

Anthropometric measurements and its indication towards health among post-menopausal women of Mishing community, Lakhimpur district, Assam

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Citation: Roy C, Mondal N and Singh HV. 2020. Anthropometric measurements and its indication towards health among post-menopausal women of Mishing community, Lakhimpur District, Assam. Human Biology Review, 9 (2), 183-200.

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ABSTRACT

Background: Menopause, the last menstrual period in women's life is visibly marked with the end of female fecundity. Post-menopause is one year from menopause and various researches on menopause in India states that average menopause ranges from 40 to 50 years. **Objectives:** The objectives of the present investigation are to assess the age-specific variation anthropometric measurements and adiposity levels among tribal post-menopausal women. **Materials and Methods:** A purposive sampling of post-menopausal women has been used for the present investigation and based on that 100 post-menopausal women of 40-60 years were selected from Lakhimpur district. The data has been collected using a structured-research schedule. Anthropometric measurement of height, weight, waist circumference and hip circumference were collected using standard procedure. Statistical analysis includes descriptive statistics, correlation and ANOVA were done using SPSS (version, 16.0). **Results:** The results indicates that, 43.0% of the post-menopausal women were found to be normal (BMI: 18.5-22.9 kg/m²), 29.0% of the respondents were at the increased risk of adiposity (BMI: 23.0-27.5 kg/m²) and 6.0% were belonged to category grade I obesity or higher high risk of adiposity (BMI: >27.5 kg/m²), whereas 22% were underweight or chronic energy deficiency (BMI: <18.5 kg/m²). Regarding WHR, 36.0% of the post-menopausal women were at high risk (WHR >0.85), 42.0% belongs to moderate risk (WHR 0.81-0.85) and 22% at low risk (≤0.80). The relative risks of co-morbidity related to excess adiposity were 31.0% (WC ≥80 cm), 78.0% (WHR>0.80) and 51.0% (WHR ≥0.50) among Mishing post-menopausal women. **Conclusion:** Women of middle age group are less covered under any specific health scheme in India. Increased Body Mass Index and WHR indicate a need to educate post-menopausal women on a healthy lifestyle and proper food habits. Post-menopause period is an important and a usual stage in every woman's life, one should not neglect this transition period.

Keywords: Anthropometric, BMI, Menopause, Post-menopause, WHR, Waist Circumference

INTRODUCTION

Menopause, the last menstrual period in women's life is visibly marks the end of female *fecundity* (Sherman 2005; Phipps et al., 2011; Bogin and Smith, 2012; Peacock and Ketvertis, 2019). As defined by WHO, it is the permanent end of menstruation due to hormonal activity, the opposite of menarche which occurs in women in their mid age, usually in late 40's or early 50's (WHO, 1996; Bogin and Smith, 2012; Dalal and Agarwal, 2015; Peacock and Ketvertis, 2019). Several research investigations have reported the age at menopause in different Indian ethnic population (e.g., Dasgupta et al., 2012; Dalal and Agarwal, 2015; Karunakaran and Urooj, 2017; Sinha and Sen, 2017). It varies from person to person and also depends upon various socio-economic, cultural, physiological and psychological factors (e.g., Towner et al., 2016; Sapre and Thakur, 2019). Post-menopause is the span of time after a year of menopause (WHO, 1996; Peacock and Ketvertis, 2019). A continuous absence of menstruation for 12 consecutive months of amenorrhea is post-menopause (WHO, 1996; Peacock and Ketvertis, 2019). Post-menopause can be categorized in two stages, early post-menopause and late post-menopause depending upon the duration of amenorrhea. Early post-menopause can be defined as 4 years since the last menstrual period and the former is the period beyond 4 years of menopause which lasts until death (e.g., Soules et al., 2001; Sherman, 2005; Brinton, 2010; Harlow et al., 2012). The onset of menopause brings tremendous changes in their life, which is the result of hormonal imbalance (Dalal and Agarwal, 2015; Peacock and Ketvertis, 2019). During this transition, women experiences vasomotor, urogenital, psychosomatic and physiological symptoms which may disrupt the quality of life (Santoro et al., 2016). The prevalence of these symptoms depends upon various factors include socio-economic condition, lifestyle, food habits, environmental condition, and psychological factor, ethnic and socio-cultural group, marital and reproductive phase (e.g., Sengupta et al., 2010; Gold, 2012; Gold et al., 2013; Dalal and Agarwal, 2015; Karunakaran and Urooj, 2017; Sinha and Sen, 2017; Peacock and Ketvertis, 2019).

