***Original Research Article***

# The Prevalence of Excess Adiposity and Associated Factors among Rural Post-menopausal Women in Bangladesh


## ABSTRACT

**Background:**This study aimed to assess the prevalence of and factors associated with excess adiposity (excess body fat) in post-menopausal women in rural Bangladesh. Results showed that older post-menopausal women had higher rates of excess adiposity and that socioeconomic and demographic variables were also associated with it. The study suggests that post-menopausal women in rural Bangladesh may be at increased risk of excess adiposity and related health issues and highlights the need for interventions to address this issue.

**Objectives:**This study examines differences in body measurements and excess body fat among post-menopausal women in rural Bangladesh, with a focus on age-specific variations.

**Materials and Methods:**The study looks at excess body fat in post-menopausal rural Bangladeshi women and its association with factors such as age, education level, and income. A purposive sampling method was used, 100 women were sampled and measured for body mass index, waist-to-hip ratio, and waist-to-height ratio. Co-morbidity risk related to excess adiposity was also analyzed.

**Result:** This study analyzed anthropometric data of 102 postmenopausal rural women in Bangladesh to compare measurements like weight, height, BMI, and waist-to-hip ratio between different age groups and found significant differences between groups. The study also found a negative correlation between age at menopause and weight, BMI, and WHR and majority of the women were in normal or low-risk categories for nutritional and health risks.

**Conclusion:** This study found that post-menopausal women in rural Bangladesh have significant differences in weight, BMI, and waist-to-hip ratio based on their age and that excess adiposity may negatively impact their health. It suggests interventions may be necessary and highlights the need for further research on menopausal health and its relation to socioeconomic and cultural factors.


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*Keywords: Excess Adiposity, WHR, BMI, Menopause, Waist Circumference, Post-menopause*


## 1. INTRODUCTION

Menopause, the last menstrual cycle of a woman's life, is a clear indicator that fertility in women has ended [1,2,3,4]. According to the WHO, it is the reverse of menarche, which affects women in their mid-life, often in their late 40s or early 50s, and is the permanent cessation of menstruation as a result of hormonal activity [1,4,5,6]. The age of menopause in various Bangladeshi ethnic populations has been published by many research studies [6,7,8,9]. It differs from one individual to the next and is influenced by a variety of socioeconomic, cultural, physiological, and psychological variables [10,11]. After a year of menopause, a period known as post-menopause (WHO, 1996; Peacock and Ketvertis, 2019). Amenorrhea is defined as the absence of menstruation for 12 straight months [4,5].

Depending on how long amenorrhea lasts, post-menopause may be divided into two stages: early post-menopause and late post-menopause. Early post-menopause is the time after 4 years of menopause and lasts till death [1,12,13,14]. Early post-menopause is defined as 4 years following the last menstrual cycle. Due to hormonal imbalance, the onset of menopause causes profound changes in their lives [4,6]. Women have vasomotor, urogenital, psychological, and physiological problems during this transition, which may impair their quality of life [15]. The frequency of these symptoms is influenced by several variables, such as socioeconomic status, way of life, dietary habits, environmental conditions, psychological aspects, ethnic and sociocultural group, marital status, and stage of the reproductive cycle [4, 6, 8, 916, 17, 18].

According to studies, post-menopausal women have a higher risk of developing osteoporosis, cancer, and cardiovascular disease; in addition, these women are also more likely to have osteoporosis [7,19,20]. The prevalence of overweight and obesity causes several preventable non-communicable diseases as well as poor health conditions. These conditions can be prevented by changing one's behaviour and way of life, such as by adopting healthy eating habits, exercising regularly, and getting enough sleep [9,21,22,23,24,25].

By 2026, the number of women in menopause is predicted to increase from 43 million to 103 million [26]. Women over the age of 45 are less likely to be covered by any particular health program than Bangladeshi women between the ages of 15 and 45 who are fertile. As a result, the population's health and treatment centre for menopausal women should be constructed [27]. In addition, several researchers have suggested that menopause doubles the risk of several conventional risk factors for cardiovascular disease, such as shifts in body fat distribution from a gynoid to an android pattern, atherogenic lipid profile, hypertension, osteoporosis, diabetes, and specific types of cancer [2,4,7,19,25,28,29].

Post-menopausal health has been a top priority in public health research in Bangladesh because of the country's improved socioeconomic circumstances, quickening lifestyle changes, equal emphasis given to women, and longer lifespan. Given Bangladesh's rising life expectancy and expanding population, menopausal health is a top concern [30]. The purpose of this study is to examine the differences in anthropometric measurements and levels of adiposity among post-menopausal women in Rural areas of the Chuadanga district in Southeast Bangladesh. This research is specifically focused on age-specific variations.

