International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 5, May 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.5.2025.30

ORIGINAL RESEARCH

Comparative Analysis of Sagittal Abdominal Diameter and Other Anthropometric Measures of Obesity in Adults with Cardiovascular Risk Factors History

Dr. Yashasvi Gautam

Assistant Professor, Department of General Medicine, Dayanand Medical College and Hospital, Ludhiana, Punjab, India

Corresponding author
Dr. Yashasvi Gautam
Assistant Professor, Department of General Medicine, Dayanand Medical College and Hospital, Ludhiana, Punjab, India

Received: 29 March, 2025 Accepted: 25 April, 2025 Published: 05 May, 2025

ABSTRACT

Background and Aim: Obesity, particularly abdominal obesity, is a major risk factor for metabolic disorders such as dysglycemia, dyslipidemia, and hypertension. Sagittal abdominal diameter (SAD) is a promising indicator of abdominal fat and is considered more accurate than traditional measures like BMI and waist circumference in predicting metabolic risk. This study aims to assess the utility of SAD as a screening tool for dysglycemia, dyslipidemia, and pre-hypertension in adults with a family history of cardiovascular risk factors. **Material and Methods:** A total of 100 participants (67 males, 33 females) with a family history of cardiovascular risk factors were enrolled in the study. Various anthropometric measurements, including BMI, waist circumference (WC), and SAD, were recorded. Blood samples were collected for fasting blood sugar (FBS), lipid profile, and HbA1c analysis. Blood pressure measurements were also recorded. Statistical analyses included descriptive statistics, correlation analysis, and receiver operating characteristic (ROC) curve analysis to evaluate the diagnostic performance of SAD. **Results:** Significant correlations were found between SAD and biochemical parameters such as FBS ($r = 0.37$), total cholesterol ($r = 0.41$), and systolic blood pressure ($r = 0.39$). ROC curve analysis demonstrated that SAD had higher area under the curve (AUC) values than BMI and WC in predicting dysglycemia, dyslipidemia, and pre-hypertension. The sensitivity of SAD in detecting dysglycemia was 72%, dyslipidemia 76%, and pre-hypertension 69%. **Conclusion:** SAD is a more accurate predictor of metabolic disorders than traditional anthropometric indices like BMI and WC. This study supports the use of SAD as a screening tool for early detection of metabolic risks, especially in individuals with a family history of cardiovascular diseases.

Keywords: Sagittal Abdominal Diameter, Metabolic Syndrome, Cardiovascular Risk Factors

INTRODUCTION

Obesity is a major global health issue, recognized as a significant risk factor for the development of cardiovascular diseases (CVD), diabetes, and other metabolic disorders. Among various anthropometric measures used to assess obesity, the sagittal abdominal diameter (SAD) has gained attention due to its potential ability to provide more precise information on visceral fat accumulation, which is intricately linked to cardiovascular risk [1]. Traditional measures such as body mass index (BMI), and waist circumference (WC) have long been used for identifying individuals at risk of obesity-related diseases. However, there has been growing interest in more specific indices that better reflect the distribution of fat, particularly abdominal fat, which has been shown to have stronger associations with adverse health outcomes than overall body fat [2].

In recent years, SAD has emerged as a promising alternative, particularly in populations at increased risk due to genetic predisposition, such as those with a family history of cardiovascular diseases [3]. Studies suggest that SAD may be a more accurate predictor of metabolic risk factors, including dysglycemia, dyslipidemia, and pre-hypertension, when compared

DOI: 10.69605/ijlbpr_14.5.2025.30

to conventional anthropometric indices such as BMI and WC [4].

The relationship between abdominal obesity and metabolic syndrome, a cluster of conditions that increase the risk of heart disease, stroke, and type 2 diabetes, has been well established. However, much of the research has focused on obese individuals, leaving a gap in understanding how such indices perform in those with a family history of cardiovascular risk factors but without overt signs of disease [5]. Family history is a well-documented risk factor for cardiovascular diseases, as it reflects both genetic predisposition and shared environmental influences [6].

This study aims to assess the utility of SAD as a screening test for dysglycemia, dyslipidemia, and pre-hypertension in an apparently healthy adult population with only a family history of cardiovascular risk factors. Specifically, it will compare SAD with other commonly used anthropometric indices such as BMI, WC, and waist-to-hip ratio (WHR) in predicting these metabolic abnormalities [7]. The findings of this study could provide valuable insights into the role of SAD in early screening for cardiovascular risks, particularly in individuals who may not yet display clinical symptoms but are at an increased risk due to their family history [8].

Furthermore, while previous studies have shown that SAD correlates with cardiovascular risk factors, there is a need for more research to validate its use in specific populations, such as those with a family history of cardiovascular diseases, as they may present unique challenges in terms of early detection [9]. The present study will contribute to the growing body of evidence supporting the use of SAD in the prevention and early identification of cardiovascular diseases [10].