Studies reports, high risk of cardiovascular disease, cancer and osteoporosis are seen among post-menopausal woman further, women with osteoporosis are more prone to cardiovascular disease (e.g., Tanko et al., 2005; Warburton et al., 2006; Dasgupta et al., 2012). Prevalence of overweight and obesity leads to poor health conditions and several preventable non-communicable diseases, which can be overcome by behavioral and lifestyle modification such as inculcating proper dietary habits, exercise, good sleep which can combat such health

conditions (e.g., WHO, 2000; WHO Expert Consultation, 2004; Chan and Woo, 2010; Banack et al., 2018; Sinha et al., 2018; Singh et al., 2018). It is evident that one among six women of age group 50 years and more are affected by osteoporosis, also women's experiences more fractures than men (Cheung et al., 2004). It is estimated that the menopausal population may move up from about 43 million to 103 million in 2026 (Unii, 2010). Women of age group 45 years and above are less covered under any specific health scheme, whereas women of reproductive age 15-45 years are covered under various health programs in India (e.g., Reproductive and Child Health Program and Janani Suraksha Yojana). Therefore, the health and treatment centre should be established for menopausal women in population (Shobeiri et al., 2017). Furthermore, several researchers have attributed that the menopause doubles the risk of many traditional cardiovascular disease risk factors, including changes in body adiposity distribution from gynoid to android pattern, atherogenic lipid profile, hypertension, osteoporosis, diabetes and certain types of cancers (e.g., breast cancer) (e.g., Franceschi et al., 1996; Tanko et al., 2005; Phipps et al., 2010; Dasgupta et al., 2012; Marjani and Moghasemi, 2012; Singh et al., 2018; Peacock and Ketvertis, 2019). Due to improving socio-economic conditions, rapid lifestyle changes, equal importance to women and increased longevity, post-menopausal health has been a high concern in public health research in India. Menopausal health demands high priority in Indian scenario due to increase life expectancy and growing population (Praveena, 2014). The objectives of the present investigation are to assess the age-specific variation anthropometric measurements and adiposity levels among Mishing tribal post-menopausal women of Lakhimpur district of Assam, Northeast India.

MATERIALS AND METHODS

The present investigation was carried out among Mishing tribal post-menopausal women of Kadam village of Lakhimpur district of Assam, Northeast India. This village was selected for the study because of its Mishing majority and they are the second largest tribe in Assam. Based on this background, purposive sampling of post-menopausal women was used for the current study. A total of 100 post-menopausal women of age group 40-60 years were included in the present investigation. Menopausal women who have attained menopause naturally were included for the study. Furthermore, women with unnatural menopause (removal of both the ovaries with or without hysterectomy), women with severe illness, over aged, bedridden, mentally challenged

and women on chemotherapy were excluded. Details of the research investigation were explained to participants. A total of 12 participants had excluded from the investigation as either their age at menopause could not be recalled or they had not experienced natural menopause; rather, they experienced menopause as a result of surgery or removal of the uterus. The age at natural menopause was collected (i.e., N=100), only from those Mishing tribal women who reported spontaneous cessation of menstruation for more than one year based on the WHO criterion (WHO, 1996). Age at natural menopause was determined by subtracting the year of the birth of women from the year of their final menstrual period. Dates of birth of the participants were collected using relevant official documents issued by the Government. A structured-schedule was used to collect the relevant data and age at menopause using face-to-face interview and household survey methods.

Collection of Anthropometric Measurement

The anthropometric measurements of height, weight, waist circumference (WC) and hip circumference (HC) were measured following standard procedures (Hall et al., 2007). Height was measured to the nearest 0.10 cm using an anthropometer with the individual standing in an erect position with the head oriented in the Frankfort Horizontal plane. Weight was recorded to the nearest 0.10 kg with the individual standing motionless on a portable weighing scale. WC was measured at the level halfway between the iliac crest and the costal margin in the mid-axillary line after exhaling with the subject in the standing position. HC was measured at the level of the greater trochanters with the subject in a standing position with two feet together. Two consecutive readings were recorded for WC and HC to the nearest 0.1 cm using a plastic coated non-stretchable measuring tape without compression of skin.

