevention requires modification of various risk factors. But, there are several evidences suggesting that even a single intervention, i.e. increased physical activity and weight loss, leads to marked reduction of hypertension and diabetes mellitus. People with impaired glucose tolerance can change their lifestyle to delay the onset of diabetes.

REFERENCES

1. Al-Lawati J, Barakat N, Al-Lawati A, Mohammed A. Optimal cut-points for body mass index, waist circumference and waist-to-hip ratio using the Framingham Coronary heart disease risk score in an Arab population of the Middle East. Diabetes and Vascular Disease Research 2008; 5: 304-309.
2. Ali M, Narayan K, Mohan V. Innovative research for equitable diabetes care in India. Diabetes Res Clin Pract 2009; 86: 155-167.
3. Agrawal P, Jayendrasinha, M Jadeja, Geeta B nair et al. Relationship of anthropometric adiposity indices with blood pressure in urban community of Ahmedabad, International Journal of basic and applied physiology; vol 1(1) Dec.2012 pg 71.
4. Divya Bishnoi, Tanveen kaur, and Badaruddoza. Predictor of cardiovascular disease with respect to BMI, WHR and lipid profile in females of three population groups. Biology and Medicine (09748369) 2010; 2(2); 32-41.
5. IDF Diabetes Atlas, 5th edition. Version current 1 November 2011. Internet: http://www.idf.org/diabetesatlas /5e/the-global-burden (accessed 27 November 2011).
6. Marcadenti Aline, Fuchs Sandra C, Moriera Leila B, Wiehe Mario, Gus Miguel and Fuchs Flavio D. Accuracy of Anthropometric Indexes of Obesity to predict Diabetes Mellitus type 2 among men and women with hyperertension. American journal of Hypertension 2011 February;24 : 175-180
7. Nitin Nahar, Simmi Dubey. Association of anthropometric indices of obesity with diabetes, hypertension and dyslipidemia. A study from central India. Journal of medical specialities,2012;3(1):6-11