

Determinants of Age at Menopause among Married Women in an Urban Area of Bangladesh

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Abstract

Menopause is the upper bound of the female reproductive span. Considering the importance of this demographic event in the context of reproductive process and fertility, the prime objective of this research work is to investigate thoroughly the current scenario of age at menopause and also to identify the significant covariates of this last segment of human reproductive span among adult married women in an urban area of Bangladesh. This research work was based on the primary data, collected by direct field investigation through a well-structured interview schedule. In this study, a sample of 234 married women aged 40-55 years was interviewed; out of them, 113 respondents reported that they reached the menopausal stage at the time of the interview. The results show that the overall mean age at menopause among the studied women is 47.07 ± 3.35 years with substantial variations by the respondents' background characteristics. The coefficient of variation (7.1%) indicates extreme heterogeneity in age at menopause of the respondents. The coefficient of skewness ($\gamma_1 = -0.58$) and excess of kurtosis ($\gamma_2 = -0.86$) reflect that the shape characteristics of menopausal age are negatively skewed and platykurtic. Findings from multivariate Cox-proportional hazard analysis demonstrate that respondents' current age, BMI, husbands' occupation, use of contraception, exercising habit, and presence of disease significantly influence the age at menopause. Based on the findings of this study, it can be concluded that awareness regarding the aforementioned issues should be taken into cognizance for the natural age at menopause.

Keywords: Married women, Menopause, Reproductive span, BMI, Cox-proportional Hazard Model.

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মেনোপজ হলো মহিলাদের প্রজনন ব্যাপ্তির উপরের সীমা। প্রজনন প্রক্রিয়া ও জনউর্বরতার প্রেক্ষাপটে এই জনমিতিক ইভেন্ট এর গুরুত্ব বিবেচনা করে এ গবেষণার প্রচেষ্টা হলো যে, বাংলাদেশের একটি শহর এলাকার বয়স্ক মহিলাদের মেনোপজ বয়সের বর্তমান পরিস্থিতি পুংখানুপুংখ ভাবে অনুসন্ধান করা এবং মানব প্রজনন ব্যাপ্তির শেষ সীমাটির তাৎপর্যপূর্ণ নির্নায়কগুলো চিহ্নিত করা। এ গবেষণা কর্মটি একটি সুগঠিত প্রশ্নমালার মাধ্যমে সরাসরি মাঠ পর্যায় থেকে প্রাথমিক তথ্য সংগ্রহ করে সম্পাদন করা হয়েছে। এই গবেষণায় ৪০-৫৫ বছর বয়সের ২৩৪ জন বিবাহিত মহিলাদের একটি নমুনা সংগ্রহ করে তথ্য সংগৃহীত হয়েছে, যার মধ্যে ১১৩ জন উত্তরদাতা জানিয়েছেন যে, তারা উল্লেখিত সময়ের মধ্যে মেনোপজ স্তরে উপনীত হয়েছেন। এ গবেষণার ফলাফল সমূহে দেখা যায় যে, নির্বাচিত মহিলাদের পটভূমি বৈশিষ্ট্যের উল্লেখযোগ্য তারতম্যসহ তাদের মেনোপজ বয়সের সামগ্রিক গড় বয়স ৪৭.০৭±৩.৩৫ বছর। বিভেদাংকের সহগ (৭.১%) নির্দেশ করে যে, উত্তরদাতাদের মেনোপজ বয়সের মধ্যে চরম তারতম্য বিদ্যমান। বন্ধিমতাক্ষ ($\beta_1 = -০.৫৮$) এবং সূঁচালতাক্ষ ($\beta_2 = -০.৮৬$) প্রতিফলিত করে যে, মেনোপজ বয়সের গঠন ঋণাত্মক বন্ধিম এবং অনতিসূঁচালো। বহুচলক কক্স-প্রোপশনাল হেজার্ড বিশ্লেষণে দেখা যায় যে, বর্তমান বয়স, BMI, স্বামীদের পেশা, গর্ভনিরোধকের ব্যবহার, ব্যায়ামের অভ্যাস এবং রোগের উপস্থিতি মেনোপজ বয়সকে তাৎপর্যপূর্ণভাবে প্রভাবিত করে। এ গবেষণার ফলাফলের আলোকে উপসংহারে বলা যায় যে, স্বাভাবিক মেনোপজ বয়সের জন্য উপরে উল্লেখিত বিষয়গুলো সচেতনভাবে আমলে নেয়া উচিত।