Assessment of Nutritional status and Adiposity Risks

The adiposity measures of Body Mass Index ($BMI = \text{weight}/\text{height}^2$, kg/m^2), Waist-Hip-Ratio ($WHR = WC/HC$) and Waist-to-Height Ratio ($WHtR = WC/\text{Height}$) have been calculated using standard equations. The individuals were classified to assess the nutritional and health risks according to suggested cut-off point for Asia-Pacific population of WHO Expert Consultation (2004). Where, less than $18.50 \text{ kg}/\text{m}^2$ underweight; $18.5\text{--}23.0 \text{ kg}/\text{m}^2$ increasing but acceptable risk or Normal; $23.10\text{--}27.50 \text{ kg}/\text{m}^2$ increased risk or overweight; and $27.50 \text{ kg}/\text{m}^2$ or higher high risk or obese. The fixed cut-offs used for WHR was used to assess the excess adiposity of >0.8 for females (Webb 2002). Further, the women were classified into low ($WHR \leq 0.80$), moderate

(WHR 0.81-0.85) and high risk (WHR >0.85) groups according to the classification based on WHR proposed by Singh et al. (2018). WHtR, the cut-offs used to assess the excess risks to adiposity was ≥ 0.50 for both sexes (Hsieh and Muto 2004). The co-morbidity risk related to excess adiposity was assessed according to the classification/cut-off of <80 cm (i.e., Normal) and ≥ 80 cm (i.e., High risk) proposed by WHO (2000).

Statistical Analysis

The data were statistically analyzed using the Statistical Package of Social Sciences SPSS (version 16.0). The data were analyzed using the relevant statistical contents of descriptive statistics (mean \pm standard deviation), Pearson correlation and One-way Analysis of Variance (ANOVA). Pearson correlations were utilized to determine the association between the anthropometric measurements and indicators and age at natural menopause. ANOVA was done to assess the mean differences in anthropometric measures between age-groups. A p-value of <0.05 and <0.01 were considered to be statistically significant.

RESULTS

Age-specific descriptive statistics of anthropometric variables among Mishing post-menopausal women

The age-specific descriptive statistics (mean \pm standard deviation) of anthropometric variables of weight, height, WC, HC, BMI, WHR and WHtR of post-menopausal women are presented in Table 1. The mean weight and height of post-menopausal women were 48.38 ± 11.37 kg and 151.72 ± 5.38 cm for age group 40-45 years 50.65 ± 9.83 kg and 152.32 ± 4.99 cm for age group 46-50 years, 48.30 ± 6.98 kg and 147.55 ± 4.34 cm for age group 51-55 years and 48.07 ± 10.11 kg and 149.85 ± 4.23 cm for age group 56-60 years, respectively. Age-specific mean BMI was observed to higher in 51-55 years (22.18 ± 2.96 kg/m²) and lower in 40-45 years (20.94 ± 4.26 kg/m²) among post-menopausal women. A similar study was done by Dhavan and Kamble (2018) and their results indicated that the mean weight, BMI and WHR were high which signifies obesity among Mishing post-menopausal women. The mean WC and HC of post-menopausal women were 77.00 ± 9.17 cm and 90.67 ± 8.87 cm for age group 40-45 years, 76.03 ± 8.72 cm and 91.86 ± 8.73 cm for age group 46-50 years, 76.52 ± 6.34 cm and 91.61 ± 8.48 cm for age group 51-55 years, and 74.80 ± 9.52 cm and 89.06 ± 9.56 cm for age group 56-60 years, respectively. The age-specific mean WHR and WHtR were not showing any specific age-related trends among Mishing post-menopausal women ($p > 0.05$). The age-specific mean differences in

anthropometric variables of weight, WC, HC, BMI, WHR and WHtR were observed to be statistically not significant using ANOVA ($p>0.05$), except height ($F=4.91$; $p<0.05$). The box-plot of the collected anthropometric variables of height, weight, WC and HC among post-menopausal women is depicted in Figure 1.

Pearson correlation of anthropometric variables with age at menopause among Mishing post-menopausal women

Results of Pearson correlation of anthropometric variables of weight, height, BMI, WC, HC, WHR and WHtR with age at menopause among Mishing post-menopausal women is depicted in Table 2. Positive correlations was found between BMI and age at menopause ($r=0.037$), WHR and age at menopause ($r=0.081$) and WHtR and age at menopause ($r=0.035$) ($p>0.05$). Whereas, statically insignificant negative was between age at menopause and height ($r=-0.183$), weight ($r=-0.035$), WC ($r=-0.026$) and HC ($r=-0.103$) ($p>0.05$). The positive associations were observed between the adiposity measures, between BMI with WC ($r=0.562$), HC ($r=0.726$) and WHtR ($r=0.5776$) ($p<0.01$).