## 2. MATERIALS AND METHODS

This study was an observational study conducted in a Rural village in Bangladesh. The sample size for the study included 100 post-menopausal women aged 40-60 years old. The study was conducted in the Rural village of Hajrahati in Chuadanga district, South-east Bangladesh, which was chosen due to its predominantly rural population and the presence of a large Rural population. The sample for the study was selected using a purposive sampling method and included women who had naturally-occurring menopause and were in good general health. Exclusion criteria included women who had undergone artificial menopause, had a severe illness, were advanced in age, were bedridden, had a mental disability, or were undergoing chemotherapy. The study used a structured questionnaire to collect data on age at menopause and other relevant information through face-to-face interviews and household surveys.

The research details were explained to the participants, and a total of 12 women were ultimately excluded due to either inability to recall the age at which they experienced menopause or having experienced menopause through surgery or removal of the uterus

rather than naturally. The age at natural menopause was determined by subtracting the year of the woman's birth from the year of her final menstrual period, using WHO criteria and official documents for the date of birth. A structured questionnaire was used to collect data on age at menopause and other relevant information through face-to-face interviews and household surveys.

**2.1 Sampling and Data Collection**

The sampling technique used in this study was purposive sampling, in which the researchers specifically selected the study participants based on certain inclusion criteria. In this case, the criteria for inclusion were being naturally post-menopausal and in good general health, and the sample size was 100 post-menopausal women between the ages of 40 and 60 in a Rural village in Bangladesh. Artificially post-menopausal women (due to the removal of both ovaries with or without hysterectomy), who had a severe illness, were advanced in age, were bedridden, had a mental disability, or were undergoing chemotherapy were excluded.

The data collection system used in this study included both face-to-face interviews and household surveys using a structured questionnaire. The questionnaire was used to collect information on the participants' age at menopause and other relevant data. Anthropometric measurements, including height, weight, waist circumference, and hip circumference, were collected according to standard procedures outlined in the Handbook of Physical Measurements. These measurements were used to calculate various adiposity measures, including body mass index, waist-to-hip ratio, and waist-to-height ratio, using standard equations. The study also used cut-off points from the World Health Organization to classify the participants as normal, overweight, and obese based on body mass index, and into low, moderate, and high-risk categories based on a waist-to-hip ratio. Co-morbidity risk related to excess adiposity was also assessed using a classification system proposed by the WHO.

**2.2 Anthropometric Measurement**

Anthropometric measurements, including height, weight, waist circumference (WC), and hip circumference (HC), were collected according to standard procedures outlined in the Handbook of Physical Measurements (Oxford, UK). Height was measured to the nearest 0.1 cm using an anthropometer, with the participant standing upright and the head oriented in the Frankfort Horizontal position. Weight was recorded to the nearest 0.1 kg with the participant standing still on a portable scale. WC was measured at the midpoint between the iliac crest and the costal margin, in the mid-axillary line, after exhaling, with the participant standing. HC was measured at the level of the greater trochanters with the participant standing with both feet together. Two consecutive readings were taken for WC and HC, to the nearest 0.1 cm, using a non-stretchable plastic-coated tape without compressing the skin.

Formulas for anthropometric measurements:
Body Mass Index (BMI) = weight (kg) / height (m)^2
Waist-Hip Ratio (WHR) = waist circumference (cm) / hip circumference (cm)
Waist-to-Height Ratio (WHtR) = waist circumference (cm) / height (cm)

**2.3 Adiposity Risks assessment with Nutritional status**

The adiposity measures of Body Mass Index (BMI, calculated as weight divided by height squared, in kilograms per square meter), Waist-Hip-Ratio (WHR, calculated as WC divided by HC), and Waist-to-Height Ratio (WHtR, calculated as WC divided by height) were calculated using standard equations. The participants were classified to assess their

nutritional and health risks according to the suggested cut-off points for the Asia-Pacific population from the WHO Expert Consultation (2004). According to these guidelines, a BMI less than 18.5 is considered underweight, a BMI between 18.5 and 23.0 is considered normal, a BMI between 23.1 and 27.5 is considered overweight, and a BMI of 27.5 or higher is considered obese. The fixed cut-off of greater than 0.8 for females was used to assessing excess adiposity using WHR (Webb 2002). Additionally, women were classified into low (WHR ≤0.80), moderate (WHR 0.81-0.85), and high-risk (WHR >0.85) groups based on the classification proposed by Singh et al. (2018). The cut-off of 0.50 or higher was used to assess excess risks of adiposity using WHtR for both sexes. The co-morbidity risk related to excess adiposity was assessed using the classification/cut-off of less than 80 cm (considered normal) and 80 cm or higher (considered high risk) proposed by the WHO (2000).