1. Introduction

Menopause is the upper limit of the womens' reproductive span and the symbolic end of reproductive life. This event is one of the important components of the reproductive process, fertility and reproductive health. It is the permanent cessation of a womens' ovarian function [1, 2] and is associated with socio-economic, demographic, physiological, anthropometric, and psychological factors. Recently, the study of menopause has received much attention because of women's increased life expectancy [3, 4]. The subsequent postmenopausal manifestations are associated with their estrogen deficiency, such as cardiovascular disease [5–10] and osteoporosis [11], or estrogen dominance, such as breast cancer and endometrial

[12]. A study shown that, 60% of women in developing countries were identified as postmenopausal [12]. In contrast, 40% of the women identified as postmenopausal living in industrialized countries. Another research study predicted that by 2030, the frequency of the world's population of postmenopausal women is expected to increase 1.2 billion [12, 14]. One-third of the women's lives are spent in the postmenopausal period, and their life expectancy at birth is about 71 years and higher in developing and developed countries. Therefore, it needs to draw attention to conduct more studies on the menopausal experiences of women living in developing countries. Age of menopause varies considerably across populations. Most studies have found that the median age at menopause lies between 49 and 51 years in Western industrialized countries and 46-48 years in developing countries [15-20]. Many research works in different dimensions have been conducted among menopausal women. Still, detailed and in-depth studies on age at menopause based on primary data have not been carried out in Bangladesh. Thus, to carry out this important research study, the Chattogram Metropolitan City is chosen as the study area. The rationale behind selecting the Chattogram metropolitan city as the study area is that urban facilities are adequate, per-capita income, and the standard of living is relatively high in this area because this city is cosmopolitan in nature and also the commercial capital of Bangladesh. Therefore, keeping in view the importance of menopause in reproductive characteristics and fertility process, this study is a modest attempt to investigate the current scenario of age at menopause among married women residing in such an urban area of Bangladesh.

2. Objectives of the Study

The prime objective of this research study is to investigate the age at menopause among adult married women residing in an urban area of Bangladesh. However, the specific objectives of this research work are as follows:

- i. To compute the overall mean of menopausal age along with its shape characteristics;

- ii. To investigate the age at menopause and variability by background characteristics of the selected respondents;
- iii. To observe the pattern of age at menopause among selected adult women; and
- iv. To identify the significant covariates of menopausal age of the respondent.

3. Materials and Methods

3.1. Target area

It is most important to select the study area where the particular purpose of the research work can be fulfilled. The urban area of Chattogram was chosen as the target area for this research because the standard of living of this area is comparatively high, and urban facilities are adequate. Since the women living in this area are supposed to be relatively well-nourished and belong to the overweight stratum, therefore, it would be of great interest to identify the determinants of age at menopause of the females living in this area.

3.2. Target population

Prior to the onset of the research work, the target population must be identified for the fulfillment of the study. The target population of this study was the married women aged 40-55 years living in the Chattogram metropolitan area. The women aged more than 55 years were not considered because there has the chance of memory lapse regarding the reporting of the exact date of menopause and other relevant demographic events that may be happened at distant time points from the date of the survey.

3.3. Data collection technique and study design

Reliable, adequate, valid, and accurate data is a prerequisite for considering any fruitful research work. Taking it into cognizance, this study was based on primary data, which was original, and first of its kind. The data collected for this study was retrospective because the vital registration system is incomplete, and the sampling

frame of respondents is unknown in the study area. Therefore, the purposive sampling technique was used rather than random sampling scheme to select the sampling units. The weight of the selected women was measured by the digital weighing machine and height, waist, and hip circumference by flexible tape. The field survey was conducted for this research work from April to June 2019.

3.4. Preparation of questionnaire and selection of respondents

The interview schedule for this study was designed with utmost care. All the relevant and crucial information from the selected respondents was collected without ambiguity and vagueness. The questionnaire was designed based on the research objectives of the study. First of all, a draft questionnaire was designed, and thereafter pretesting was carried out, on the basis of a small sample of 20 women to upgrade the questionnaire. After pretesting, most of the ambiguous matters were revised, and finalized the questionnaire for the fieldwork. The questionnaire was prepared in English with simple, understandable, self-explanatory, and the questions are arranged in a logical order. In this study, 234 women aged 40-55 years were selected. Among them, 113 and 121 respondents reported that they were at the menopausal stage and did not reach menopause respectively at the time of the interview.