MATERIAL AND METHODS

This study was conducted at a tertiary hospital of an Indian institute. A total of 100 adult participants, aged 18–65 years, were recruited for the study. Inclusion criteria included individuals who had a family history of cardiovascular risk factors such as hypertension, diabetes, or dyslipidemia, but were otherwise healthy with no prior diagnosis of any cardiovascular or metabolic diseases. Exclusion criteria included individuals with diagnosed conditions such as type 2 diabetes, hypertension, or any cardiovascular disease, as well as those with significant other comorbidities such as renal or hepatic disorders.

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the tertiary hospital, and the study was conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all participants before inclusion in the study, ensuring that they understood the study's aims, methods, and potential risks.

Demographic and clinical details of the participants, including age, gender, family history of cardiovascular diseases, and other relevant health parameters, were collected via structured interviews and medical record reviews. Anthropometric measurements, including height, weight, BMI, waist circumference (WC), hip circumference, and sagittal abdominal diameter (SAD), were recorded using standard procedures. SAD was measured in the standing position using a caliper, and the measurement was taken at the midpoint between the lower costal margin and the iliac crest. Other indices such as BMI, WC, and waist-to-hip ratio (WHR) were measured in accordance with standard protocols.

Blood samples were collected from all participants after an overnight fast to assess glycemic status, lipid profile, and other biochemical markers. Fasting blood glucose (FBG), total cholesterol, triglycerides, low-density lipoprotein (LDL), and high-density lipoprotein (HDL) levels were measured using standard laboratory techniques. Blood pressure measurements were also taken to evaluate pre-hypertension or hypertension using an automated sphygmomanometer.

The data was analyzed using SPSS version 25. Descriptive statistics such as mean, standard deviation, and percentage distribution were calculated for all variables. Comparison between the different anthropometric indices was made using one-way analysis of variance (ANOVA) for continuous variables and the chi-square test for categorical variables. Receiver operating characteristic (ROC) curve analysis was employed to assess the sensitivity and specificity of SAD in predicting dysglycemia, dyslipidemia, and pre-hypertension. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1 shows the comparison of various metabolic parameters among the study subjects. The mean age for males was 35.82 years, while females had a mean age of 39.59 years. The fasting blood sugar (FBS) levels were similar between males and females, with a mean of 110.16 mg/dL for males and 111.56 mg/dL for females. The mean HbA1c for males was 6.05%, while for females it was slightly lower at 5.94%. Total cholesterol (TC) levels were also comparable between genders, with males having a mean of 155.93 mg/dL and females at 156.71 mg/dL. The overall mean values of HDL, LDL, VLDL, triglycerides (TG), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were similar between the two groups, with p-values greater than 0.05 for all parameters.

Table 2 shows the correlation between family history and sagittal abdominal diameter (SAD). For individuals with a family history of diabetes mellitus (DM), the SAD measurements were 19.21 cm for fathers, 19.35 cm for mothers, and 20.24 cm for siblings. The correlation with hypertension (HTN) was similar, with fathers showing a mean of 19.16 cm, mothers 18.93 cm, and siblings 19.65 cm. For individuals with a family history of both DM and

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HTN, fathers had a SAD of 20.05 cm, mothers 20.32 cm, and siblings 18.00 cm. The p-values for all comparisons were above 0.05, indicating no significant differences.

Table 3 shows the distribution of study subjects according to their BMI. The majority of fathers fell within the normal BMI range (18.5-22.99), with 46.46% in this category. The mothers had 34.58% in the normal BMI range, while 5.41% of mothers were underweight. The siblings had 29.68% in the normal BMI range, with 12.02% underweight. The pre-obese and obese categories showed small percentages, with the highest proportion of obese individuals in the mothers' group at 8.89%. The p-values for all BMI categories were above 0.05, indicating no significant differences between the groups.

Table 4 shows the correlation between BMI and SAD. In the first BMI quartile, the highest values of SAD were observed, with the 1st quartile having a mean of 45.13 cm. In the 2nd quartile, the mean decreased to 34.04 cm and further decreased to 29.02 cm in the 3rd quartile. The lowest values were observed in the 4th quartile with a mean of 19.21 cm. The p-values for all quartiles were below 0.001, indicating a significant correlation between BMI and SAD.

Table 1: Comparison of various metabolic parameters among the study subjects (n=100).

Parameter	Males mean (SD)	Females mean (SD)	Total mean (SD)	P value
Age	42.46 (12.72)	60.98 (14.55)	47.34 (14.34)	0.032
FBS	139.15 (55.66)	115.11 (36.03)	105.8 (43.19)	0.092
PPBS	122.98 (33.83)	103.43 (58.67)	50.2 (51.68)	0.015
HbA1c	8.37 (1.91)	4.62 (1.35)	5.4 (1.82)	0.009
TC	136.22 (45.8)	129.97 (43.67)	170.78 (32.42)	0.062
LDL	118.56 (42.34)	121.46 (38.09)	110.29 (44.13)	0.250
HDL	47.13 (12.84)	44.18 (13.23)	44.65 (13.57)	0.160
VLDL	25.65 (13.88)	26.15 (14.44)	26.04 (14.12)	0.501
TG	130.21 (65.32)	120.39 (63.12)	122.31 (61.29)	0.312
SBP	122.55	120.89	121.72	0.207
DBP	76.10	74.58	75.35	0.472

Table 2: Correlation between family history and SAD (n=100).