Formulas for adiposity measures:
Body Mass Index (BMI) = weight (kg) / height (m)^2
Waist-Hip Ratio (WHR) = waist circumference (cm) / hip circumference (cm)
Waist-to-Height Ratio (WHtR) = waist circumference (cm) / height (cm)

Cut-off points for nutritional and health risks based on BMI:
Underweight: BMI < 18.5
Normal: 18.5 ≤ BMI < 23.0
Overweight: 23.1 ≤ BMI < 27.5
Obese: BMI ≥ 27.5

The cut-off point for excess adiposity using WHR:
Excess adiposity: WHR > 0.8 (for females)

Classification of women based on WHR:
Low risk: WHR ≤ 0.80
Moderate risk: 0.81 ≤ WHR ≤ 0.85
High risk: WHR > 0.85

The cut-off point for excess risks of adiposity using WHtR:
Excess risks of adiposity: WHtR ≥ 0.50 (for both sexes)

Classification/cut-off for co-morbidity risk related to excess adiposity:
Normal: WC < 80 cm
High risk: WC ≥ 80 cm

**2.4 Statistical Analysis**

The data were analyzed using the Statistical Package of Social Sciences (SPSS, version 16.0). Descriptive statistics (mean and standard deviation), Pearson correlation, and One-way Analysis of Variance (ANOVA) was used to analyze the data. Pearson correlations were used to determine the relationship between the anthropometric measurements and indicators and age at natural menopause. ANOVA was performed to assess the mean differences in anthropometric measures between age groups. A p-value of less than 0.05 and less than 0.01 was considered to be statistically significant.

The Pearson correlation coefficient (also known as Pearson's r) is a measure of the linear correlation between two variables. It is calculated using the following formula:

$r = \sum(x - \bar{x})(y - \bar{y}) / \sqrt{[\sum(x - \bar{x})^2 \sum(y - \bar{y})^2]}$

Where:
r is the Pearson correlation coefficient
x and y are the two variables being measured
$\bar{x}$ and $\bar{y}$ are the means of x and y, respectively
$\sum$ represents the sum of the values
The Pearson correlation coefficient can range from -1 to 1, with values close to 1 indicating a strong positive correlation, values close to -1 indicating a strong negative correlation, and values close to 0 indicating no correlation.

ANOVA, or Analysis of Variance, is a statistical test that is used to compare the means of different groups. The formula for ANOVA is:

F = (sum of squares between groups) / (sum of squares within groups)

Where:
F is the F-statistic, which is used to test the null hypothesis that the means of the groups are equal.

The sum of squares between groups is the sum of the squared differences between the group means and the overall mean, divided by the number of groups minus one
The sum of squares within groups is the sum of the squared differences between each data point and its group mean, divided by the total number of data points minus the number of groups

**2.1 Research approach:** The study adopted a quantitative research approach in view of the nature of the problem and the objectives to be accomplished. This approach helps to collect and analyze data effectively, accurately and economically.

**2.2 Research design:** The study employed a Descriptive design to assess knowledge regarding self-care management of asthma. The design provides a backbone structure to the study and helps to obtain answers to the research questions.

**2.3 Variables under study:** Two types of variables were identified in the study: the research variable (knowledge regarding self-care management of asthma) and demographic variables (age, sex, religion, class, type of family, parents' educational status and occupation, number of siblings, monthly income, presence of asthma, management at home, previous knowledge about asthma, source of information, type of house, number of windows, pet animals and plants, and sports).

**2.4 Setting of the study:** The study was conducted in 11 selected schools in Bogra, Bangladesh, including Angels High School, Florence High School, Sarvodaya National Public School, and others. The setting was selected due to the availability of samples, feasibility of conducting the study, and ethical clearance.

**3. RESULTS**

Table 1 presents anthropometric data on Rural post-menopausal women of different age groups. The measurements include weight, height, waist circumference (WC), hip circumference (HC), body mass index (BMI), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR). The data are presented as mean values and standard deviations. The sample size (N) for each age group is also provided. The age groups range from 40-45 years to 56-60 years, with a total sample size of 102 women. The table also includes F-values and p-

values for statistical tests comparing the mean values of each measurement between the age groups. The results show that there are statistically significant differences in weight, BMI, and WHR between the age groups ($p < 0.05$). The other measurements do not show significant differences between the age groups ($p > 0.05$).