3.5. Formation of variables

Some of the variables that cannot be obtained directly from the respondents were created using the relative information obtained from the other variables. The body mass index (BMI) was computed by dividing weight (kg) by height (m²) and waist to hip ratio was created by dividing waist circumference (cm) by hip circumference (cm). Age at menopause was calculated by subtracting the duration after menopause from the current age at the survey time. The formula of age at menopause can be written as:

Age at menopause (Closed interval) = Current age – Duration after menopause (Years)

Moreover, for survival analysis, the "duration of exposure intervals" were estimated, considering the non-menopausal women (censored) by using the following formula:

Exposure interval (Open interval) = Date of interview – Date of birth (Years)

3.6. Methodology

The primary data was collected considering a total of 26 available variables. The raw data was verified and organized by field editing, coding, and graphical presentation. Descriptive measures of the age at menopause were computed on the basis of different background characteristics of the respondents. Multivariate Cox-proportional Hazard model was applied to determine the significant covariates of age at menopause among adult married women in Chattogram urban area. The variables found significant in the Kaplan-Meier log-rank test were included in the model. To examine the fitness of the model, Omnibus test of goodness of fit was carried out. The statistical software IBM SPSS v25 was employed for conducting all the statistical analyses.

4. Results and Discussion

At the very outset, descriptive statistics about the age at menopause of the sampled respondents by available background characteristics were computed, and the findings are given in the Table 1. In the descriptive study only the respondents who attained the menopausal stage at the time of the survey were considered. The result from Table 1 reveals that the overall mean age at menopause is found 47.07 ± 3.35 years. The coefficient of variation (7.1%) states that the age at menopause is heterogeneous among the respondents. The coefficient of skewness ($\gamma_1 = -0.58$) and excess of kurtosis ($\gamma_2 = -0.86$) reflect that the distribution of age at menopause is negatively skewed and platykurtic. Mean age at menopause by background characteristics illustrate that the lowest age cohort (40-45 years) has the lowest age at menopause (41.75 ± 1.28 years), and the highest age cohort (51-55 years) has the highest age at menopause (48.96 ± 2.31 years). That means, age at menopause is

positively correlated with current age of respondents. In regards to religion, Muslim women take more time to attain menopause (47.31 ± 3.24 years) than their non-Muslim counterparts (45.95 ± 3.71 years). Findings from Table 1 show that the mean age at menopause is lower among the women living in the semi-urban areas (44.94 ± 3.36 years) than their urban counterparts (47.45 ± 3.22 years). As expected, the overweighted respondents have about four years of higher mean age at menopause (47.67 ± 3.15) than those who are malnourished (43.71 ± 2.84).

Table 1. Summary measures of age at menopause by background characteristics of respondents in Chattogram metropolitan area, Bangladesh.

Background Characteristics	Mean age at menopause (years)	S.D.	γ_1	γ_2	95% Min.	C. I. Max.	No. of respondents
Respondents' current age (years)							
40-45	41.75	1.28	0.61	-0.02	40.68	42.82	8
46-50	44.87	2.58	-0.37	-0.95	44.02	44.72	38
51-55	48.96	2.31	-1.54	2.16	48.39	49.52	67
Religion							
Muslim	47.31	3.24	-0.67	-0.69	46.64	47.98	93
Others	45.95	3.71	-0.16	-1.31	44.22	47.68	20
Current place of residence							
Semi-urban	44.94	3.36	0.14	-0.76	43.21	46.67	17
Urban	47.45	3.22	-0.74	-0.64	46.80	48.10	96
Body mass index ((wt.)kg/(hi)m²)							
Underweight	43.71	2.84	0.88	0.47	42.07	45.35	14
Normal weight	46.88	3.18	-0.49	0.02	45.18	48.57	16
Overweight	47.67	3.15	-0.89	-0.28	46.99	48.36	83