Table 1. Age-specific descriptive statistics (mean \pm standard deviation) of anthropometric measurements among Mishing tribal post-menopausal women

Age groups	N	Weight (kg)	Height (cm)	WC (cm)	HC (cm)	BMI (kg/m ²)	WHR	WHtR
40-45 years	21	48.38 ± 11.37	151.72 ± 5.38	77.00 ± 9.17	90.67 ± 8.87	20.94 ± 4.26	0.84 ± 0.03	0.51 ± 0.05
46-50 years	37	50.65 ± 9.83	152.32 ± 4.99	76.03 ± 8.72	91.86 ± 8.73	21.75 ± 3.57	0.84 ± 0.08	0.50 ± 0.05
51-55 years	21	48.30 ± 6.98	147.55 ± 4.34	76.52 ± 6.34	91.61 ± 8.48	22.18 ± 2.96	0.84 ± 0.06	0.52 ± 0.03
56-60 years	21	48.07 ± 10.11	149.85 ± 4.23	74.80 ± 9.52	89.06 ± 9.56	21.34 ± 4.00	0.83 ± 0.04	0.50 ± 0.06
40-60 years	100	49.15 ± 9.66	150.68 ± 5.10	76.08 ± 8.30	91.06 ± 9.01	21.59 ± 3.69	0.83 ± 0.06	0.51 ± 0.05
F-value		4.91	0.48	0.27	0.36	0.47	0.15	0.82
p-value		0.03	0.69	0.85	0.78	0.72	0.93	0.49



Figure 1: Box-plot distribution of anthropometric measurements among Mishing tribal post-menopausal women

Table 2: Pearson correlation analysis of anthropometric variables and age at menopause among Mishing tribal post-menopausal women

Anthropometric measures	Height	Weight	BMI	WC	HC	WHR	Age at Menopause
Height	1	0.477**	0.131	0.450**	0.426**	0.094	-0.183
Weight	0.477**	1	0.932**	0.660**	0.793**	-0.054	-0.035
BMI	0.131	0.932**	1	0.562**	0.726**	-0.102	0.037
WC	0.450**	0.660**	0.562**	1	0.690**	0.487**	-0.026
HC	0.426**	0.793**	0.726**	0.690**	1	-0.265**	-0.103
WHR	0.094	-0.054	-0.102	0.487**	-0.265**	1	0.081
WHR	0.150	0.563**	0.577**	0.95**	0.615**	0.081	0.035
Age at Menopause	-0.183	-0.035	0.037	-0.026	-0.103	0.081	1

**p<0.01

Nutritional and regional adiposity risks status among Mishing post-menopausal women

The assessment of overall nutritional status and relative health risks of excess adiposity using recommended BMI classification for Asia-Pacific population among Mishing post-menopausal women is shown in Figure 2. The results showed that a total of 43.0% of the post-menopausal women were found to be in normal category (BMI: 18.5-22.9, kg/m²), 29.0% of the participants were at increased risk group (BMI: 23.0-27.5 kg/m²) and 6% belongs to category grade-I obesity or higher high risk (BMI: >27.5 kg/m²). The overall prevalence of underweight or chronic energy deficiency was observed to be 22% (BMI: <18.5 kg/m²). The overall prevalence of regional/central adiposity using WHR (>0.80) cut-off was observed to be 78% among post-menopausal women. Furthermore, it is clear that 36.0% of the post-menopausal women were at high risk (WHR >0.85), 42.0% belongs to moderate risk (WHR 0.81-0.85) and only 22% belongs to low risk (WHR ≤0.80 below) using WHO classification of adiposity risks (Figure 3). The relative risk of co-morbidity related to excess adiposity and normal were observed to be 31.0% (WC ≥80 cm) and 69.0% (WC<80 cm) among Mishing tribal post-menopausal women. The overall risk of regional adiposity (WHtR ≥0.50) and normal (WHtR<0.50) was observed to be 51.0% and 49.0% using WHtR among Mishing post-menopausal women (Figure 4).