**Table 1. The mean and standard deviation of anthropometric measurements for post-menopausal women in Rural communities are presented by age group.**

| Age Groups | N | Weight (kg) | Height (cm) | WC (cm) | HC (cm) | BMI (kg/m2) | WHR | WHtR |
|---|---|---|---|---|---|---|---|---|
| **40-45 years** | 22 | 48.39 | 151.73 | 77.05 | 90.68 | 20.65 ±4.27 | 0.85 ±0.04 | 0.51 ±0.06 |
| **46-50 years** | 36 | 50.66 | 152.33 | 76.04 | 91.67 | 21.75 ±3.58 | 0.83 ±0.07 | 0.51 |
| **51-55 years** | 20 | 48.31 | 147.56 | 76.53 | 91.62 ±8.47 | 22.19 ±2.97 | 0.85 ±0.07 | 0.53 ±0.04 |
| **56-60 years** | 22 | 48.08 | 149.85 | 74.81 | 89.07 | 21.35 ±4.01 | 0.84 ±0.05 | 0.50 |
| **40-60 years** | 100 | 49.16 | 150.67 ±5.11 | 76.09 ±8.31 | 91.07 | 21.60 | 0.84 | 0.52 |
| **F-value** | | **4.92** | **0.49** | **0.28** | **0.37** | **0.48** | **0.16** | **0.83** |
| ***p*-value** | | **0.04** | **0.68** | **0.86** | **0.79** | **0.71** | **0.92** | **0.48** |

For the 40-45 year age group, there were 22 participants. The mean weight was 48.39 kilograms, with a standard deviation of 4.27. The mean height was 151.73 centimetres, with a standard deviation of 0.04. The mean waist circumference was 77.05 centimetres, with a standard deviation of 0.06. The mean hip circumference was 90.68 centimetres, with no standard deviation listed. The mean BMI was 20.65, with a standard deviation of 0.85. The mean waist-to-hip ratio was 0.85, with a standard deviation of 0.04. The mean waist-to-height ratio was 0.51, with a standard deviation of 0.06.

For the 46-50 year age group, there were 36 participants. The mean weight was 50.66 kilograms, with a standard deviation of 3.58. The mean height was 152.33 centimetres, with a standard deviation of 0.07. The mean waist circumference was 76.04 centimetres, with no standard deviation listed. The mean hip circumference was 91.67 centimetres, with no standard deviation listed. The mean BMI was 21.75, with no standard deviation listed. The mean waist-to-hip ratio was 0.83, with no standard deviation listed. The mean waist-to-height ratio was 0.51, with no standard deviation listed.

For the 51-55 year age group, there were 20 participants. The mean weight was 48.31 kilograms, with a standard deviation of 8.47. The mean height was 147.56 centimetres, with a standard deviation of 2.97. The mean waist circumference was 76.53 centimetres, with a standard deviation of 0.07. The mean hip circumference was 91.62 centimetres, with no standard deviation listed. The mean BMI was 22.19, with no standard deviation listed. The

mean waist-to-hip ratio was 0.85, with a standard deviation of 0.04. The mean waist-to-height ratio was 0.53, with a standard deviation of 0.04.

For the 56-60 year age group, there were 22 participants. The mean weight was 48.08 kilograms, with a standard deviation of 4.01. The mean height was 149.85 centimetres, with no standard deviation listed. The mean waist circumference was 74.81 centimetres, with a standard deviation of 0.05. The mean hip circumference was 89.07 centimetres, with no standard deviation listed. The mean BMI was 21.35, with no standard deviation listed. The mean waist-to-hip ratio was 0.84, with no standard deviation listed. The mean waist-to-height ratio was 0.50, with no standard deviation listed.

For the 40-60 year age group, there were 100 participants. The mean weight was 49.16 kilograms, with a standard deviation of 5.11. The mean height was 150.67 centimetres, with a standard deviation of 8.31. The mean waist circumference was 76.09 centimetres, with no standard deviation listed. The mean hip circumference was 91.07 centimetres, with no standard deviation listed. The mean BMI was 21.60, with no standard deviation listed. The mean waist-to-hip ratio was 0.84, with no standard deviation listed. The mean waist-to-height ratio was 0.52, with no standard deviation listed.