Table 1 continued

Background Characteristics	Mean age at menopause (years)	S.D.	γ_1	γ_2	95% Min.	C. I. Max.	No. of respondents
Waist to hip ratio							
≤0.93	47.02	3.46	-0.53	-0.99	46.08	47.95	55
>0.93	47.12	3.27	-0.65	-0.69	46.26	47.98	58
Respondents' educational level							
Illiterate	48.17	3.35	-1.34	0.76	46.50	49.83	18
Primary	45.54	3.50	0.29	-1.42	43.42	47.66	13
Secondary and above	47.07	3.27	-0.62	-0.68	46.35	47.79	82
Respondents' occupation							
Housewife	47.23	3.33	-0.70	-0.63	46.54	47.92	91
Service and others	46.41	3.45	-0.14	-1.45	44.88	47.94	22
Marital status							
Currently married	47.21	3.27	-0.69	-0.58	46.54	47.88	95
Widowed/Divorced Separated	46.33	3.77	-0.11	-1.77	44.46	48.21	18
Age at first conception (years)							
11-15	45.45	3.67	0.08	-1.72	42.99	47.92	11
16-20	47.41	3.37	-0.81	-0.45	46.56	48.26	63
21 and above	46.97	3.18	-0.43	-0.96	45.95	48.00	39
Husband's age							
41-50	45.00	3.06	1.23	2.94	42.17	47.83	7
51-60	46.80	3.33	-0.54	-0.87	46.00	47.60	69
61 and above	47.97	3.26	-1.08	0.04	46.89	49.06	37
Husband's educational level							
Primary	43.62	3.25	0.51	-1.70	40.91	46.34	8
Secondary	47.00	3.19	-0.55	-0.94	45.50	48.50	20
Above secondary	47.41	3.25	-0.71	-0.59	46.71	48.11	85

Table 1 continued

Background Characteristics	Mean age at menopause (years)	S.D.	γ_1	γ_2	95% Min.	C. I. Max.	No. of respondents
Husband's occupation							
Service	47.52	2.87	-0.63	-0.64	46.67	48.37	46
Business	47.79	3.22	-0.95	-0.14	46.86	48.37	48
Others	44.16	3.37	0.54	-0.82	42.53	45.78	19
Type of family							
Nuclear	47.10	3.49	-0.63	-0.88	46.33	47.86	83
Joint	47.00	2.97	-0.42	-0.93	45.89	48.11	30
Monthly family income (Tk.)							
≤30000	45.74	3.42	-0.14	-1.24	44.63	46.85	39
31000-45000	47.30	3.34	-0.90	-0.36	45.74	48.86	20
>45000	47.94	3.04	-0.86	-0.25	47.12	48.77	54
Age at menarche (years)							
10-13	47.27	3.26	-0.73	-0.56	46.48	47.96	89
>13	46.33	3.66	-0.09	-1.42	44.79	47.88	24
Parity							
≤2	46.98	3.49	-0.62	-1.01	45.90	48.05	43
3	47.69	2.96	-0.70	-0.28	46.83	48.55	48
4+	45.91	3.69	-0.15	-1.39	44.27	47.54	22
Age at 1st delivery (years)							
15-20	46.53	3.44	-0.41	-1.22	45.37	47.69	36
21-25	47.93	2.93	-0.89	0.24	47.14	48.72	55
26+	45.82	3.75	-0.09	-1.59	44.14	47.48	22

Table 1 continued

Background Characteristics	Mean age at menopause (years)	S.D.	γ_1	γ_2	95% Min.	C. I. Max.	No. of respondents
Delay from menarche to first live birth (years)							
≤8	46.31	3.50	-0.34	-1.23	45.30	47.31	49
>8	47.66	3.13	-0.78	-0.39	46.87	48.44	64
Cumulative breast-feeding (years)							
<2	47.32	3.32	-0.75	-0.70	46.35	48.29	47
≥2	46.89	3.39	-0.48	-0.90	46.06	47.73	66
Use of contraception							
No	45.40	3.57	0.08	-1.23	44.07	46.73	30
Yes	47.67	3.07	-0.84	-0.34	47.00	48.35	83
Preferring method							
Pills	47.95	2.92	-0.94	-0.16	47.28	48.62	75
Others	45.34	3.51	0.08	-1.10	44.19	46.50	38
Exercising habit							
No	47.41	3.39	-0.67	-0.94	46.54	48.28	61
Yes	46.67	3.29	-0.54	-0.67	45.76	47.59	52
Presence of disease							
Diabetes	47.95	3.17	-1.45	1.40	46.51	49.4	21
Hypertension	46.68	3.487	-0.47	-1.05	45.4	47.96	31
Low-Pressure	48.38	2.387	-0.93	0.03	46.38	50.37	8
Cardiovascular and hypertension	48.31	2.798	-0.95	0.13	46.82	49.8	16
Diabetes, low pressure and hypertension	44.79	3.584	0.45	-0.97	43.06	46.52	19
Others	47.44	2.895	-0.32	-1.17	46	48.88	18