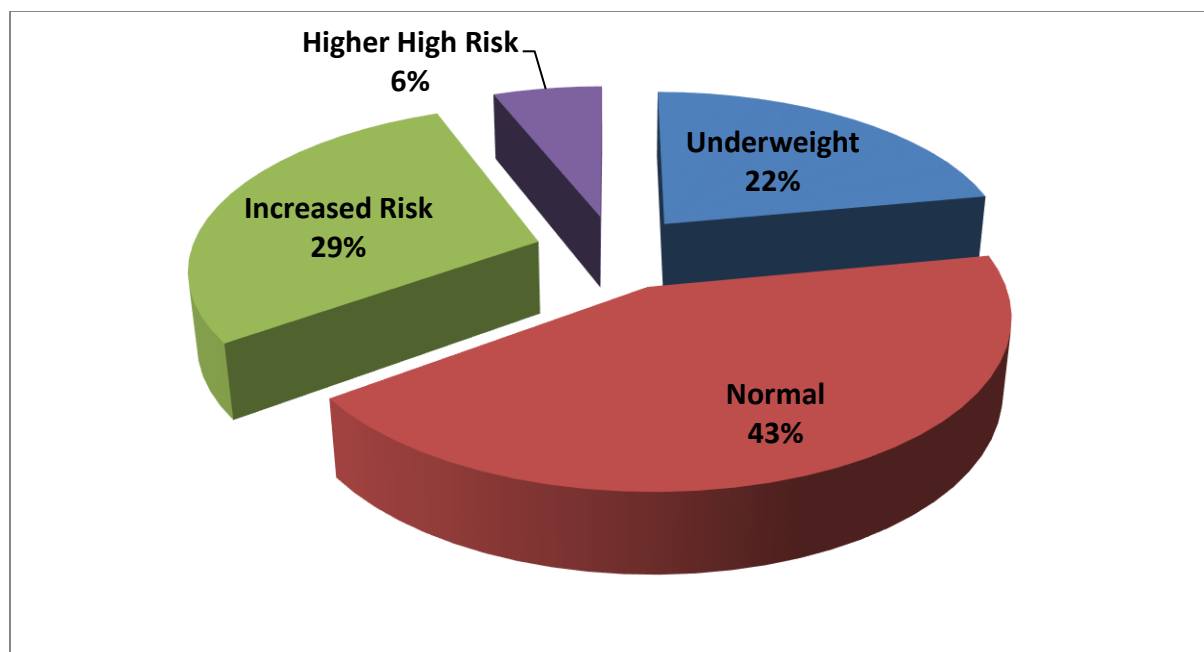


Figure 2: Overall Nutritional status and relative health risks using BMI classification among Mishing tribal post-menopausal women

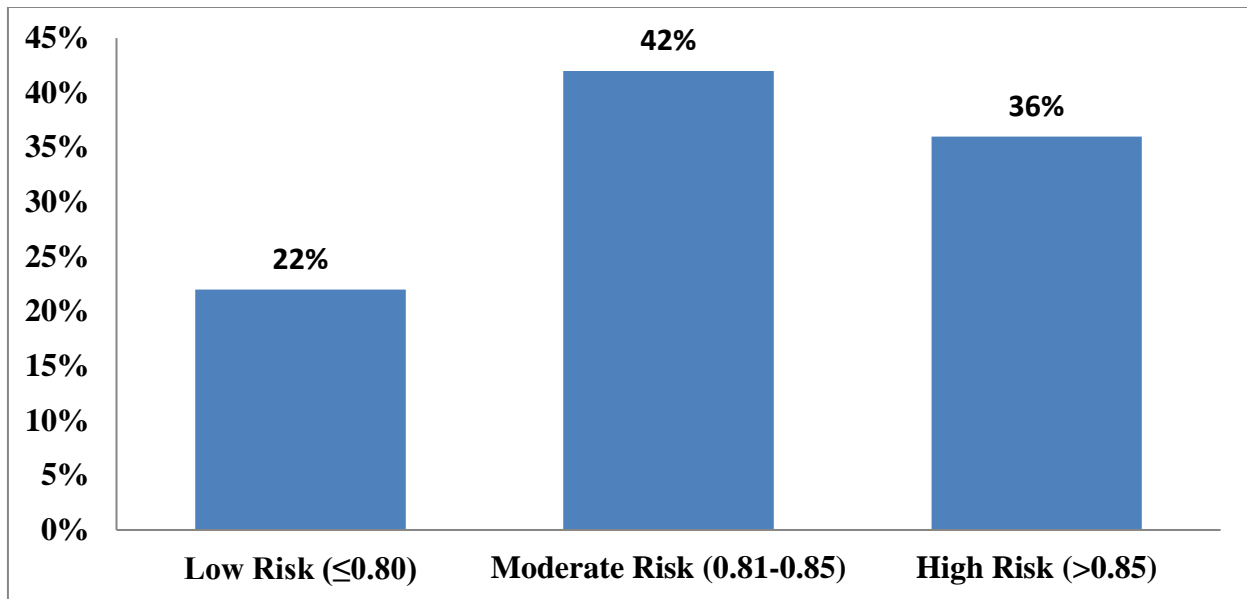


Figure 3: Overall risk of regional adiposity risks using WHR among Mishing tribal post-menopausal women