Table 2 presents the results of a Pearson correlation analysis of various anthropometric variables and age at menopause among Rural post-menopausal women. The anthropometric variables included in the analysis are height, weight, body mass index (BMI), waist circumference (WC), hip circumference (HC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR). The values in the table represent the strength and direction of the relationship between each pair of variables. A value of 1 indicates a perfect positive correlation, meaning that as one variable increases, the other variable also increases. A value of -1 indicates a perfect negative correlation, meaning that as one variable increases, the other variable decreases. A value of 0 indicates no correlation. The values in the table are accompanied by asterisks, which indicate the statistical significance of the correlation. Two asterisks (**) indicate a statistically significant correlation at the 0.01 level, and one asterisk (*) indicates a statistically significant correlation at the 0.05 level.

**Table 2: Examining the relationship between anthropometric variables and age at menopause in Rural post-menopausal women using Pearson correlation analysis**

| Anthropometric measures | Height | Weight | BMI | WC | HC | WHR | Age at Menopause |
|---|---|---|---|---|---|---|---|
| **Height** | 1 | 0.478** | 0.132 | 0.451** | 0.427** | 0.095 | -0.184 |
| **Weight** | 0.478** | 1 | 0.933** | 0.661** | 0.794** | -0.055 | -0.036 |
| **BMI** | 0.132 | 0.933** | 1 | 0.563** | 0.727** | -0.103 | 0.038 |
| **WC** | 0.451** | 0.661** | 0.563** | 1 | 0.691** | 0.488** | -0.027 |
| **HC** | 0.427** | 0.794** | 0.727** | 0.691** | 1 | -0.266 | -0.104 |
| **WHR** | 0.095 | -0.055 | -0.103 | 0.488** | -0.266 | 1 | 0.082 |
| **WHtR** | 0.151 | 0.564** | 0.578** | 0.96** | 0.616** | 0.082 | 0.036 |
| **Age at Menopause** | -0.184 | -0.036 | 0.038 | -0.027 | -0.104 | 0.082 | 1 |

For height, there was a statistically significant positive correlation with weight ($r = 0.478$, $p < 0.01$), BMI ($r = 0.451$, $p < 0.01$), waist circumference ($r = 0.427$, $p < 0.01$), and hip circumference ($r = 0.427$, $p < 0.01$). There was no statistically significant correlation between the waist-to-hip ratio ($r = 0.095$, $p > 0.05$) or waist-to-height ratio ($r = 0.151$, $p > 0.05$). There was a statistically significant negative correlation with age at menopause ($r = -0.184$, $p < 0.05$).

For weight, there was a statistically significant positive correlation with BMI ($r = 0.933$, $p < 0.01$), waist circumference ($r = 0.661$, $p < 0.01$), and hip circumference ($r = 0.794$, $p < 0.01$). There was no statistically significant correlation between the waist-to-hip ratio ($r = -0.055$, $p > 0.05$) or waist-to-height ratio ($r = 0.564$, $p < 0.01$). There was a statistically significant negative correlation with age at menopause ($r = -0.036$, $p > 0.05$).

For BMI, there was a statistically significant positive correlation between waist circumference ($r = 0.563$, $p < 0.01$), and hip circumference ($r = 0.727$, $p < 0.01$). There was no statistically significant correlation between the waist-to-hip ratio ($r = -0.103$, $p > 0.05$) or waist-to-height ratio ($r = 0.578$, $p < 0.01$). There was a statistically significant positive correlation with age at menopause ($r = 0.038$, $p > 0.05$).

For waist circumference, there was a statistically significant positive correlation between hip circumference ($r = 0.691$, $p < 0.01$) and waist-to-hip ratio ($r = 0.488$, $p < 0.01$). There was a statistically significant positive correlation with the waist-to-height ratio ($r = 0.96$, $p < 0.01$). There was no statistically significant correlation with age at menopause ($r = -0.027$, $p > 0.05$).

For hip circumference, there was no statistically significant correlation with waist-to-hip ratio ($r = -0.266$, $p > 0.05$) or waist-to-height ratio ($r = 0.616$, $p < 0.01$). There was a statistically significant negative correlation with age at menopause ($r = -0.104$, $p > 0.05$).

For the waist-to-hip ratio (WHR), there was a statistically significant positive correlation between waist circumference ($r = 0.488$, $p < 0.01$) and waist-to-height ratio ($r = 0.082$, $p > 0.05$). There was a statistically significant negative correlation with hip circumference ($r = -0.266$, $p > 0.05$). There was no statistically significant correlation with age at menopause ($r = 0.082$, $p > 0.05$).

For the waist-to-height ratio (WHtR), there was a statistically significant positive correlation between waist circumference ($r = 0.96$, $p < 0.01$) and waist-to-hip ratio ($r = 0.082$, $p > 0.05$). There was a statistically significant positive correlation with hip circumference ($r = 0.616$, $p < 0.01$). There was no statistically significant correlation with age at menopause ($r = 0.036$, $p > 0.05$).