Table 1 continued

Background Characteristics	Mean age at menopause (years)	S.D.	γ_1	γ_2	95% Min.	C. I. Max.	No. of respondents
Morbidity pattern (fever, cough, cold)							
Frequently	46.54	3.18	-0.24	-0.82	44.62	48.64	13
Occasionally	47.33	3.42	-0.82	-0.44	46.31	48.36	45
Rarely	46.98	3.38	-0.50	-1.05	46.07	47.89	55
Food intake							
Low	45.10	3.15	0.26	-0.84	43.66	46.53	21
Normal	47.68	3.26	-0.88	-0.33	46.83	48.53	59
Rich	47.24	3.26	-0.79	-0.41	46.09	48.40	33
Psychological symptoms							
Irritability	50.00	1.63	-1.91	3.76	48.83	51.17	10
Mood swings	48.12	2.64	-2.16	5.26	45.92	50.33	8
Tension and depression	43.58	2.88	1.61	3.56	41.76	45.41	12
Irritability and mood swings	48.00	3.23	-1.61	2.79	44.62	51.38	6
Irritability and tension, and depression	46.32	3.05	-0.24	-0.64	45.06	47.58	25
Mood swings and tension, and depression	48.53	3.12	-1.59	1.96	47.01	50.03	19
All the three	46.76	3.26	-0.67	-0.59	45.60	47.91	33
Overall	47.07	3.35	-0.58	-0.86	40	51	113
C.V. (%)				7.1			

The mean age at menopause is found 47.02 ± 3.46 years among urban women whose waist-to-hip ratio is ≤ 0.93 and is 47.12 ± 3.27 years whose waist-to-hip ratio is ≥ 0.93 . Moreover, the mean age at menopause is found high (48.17 ± 3.35 years) among the respondents who are illiterate. The working women have less mean age at menopause (46.41 ± 3.45 years) than those who are housewives (47.23 ± 3.33 years). The mean menopausal age is found the highest (47.10 ± 3.49 years) among those living in a nuclear family compared to those who are living in a joint family (47.00 ± 2.97 years). Family income is one of the important factors for the variations of mean age at menopause. The average age at menopause is low (45.74 ± 3.42 years) in the stratum, whose monthly family income is less than equal to 30000 taka. In contrast, the mean age at menopause is the highest (47.94 ± 3.04 years) among those whose monthly family income is above 45000 taka. Age at menarche is found inversely correlated with age at menopause. The findings from Table 1 show that the women whose first menstruation started at the age of 10-13 years take relatively longer time to attain menopause (47.27 ± 3.26 years) than those whose first menstruation began at age >13 years (46.33 ± 3.66 years). The respondents whose first pregnancy outcome occurred in the age group 21-25 years have experienced high age at menopause (47.93 ± 2.93 years). Delay from menarche to first live birth is one of the important determinants of age at menopause. Table 1 reveals that the mean age at menopause is lower (46.31 ± 3.50 years) among the respondents whose delay from menarche to first live birth is eight years. On the other hand, the mean age at menopause is found relatively higher (47.66 ± 3.13 years) among the respondents whose delay from menarche to first live birth intervals is above eight years. The mean age of menopause is relatively high (47.67 ± 3.07 years) among the respondents who use family planning methods. On the contrary, the mean age at menopause is found the lowest (44.79 ± 3.58 years) among the respondents who have diabetes, low pressure, and hypertension. In addition to descriptive measures, ages at menopause of the respondents is also depicted in Figure 1 to understand age patterns of menopause at a momentary look.