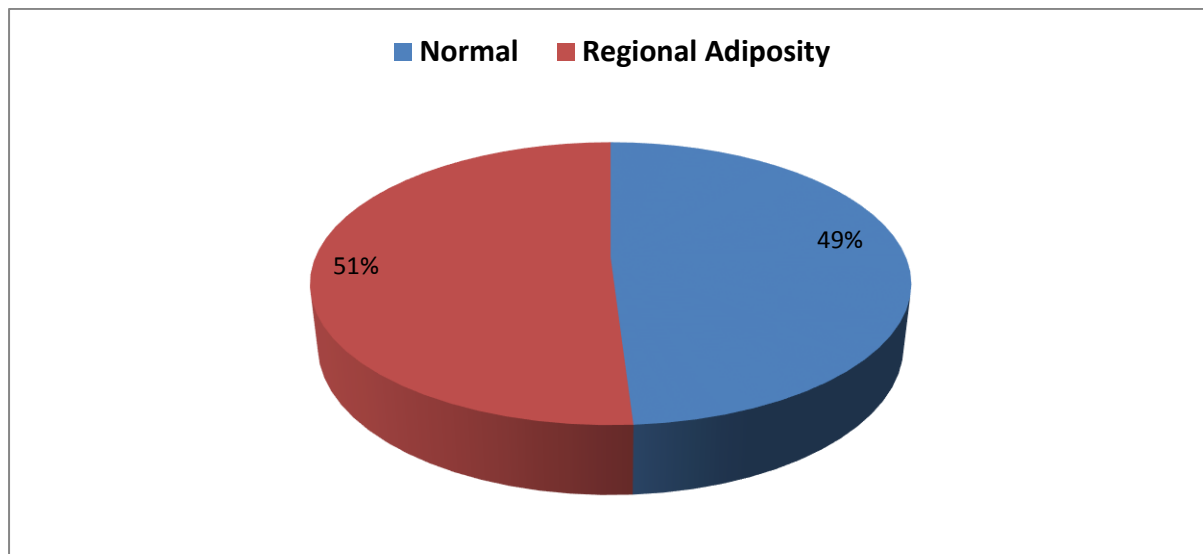


Figure 4: Overall risk of regional adiposity risks using WHtR among Mishing tribal post-menopausal women

Profile of age at menopause among Mishing tribal post-menopausal women

The profile of age at menopause attainment among Mishing tribal post-menopausal women was described in Figure 5. The mean age of the study population was 51.04 ± 5.44 years and the mean age at menopause was 46.42 ± 4.42 years which were significantly lower than (Unii, 2010) Indian Menopause Society (MSI) which says, 47.5 years as average age. The median age at menopause was observed to be 46 years. A study by and Thomas (2018), noted that mean age

at menopause is 46.21 ± 3.33 years while another study by Marahatta (2012), stated mean age at menopause as 49.9 years with lowest age at 41.5 years and highest 58.3 years. The selected post-menopausal women were divided according to the duration of menopause i.e. less than 4 years of menopause is categorized as early post-menopause and more than 4 years is termed as late post-menopause. Majority (57%) of the respondents belongs to late post-menopause, whereas 43% were at early post-menopause stage.