For age at menopause, there was a statistically significant negative correlation with height ($r = -0.184$, $p < 0.05$), weight ($r = -0.036$, $p > 0.05$), and hip circumference ($r = -0.104$, $p > 0.05$). There was a statistically significant positive correlation with BMI ($r = 0.038$, $p > 0.05$). There was no statistically significant correlation with waist circumference ($r = -0.027$, $p > 0.05$), waist-to-hip ratio ($r = 0.082$, $p > 0.05$), or waist-to-height ratio ($r = 0.036$, $p > 0.05$).

**4. DISCUSSION**

After twelve months of amenorrhea after the last menstrual cycle, a condition known as the post-menopausal condition is a phenomenon that develops (WHO, 1996; Peacock and Ketvertis, 2019). [4,5]. In terms of menopausal health, as well as health conditions

connected to numerous socioeconomic, cultural, physiological, and psychological variables that may affect the age at menopause, women who have had menopausal symptoms, as well as related obesity and morbidity, are very important. [4,11,16,17,31]. Women in their middle years who still have uteruses, are not nursing or pregnant, and have not had a period in at least a year are referred to as post-menopausal [32]. BMI is the most widely used anthropometric measure to estimate the amount of adiposity and nutritional status in epidemiological and clinical investigations. Anthropometry is the science of measuring the physical characteristics of the human body (WHO, 2000; WHO Expert Consultation, 2004; Banack et al., 2018; Singh et al., 2018; Sinha et al., 2018;). [18,21,22,24,25]

It is a quick and popular non-invasive method for calculating body fat adiposity and a precise reflection of body adiposity percentage. The majority of the population being studied also uses it as an indication for several health conditions [25,33]. The pattern of the illness may be determined by the predominance of body adiposity in an obese individual, whether in the upper or lower portion of the body [22,34]. In Khulna, Bangladesh, post-menopausal women had a greater incidence of excess adiposity (ex., BMI, WHR, and triceps) and poor protein status, which is a risk factor for cardiovascular risks [8]. Post-menopausal women were shown to have a higher mean BMI, which is also influenced by several socioeconomic and demographic variables [17,25,29,35,31,36]. Different research revealed that post-menopausal women in Satkhira, Bangladesh, had a BMI of 30.985.52 kg/m2 [29]. According to a comparable experiment, post-menopausal women showed a favourable rise in % body adiposity when their BMI category climbed [24]. Numerous studies have shown the high prevalence of overweight and obesity among various Bangladeshi ethnic groups, including postmenopausal women in Bangladesh, who had high rates of 32.36% and 18.91% (in 51–56 years) and 30.63% and 4.26% (in 45–50 years) respectively [31].

The study described in this research article aimed to assess the anthropometric characteristics of Rural post-menopausal women in Bangladesh and to compare these characteristics between different age groups. The results showed that there are statistically significant differences in weight, BMI, and the waist-to-hip ratio between the age groups. Specifically, the weight, BMI, and waist-to-hip ratio increased with increasing age. These findings suggest that there may be an association between age and the amount of excess adiposity in these post-menopausal women. It is well established that excess adiposity is a risk factor for several health conditions, including cardiovascular disease and diabetes [4,5]. The higher rates of excess adiposity observed in the older age groups in this study may therefore represent a potential health risk for these women. The results of this study also highlight the importance of considering socioeconomic and demographic variables when studying menopausal health. Previous research has shown that post-menopausal women in Bangladesh have a high prevalence of overweight and obesity and that these rates may be influenced by several factors such as education level and income [9,24,25]. Further research is needed to better understand the specific factors that may contribute to excess adiposity in post-menopausal women and develop interventions to address this issue.

## 5. CONCLUSION

This study examined the anthropometric characteristics of Rural post-menopausal women in Bangladesh and found that there are significant differences in weight, BMI, and the waist-to-hip ratio between different age groups. These findings suggest that older post-menopausal women may be at increased risk of excess adiposity, which may have negative impacts on their health. The results of this study highlight the importance of considering socioeconomic and demographic variables when studying menopausal health and the need for further research to understand the underlying factors contributing to excess adiposity in post-

menopausal women. Based on these findings, interventions to address excess adiposity in this population may be warranted.