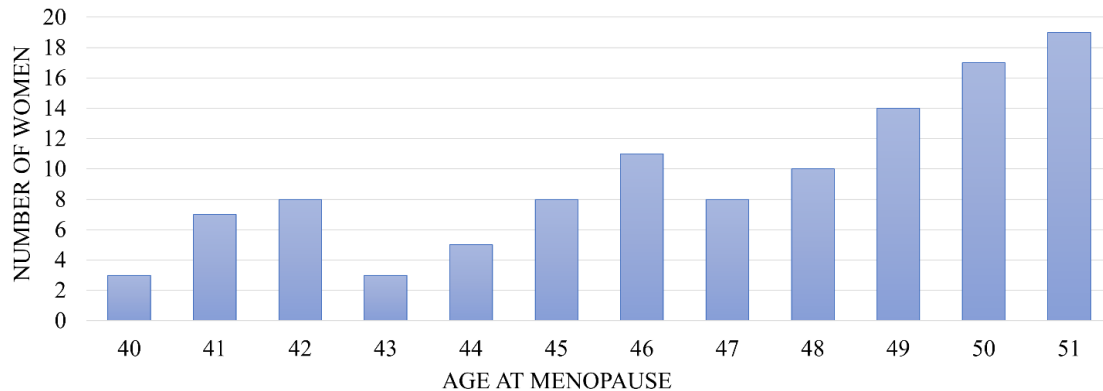


Figure 1. Distribution of respondents by age at menopause in Chattogram metropolitan area, Bangladesh

From Figure 1 it is observed that the age at menopause begins at age 40 years; then, it narrowly increases up to 48 years. Thereafter, it sharply increases to 51 years followed by 50 years. Figure 1 indicates that the mode of the age at menopause is 51 years in the study areas. Since the mode of the age at menopause is higher than the mean (47.07 years), which also confirms that the shape characteristic of age at menopause is negatively skewed based on Pearson's coefficient of skewness. Figure 1 at a glance reflects that current age and age at menopause of the respondents is positively correlated.

This section of the study examines factors influencing age at menopause by employing the Cox- proportional hazard model. In the descriptive analysis, only menopausal women at the time of the survey were considered. But in the multivariate Cox-proportional hazard model, uncensored ($n_1=113$) cases and the respondents who had not reached the menopausal stage (censored; $n_2=121$) at the time of that survey were also considered because this technique is suitable for analyzing both censored and uncensored cases simultaneously. In this study, the multivariate Cox-proportional hazard model was employed to identify the significant

covariates of onset of age at menopause. Before fitting the model, Kaplan-Meier log-rank test was done considering all the variables in the study but only 14 variables were found significant with age at menopause. These significant variables were only considered in the Cox proportional hazard model and the outputs are presented in Table 2.

The result in Table 2 shows that respondents' current age is one of the significant predictor of menopausal age ($p < 0.05$) of the females. The relative risk of having early menopause is higher for the age groups 40-45 years (OR: 1.92, 95% CI: 0.65-5.67) and 46-50 years (OR: 3.61, 95% CI: 1.88-6.93) than those belong to age group 51-55 years. The important anthropometric variable body mass index (BMI) has a significant impact on age at menopause ($p < 0.05$). The hazard ratio regarding BMI in Table 2 reveals that the likelihood of earlier menopause for underweighted women is 4.27 times higher (OR: 4.27, 95% CI: 1.97 – 9.26) than their over-weighted counterparts. The result of the study indicates that the husbands' occupation ($p < 0.05$) is a significant predictor of age at menopause. The hazard ratio for having earlier menopause is significantly lower for the respondents whose husbands are service holders (OR: 0.28, 95% CI: 0.13 – 0.58) and businessmen (OR: 0.25, 95% CI: 0.12-0.54) compared to those whose husbands are involved in other occupations. The use of contraception has a significant effect on age at menopause. Results in Table 2 illustrate that the respondents who do not use contraception have a lower relative risk (OR: 0.42, 95% CI: 0.19-0.93) of attaining early menopause than the respondents who use any contraceptive method.

Table 2. Cox-proportional hazard model estimates by selected background characteristics of age at menopause among married women in Chattogram metropolitan area, Bangladesh.

Background characteristics	Coefficients	S.E.	Wald (χ^2)	P-value	Odds ratio	95% CI of odds ratio	
						Min.	Max.
Respondents' current age (years)			15.37	0.001			
40-45	0.65	0.55	1.39	0.238	1.92	0.65	5.67
46-50	1.29	0.33	14.95	0.000	3.61	1.88	6.93
51-55 *	-	-	-	-	-	-	-
Current place of residence			0.76	0.384			
Semi-urban	0.38	0.43	0.76	0.384	1.46	0.62	3.40
Urban *	-	-	-	-	-	-	-
Body mass index			18.43	0.000			
Underweight	1.45	0.40	13.55	0.000	4.27	1.97	9.26
Normal weight	-0.45	0.36	1.62	0.203	0.64	0.32	1.28
Overweight *	-	-	-	-	-	-	-
Husband's education			1.62	0.446			
Primary	-0.08	0.61	0.02	0.898	0.92	0.28	3.07
Secondary	-0.47	0.41	1.32	0.250	0.62	0.28	1.40
Above secondary *	-	-	-	-	-	-	-
Husband's occupation			13.63	0.001			
Service	-1.29	0.38	11.42	0.001	0.28	0.13	0.58
Business	-1.37	0.38	12.90	0.000	0.25	0.12	0.54
Others *	-	-	-	-	-	-	-