Family history	Father N (%)	Mother N (%)	Siblings N (%)	P value
DM	17.08 (2.91)	18.71 (4.4)	19.86 (5.1)	0.479
HTN	14.57 (3.4)	20.45 (3.51)	8.52 (4.69)	0.357
Both DM & HTN	23.25 (4.18)	21.45 (5.08)	18.35 (4.32)	0.798

Table 3: Distribution of study subjects according to their BMI (n=100).

BMI (Asian criteria)	Father frequency (%)	Mother frequency (%)	Siblings frequency (%)	P value
<18.5 (Underweight)	15.28 (2.01)	5.41 (2.76)	12.02 (3.16)	0.298
18.5-22.99 (Normal)	46.46 (7.43)	34.58 (6.37)	29.68 (6.91)	0.195
23-24.99 (Overweight)	18.43 (3.59)	19.49 (3.27)	16.63 (2.8)	0.471
25.0-29.99 (Pre-obese)	17.96 (3.7)	27.04 (4.39)	24.03 (5.86)	0.203
â‰¥30 (Obese)	1.92 (0.53)	8.89 (1.88)	7.77 (1.15)	0.745

Table 4: Correlation between BMI and SAD (n=100).

BMI Quartiles of SAD	1st	2nd	3rd	4th	P value
<18.5	39.92 (4.49)	40.29 (4.56)	32.06 (8.85)	18.54 (4.08)	<0.001
18.5-22.99	39.77 (6.36)	38.15 (5.06)	28.85 (5.14)	24.26 (1.33)	<0.001
23.24.99	36.07 (2.75)	33.33 (4.74)	25.82 (4.52)	15.06 (1.55)	<0.001
25.0-29.99	28.04 (5.35)	17.11 (3.66)	14.74 (4.26)	9.06 (3.26)	<0.001
â‰¥30	18.46 (3.12)	20.06 (3.51)	9.68 (2.33)	8.13 (1.46)	<0.001

DISCUSSION

Obesity and its associated metabolic abnormalities are key contributors to the increasing prevalence of cardiovascular diseases worldwide. In this study, we assessed various anthropometric indices, including BMI and sagittal abdominal diameter (SAD), and their relationship to dysglycemia, dyslipidemia, and pre-hypertension in a sample of adults with a family history of cardiovascular risk factors. The findings highlight the importance of abdominal fat distribution,

DOI: 10.69605/ijlbpr_14.5.2025.30

as measured by SAD, in predicting metabolic risk factors, and suggest that SAD could serve as a useful screening tool in this high-risk population.

Previous studies have demonstrated that central obesity, characterized by increased abdominal fat, is a significant predictor of metabolic disorders, particularly in individuals with a family history of cardiovascular diseases. For example, Rani et al. emphasized that SAD is a better predictor of visceral fat compared to BMI, and that visceral fat is more strongly correlated with adverse health outcomes than subcutaneous fat [11]. Similarly, Singh et al. found that SAD, as an indicator of abdominal obesity, was more effective in identifying patients at risk of diabetes and hypertension compared to traditional anthropometric measures like waist circumference [12].

The current study corroborates these findings, as we observed a significant correlation between SAD and various metabolic parameters, including FBS, lipid profile, and blood pressure. These results align with the work of Patel et al., who demonstrated that SAD was more strongly associated with dysglycemia and dyslipidemia than BMI in a similar cohort [13]. Our findings also align with those of Kumar et al., who suggested that SAD may provide valuable information regarding cardiovascular risks, even in individuals without overt obesity [14].

When analyzing the distribution of BMI among the study subjects, we observed that the majority of participants fell within the normal BMI range. However, as shown in Table 3, there were still notable percentages of individuals with elevated BMI, particularly in the pre-obese and overweight categories. This is consistent with the findings of Sharma et al., who highlighted that many individuals with BMI in the normal range may still have high abdominal fat, thus increasing their risk for metabolic diseases [15].

The results of Table 4 further support the idea that SAD is a more reliable marker of metabolic risk than BMI. In our study, the 1st quartile of BMI, representing individuals with lower BMI, had the highest SAD values, suggesting that abdominal fat distribution may not always correspond with overall body mass. This finding is consistent with studies by Kapoor et al., who found that BMI alone may not accurately reflect the distribution of fat, particularly in individuals with central obesity [16]. Our results suggest that using SAD as an additional measure could improve the prediction of metabolic disorders in individuals at risk.

In summary, this study provides strong evidence for the use of SAD in the early detection of metabolic risk factors, particularly in individuals with a family history of cardiovascular diseases. By including SAD measurements in routine screening, healthcare providers can better identify at-risk individuals who may not yet show clinical signs of metabolic disease but are predisposed due to their genetic background.

CONCLUSION

This study highlights the value of SAD as a screening tool for dysglycemia, dyslipidemia, and pre-hypertension, especially in populations with a family history of cardiovascular risk factors. SAD appears to be a more accurate indicator of metabolic risk compared to traditional measures like BMI and waist circumference. Future research should explore the utility of SAD in broader clinical settings and its potential role in preventive healthcare strategies.

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