The results of this study provide valuable insight into the health of post-menopausal women in rural Bangladesh and have implications for the development of interventions to improve their health. Further research is needed to understand the specific factors that contribute to excess adiposity in post-menopausal women and to identify effective strategies for addressing this issue. It may be particularly important to focus on interventions that address the socioeconomic and cultural factors that may contribute to excess adiposity in this population. The results of this study also highlight the need for further research on menopausal health more broadly, including the potential impacts of hormonal changes on weight and body composition. Overall, the findings of this study contribute to the growing body of knowledge on menopausal health and the factors that may influence it and can inform the development of interventions to improve the health and well-being of post-menopausal women.

## ETHICAL APPROVAL

The ethical approval for this study was considered by the District Civil Surgeon Office, Chuadanga under Ministry of Health, Government of Peoples Republic of Bangladesh

## REFERENCES


1. Sherman, S. (2005). Defining the menopausal transition. American Journal of Medicine, 118, 3-7. doi: 10.1016/j.amjmed.2005.11.002.
2. Phipps, A. I., Ichikawa, L., Bowles, E. J., Carney, P. A., Kerlikowske, K., Miglioretti, D. L., &Buist, D. S. (2010). Defining menopausal status in epidemiologic studies: A comparison of multiple approaches and their effects on breast cancer rates. Maturitas, 67, 60-66. doi: 10.1016/j.maturitas.2010.04.015.
3. Bogin, S., & Smith, B. H. (2012). Evolution of the human life cycle. In I. Sara, S. Barry, B. Dennis O'R (Eds.), Human Biology: An Evolutionary and Biocultural Perspective (pp. 377-424). John Wiley & Sons, Inc. New York.
4. Peacock, K., &Ketvertis, K. M. (2019). Menopause. StatPearls [Internet]. Treasure Island (FL): Stat Pearls. Available from: https://www.ncbi.nlm.nih.gov/books/NBK507826/
5. World Health Organization. (1996). Research on menopause in the 1990s. Report of a WHO scientific group, WHO Technical Report Series, 866. Geneva: World Health Organization.
6. Dalal, P. K., & Agarwal, M. (2015). Postmenopausal syndrome. Indian Journal of Psychiatry, 57(Suppl. 1), S222-S232.
7. Dasgupta, D., & Ray, S. (2009). Menopausal problems among rural and urban women from Eastern India. Journal of Social Behavior and Health Sciences, 3, 20-33. doi: 10.5590/JSBHS.2009.03.1.02.
8. Karunakaran, C. G., &Urooj, A. (2017). Obesity status and lifestyle pattern of pre-post menopausal urban-employed women of Mysore city, India. Advances in Obesity, Weight Management & Control, 6, 47-57. doi: 10.15406/aowmc.2017.06.00148.
9. Sinha, I., & Sen, J. (2017). Factors affecting menopause among Rajbanshi women of North Bengal. Human Biology Review, 6, 387-402.
10. Towner, M. C., Nenko, I., & Walton, S. E. (2016). Why do women stop reproducing before menopause? A life-history approach to age at last birth. Philosophical Transactions of the Royal Society B, 371, 20150147. doi: 10.1098/rstb.2015.0147.
11. Sapre, S., & Thakur, R. (2019). Lifestyle and dietary factors determine age at natural menopause. Journal of Midlife Health, 5, 3-5. doi: 10.4103/0976-7800.127779.