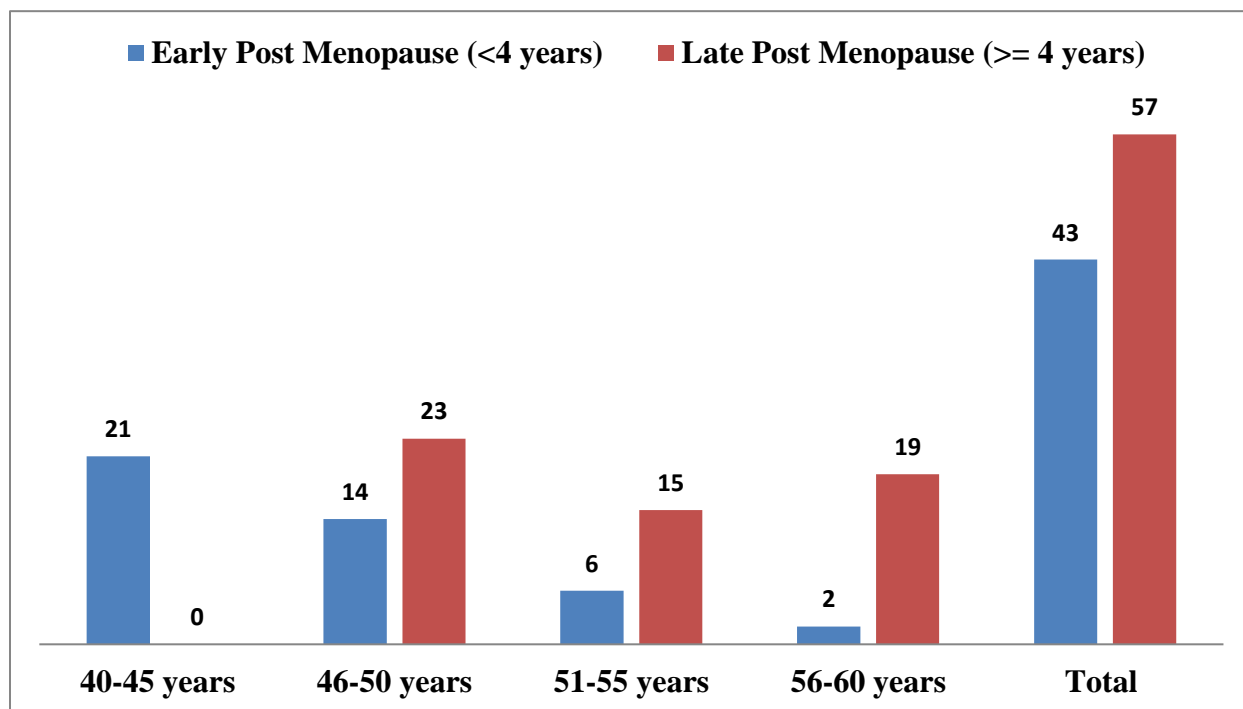


Figure 5: Classification of duration of age at menopause attainment among Mishing tribal post-menopausal women

DISCUSSION

Post-menopausal condition is a phenomenon which occurs after twelve consecutive months of amenorrhea from the final menstrual period (WHO, 1996; Peacock and Ketvertis, 2019). Women who have undergone menopausal symptoms, and related adiposity and morbidity are of great significance in regard to menopausal health, and furthermore health condition which also associated to various socio-economic, cultural, physiological and psychological factors which also impact on age at menopause (e.g., Sengupta and Srinivasan, 2010; Gold et al., 2013; Sinha et al., 2018; Peacock and Ketvertis, 2019; Sapre and Thakur, 2019). The term post-

menopause is used to describe middle-aged women who have a uterus, not pregnant or lactating and who have stopped menstruating for at least twelve months (Landau et al., 1995; WHO, 1996). Anthropometry is the techniques to determine physical size and dimensions of the human body and the BMI is the most commonly used anthropometric measure to ascertain the level of adiposity and nutritional status in epidemiological and clinical studies (WHO, 2000; WHO Expert Consultation, 2004; Banack et al., 2018; Singh et al., 2018; Sinha et al., 2018;). It is the simple and widely used non-invasive measure for estimating the body fat adiposity and an accurate reflection of body adiposity percentage, also used as an indicator for several health issues in the majority of the selected population (Nuttall, 2015; Sinha et al., 2018). The predominant distribution of body adiposity of an obese person, whether in the upper part or the lower part of the body may determine the disease pattern (WHO Expert Consultation, 2004; WHO, 2008). Karunakaran and Urooj (2017) have reported the higher prevalence of excess adiposity (e.g., BMI, WHR and triceps) and low protein status as indication of predisposition factor for cardiovascular factors among post-menopausal women in Mysore, India. The mean BMI was found to be higher among post-menopausal women (Javoor et al., 2008; Marjani and Moghasemi, 2011; Singh et al., 2018) and also depends on various socio-economic and demographic factors (Gold et al., 2013; Roeca et al., 2018; Sinha et al., 2018). Sharma and Sharma (2015) in their study reported that mean BMI of selected post-menopausal women were $24.65 \pm 4.76 \text{ kg/m}^2$ with anaemia (29.0%), low calcium (90.0%), also states that menopausal condition was stressful which affect their physical and mental health too, another investigation by Marjani and Moghasemi (2011) found BMI as $30.98 \pm 5.52 \text{ kg/m}^2$ among post-menopausal women in Gorgan, India. Whereas, results of the present investigation showed the age-specific and overall mean BMI showed lower values that the reported investigations in India (Table 1). The assessment of relative risk among Mishing post-menopausal women showed that 29.0% were at the increased risk adiposity (BMI: $23.0\text{-}27.5 \text{ kg/m}^2$) and 6.0% were belonged to category grade-I obesity or higher high risk of adiposity (BMI: $>27.5 \text{ kg/m}^2$) and 22.0% were underweight or chronic energy deficiency (BMI: $<18.5 \text{ kg/m}^2$) (Figure 2). A similar investigation has reported that there was a positive increase in percent body adiposity as BMI category increased among post-menopausal women (Banack et al., 2018). Several research investigation have reported the high magnitude of overweight and obesity among different Indian ethnic population include 30.63% and 4.26% (in 45-50 years) and 32.36% and 18.91% (in 51-56 years) Rajbanshi post

menopausal women of North Bengal (Sinha et al., 2018), obesity among post menopausal women of Dharwad city (29.15%) (Javoor et al., 2008). Karunakaran and Urooj (2017) reported the prevalence of overweight and obesity was observed to be 48.4% and 17.7% among post-menopausal women of Mysore city. Rhitu and Balakrishnan (2015) reported higher prevalence of overweight (32%) and obesity (13.5%) among post-menopausal women of Indore, India.