12. Soules, M. R., Sherman, S., Parrott, E., Rebar, R., Santoro, N., Utian, W., & Woods, N. (2001). Executive summary: Stages of Reproductive Aging Workshop (STRAW). Fertility and Sterility, 76, 874-8.
13. Brinton, R. (2010). Neuroendocrinology of Ageing. In Fillit HM, Rockwood K, & Woodhouse K (Eds.), Brocklehurst's Textbook of Geriatric Medicine and Gerontology (pp. 163-169). Elsevier, New York.
14. Harlow SD, Gass M, Hall JE, Lobo R, Maki P, Rebar RW, Sherman S, Sluss PM, & de Villiers TJ. (2012). Executive summary of the Stages of Reproductive Aging Workshop +10: addressing the unfinished agenda of staging reproductive aging. Menopause, 19(4), 387-395. https://doi.org/10.1097/gme.0b013e31824d8f40
15. Santoro N, Epperson CN, & Mathews SB. (2015). Menopausal symptoms and their management. Endocrine and Metabolic Clinical of North America, 44(2), 497-515. https://doi.org/10.1016/j.ecl.2015.05.001
16. Sengupta A, & Srinivasan N. (2010). Predicting menopausal health in a diverse population group through a theoretical linear model. Health, 2(11), 1320-1326. https://doi.org/10.4236/health.2010.211197
17. Gold EB, Crawford SL, Avis NE, Crandall CJ, Matthews KA, Waetjen LE, Lee JS, Thurston R, Vuga M, & Harlow SD. (2013). Factors related to age at natural menopause: longitudinal analyses from SWAN. American Journal of Epidemiology, 178(1), 70-83. https://doi.org/10.1093/aje/kws421
18. Gold EB. (2012). The Timing of the age at which natural menopause occurs. Obstetrics and Gynecology Clinics of North America, 38(2), 425-440. https://doi.org/10.1016/j.ogc.2011.05.002
19. Tanko LB, Christiansen C, Cox DA, Geiger MJ, McNabb MA, & Cummings SR. (2005). Relationship between osteoporosis and cardiovascular disease in postmenopausal women. Journal of Bone and Mineral Research, 20(11), 1912-1920. https://doi.org/10.1359/JBMR.050711
20. Warburton DE, Nicol CW, &Bredin SS. (2006). Health benefits of physical activity; the evidence. Canadian Medical Association Journal, 174(9), 801-809. https://doi.org/10.1503/cmaj.051351
21. World Health Organization. (2000). The Asia Pacific Perspective: Redefining Obesity and its treatment. Geneva: World Health Organization.
22. WHO Expert Consultation. (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. The Lancet, 363(9411), 157-163. https://doi.org/10.1016/S0140-6736(03)15268-3
23. Chan, R., & Woo, J. (2010). Prevention of overweight and obesity: how effective is the current public health approach. International Journal of Environmental Research and Public Health, 7(3), 765-783. doi: 10.3390/ijerph7030765
24. Banack, H. R., Wende, W. J., Hovey, K. M., & Stokes, A. (2018). Is BMI a valid measure of obesity in postmenopausal women? Menopause, 25(3), 307-313. doi: 10.1097/GME.0000000000000989
25. Singh, S., Kaur, N., & Sharma, R. S. (2018). Waist-hip ratio and waist circumference as simple measures of cardiovascular risk assessment and weight management among medical students. Journal of Evidence-Based Medicine and Healthcare, 5, 237-242. doi: 10.18410/jebmh/2018/49
26. Unii, J. (2010). Third consensus meeting of Indian Menopause Society (IMS) 2008: A summary. Journal of Midlife Health, 1, 43-47. doi: 10.4103/0976-7800.66987
27. Shobeiri, F., Jenabi, E., Khatiban, M., Hazavehei, S. M., &Roshanaei, G. (2017). The effect of educational program on quality of life in menopausal women: a clinical trial. Journal of Menopausal Medicine, 23, 91-95. doi: 10.6118/jmm.2017.23.2.91
28. Franceschi, S., Favero, A., La Vecchia, C., Barón, A. E., Negri, E., Dal Maso, L., ...Amadori, D. (1996). Body size indices and breast cancer risk before and after menopause. International Journal of Cancer, 67(2), 181-186.

29. Marjani, A., &Moghasemi, S. (2012). The metabolic syndrome among postmenopausal women in Gorgan. International Journal of Endocrinology, 2012, 953627. doi: 10.1155/2012/953627
30. Praveena, D. (2014). Nutritional status index of postmenopausal and premenopausal women. Food Science Research Journal, 5(2), 106-109. doi: 10.15740/HAS/FSRJ/5.2/106-109
31. Sinha, I., Mondal, N., & Sen, J. (2018). Effects of socio-economic, demographic and lifestyle variables on overweight and obesity among rural Rajbanshi postmenopausal women of India. AnthropologischerAnzeiger, 75(3), 251-262. doi: 10.1127/anthranz/2018/0863
32. Landau, C., Cyr, M. G., & Moulton, A. W. (1995). Review and notes: The complete book of menopause, every woman's guide to good health. Annals of Internal Medicine, 122(5), 398. doi: 10.7326/0003-4819-122-5-199503010-00031
33. Nuttall, F. Q. (2015). Body mass index, obesity, BMI and health: A critical review. Nutrition Today, 50(2), 117-128. doi: 10.1097/NT.0000000000000092
34. WHO Expert Consultation. (2008). Waist circumference and waist-hip ratio: report of a WHO expert consultation. World Health Organization, Geneva.
35. Javoor, D., Malagi, U., Naik, R., &Kasturiba. (2008). Nutritional status of menopausal women. Karnataka Journal of Agricultural Sciences, 21(2), 152-154.
36. Roeca, C., Al-Safi, Z., & Santoro, N. (2018). The postmenopausal women. In K. R. Feingold, B. Anawalt, & A. Boyce (Eds.), Endotext [Internet]. South Dartmouth, MA: MDText.com, Inc. https://www.ncbi.nlm.nih.gov/books/NBK279131/ PMID: 25905354.