The mean age at menopause of the Mishing tribal post-menopausal women was found to be a 46.42 ± 4.42 years. Joshi and Nair (2015) stated in their study that the mean age for post-menopausal women was 46.40 ± 5.32 years with most prevalent symptoms such as anxiety (67.4%). Getha and Parida (2015) revealed out that majority (61%) of the menopausal women were in the age group of 45-50 years with the mean age of menopause $45.26 (\pm 3.96)$ years. Muniz et al. (2003) reported that post-menopausal women whose diet were rich in saturated fatty acids, monosaturated fatty acids, polyunsaturated fatty acids had a better lipoprotein profile and lesser prevalence of lifestyle diseases. Gorniak et al. (2014) examined in their study that in obese post-menopausal women oxidative stress process occurs at the early stages of dyslipidemia and the main factor to this is improper food habits. The mean weight and height of post-menopausal women were 48.38 ± 11.37 kg and 151.72 ± 5.38 cm (in 40-45 years), 50.65 ± 9.83 kg and 152.32 ± 4.99 cm (in 46-50 years), 48.30 ± 6.98 kg and 147.55 ± 4.34 cm (in 51-55 years) and 48.07 ± 10.11 kg and 149.85 ± 4.23 cm (in 56-60 years) respectively were observed in the present investigation (Table 1). The mean WC and WC of post-menopausal women were 77.00 ± 9.17 cm and 90.67 ± 8.87 cm (in 40-45 years), 76.03 ± 8.72 cm and 91.86 ± 8.73 cm (in 46-50 years), 76.52 ± 6.34 cm, 91.61 ± 8.48 (in 51-55 years) and 74.80 ± 9.52 cm and 89.06 ± 9.56 cm (in 56-60 years) respectively (Table 1). In relation to this study Rastegari et al. (2017) showed that the mean of WHR index was 0.90 ± 7.54 among post-menopausal women and there is a significant relation between socio-economic and reproductive factors. Furthermore, the adiposity indices (e.g., BMI, WHR and WC) are measured for central and/or visceral/regional adiposity assessment, which are considered to be a major determinant of several non-communicable diseases include of cardiovascular risk of hypertension, diabetes mellitus, metabolic syndrome and certain types of cancers (e.g., breast cancer) among post-menopausal women in population (Franceschi et al., 1996; Montazori et al., 2008; Singh et al., 2018). The results indicated that 31% ($WC > 80$ cm) and 78% ($WHR \geq 0.80$) of the post-menopausal women found to have high risks of excess adiposity. The simplicity of measurement and its relation to relative adiposity

distributions are major advantages of WHR and WC over the more widely used conventional anthropometric adiposity measure such include BMI (WHO Expert Consultation, 2008; Singh et al., 2018). The magnitude of regional adiposity was observed to be significantly higher among Mishing post-menopausal women using WHR and WHtR (Figures 3 and 4), which indicates higher health risks of non-communicable diseases and related co-morbidities in population. Montazori et al. (2008) observed that obesity can increase the risk of breast cancer in post-menopausal women. Several researchers have categorized menopausal transition into several stages of life as described by Soules et al. (2001) and Roeca et al. (2015). The results of the present investigation showed that majority (57.0%) of the respondents belonged to late post-menopause, whereas, 43.0% were early post-menopause (Figure 5). Hence, there is an urgent need to create awareness related to excess adiposity, obesity as highly risk factor for breast cancer and several other co-morbidities related to adiposity among post-menopausal women in population.

CONCLUSION

Women of middle age group are less covered under any specific health scheme in India, whereas women of reproductive age group (i.e., 15-45 years) should be protected under various health programs (e.g., Reproductive and Child Health Program and Janani Suraksha Yojana). The existence of excess adiposity in terms of BMI, WC, WHR and WHtR indicate a need to educate post-menopausal women on a healthy lifestyle and proper food habits. Appropriate weight management programmes are necessary to reduce the physical burden and health risks of excess adiposity and overweight-obesity in population. Due to improving socio-economic conditions, rapid lifestyle changes, equal importance to women and increased longevity, post-menopausal health has been a high concern in public health research in India. Post-menopause period is an important stage in every women's life, one should not neglect this transition period as it is a usual stage of women's life span.

ACKNOWLEDGEMENT

Authors wishes to extend thanks to the people of the study area, co-field helpers, village headman and others local people for their help and co-operation during field work. The investigators also express deepest sense of gratitude and acknowledged the University Grants

Commission (UGC), Government of India for financial assistance in the form of UGC-NET Junior Research Fellowship [Ref. No.: 16408/(NET-DEC.2014), dated 7th April 2016].

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