Table 2 continued

Background characteristics	Coefficients	S.E.	Wald (χ^2)	P-value	Odds ratio	95% CI of odds ratio	
						Min.	Max.
Monthly family income (Tk.)			1.15	0.562			
≤30000	0.09	0.31	0.08	0.773	1.10	0.59	2.03
31000-45000	-0.28	0.33	0.70	0.402	0.76	0.40	1.45
> 45000*	-	-	-	-	-	-	-
Age at 1st delivery (years)			0.06	0.969			
15-20	0.11	0.44	0.06	0.810	1.11	0.47	2.63
21-25	0.02	0.33	0.00	0.961	1.02	0.54	1.93
26 and above *	-	-	-	-	-	-	-
Delay from menarche to 1st live birth (years)				0.939			
≤8	0.03	0.37	0.01	0.939	1.03	0.50	2.13
>8*	-	-	-	-	-	-	-
Use of contraception			4.62	0.013			
No	-0.86	0.40	4.62	0.032	0.42	0.19	0.93
Yes*	-	-	-	-	-	-	-
Preferring method			5.18	0.023			
Pills	-0.93	0.41	5.18	0.023	0.40	0.18	0.88
Others *	-	-	-	-	-	-	-
Exercising habit			4.50	0.034			
No	-0.53	0.25	4.50	0.034	0.59	0.36	0.96
Yes*	-	-	-	-	-	-	-
Presence of disease			9.84	0.08			
Diabetes	0.93	0.40	5.39	0.020	2.55	1.16	5.60
Hypertension	0.82	0.39	4.53	0.033	2.28	1.07	4.87
Low-Pressure	0.94	0.51	3.38	0.066	2.57	0.94	7.03
Cardiovascular and hypertension	0.41	0.43	0.89	0.345	1.50	0.65	3.48
Diabetes, low pressure and hypertension	1.09	0.40	7.40	0.007	2.97	1.36	6.49
Others *	-	-	-	-	-	-	-

Table 2 continued

Background characteristics	Coefficients	S.E.	Wald (χ^2)	P-value	Odds ratio	95% odds Min.	CI of ratio Max.
Food intake			0.50	0.780			
Low	0.23	0.33	0.48	0.489	1.26	0.66	2.39
Normal	0.05	0.25	0.04	0.851	1.05	0.64	1.72
Rich *	-	-	-	-	-	-	-
Psychological symptoms			6.43	0.377			
Irritability	-0.40	0.42	0.88	0.348	0.67	0.29	1.54
Mood swings	0.76	0.47	2.60	0.107	2.14	0.85	5.39
Tension and depression	0.72	0.48	2.25	0.133	2.05	0.80	5.22
Irritability and mood swings	0.61	0.52	1.41	0.235	1.85	0.67	5.08
Irritability and tension, and depression	0.37	0.33	1.26	0.261	1.44	0.76	2.73
Mood swings and tension and depression	0.19	0.36	0.27	0.601	1.20	0.60	2.42
Irritability, mood swings, tension, and depression *	-	-	-	-	-	-	-
-2log likelihood	867.788						
Chi-square	107.414						
p-value	0.000						

Note: * reference category

Similarly, the finding also depicts that the preferring method of contraception has significant impact on age at menopause ($p < 0.05$). The odds ratio for the respondents who have used pills as a family planning method is 0.40, indicating that the probability of having menopause is comparatively lower for the respondents who use traditional method like pills (OR: 0.40, 95% CI: 0.18-0.88) than the respondents who use other contraceptive methods. Exercising habits of the adult respondents significantly affect the age at menopause ($P < 0.05$). The odds ratio of menopausal age

is lower for the respondents who have no regular exercising habit (OR: 0.59, 95% CI: 0.36-0.96) than those who have exercising habit. The presence of disease among the respondents has a significant impact ($p < 0.10$) on age at menopause. It reveals from Table 2 that the respondents who are suffering from diabetes, low pressure, and hypertension have 2.97 times higher risk (OR: 2.97, 95% CI: 1.36-6.49) of attaining early menopause compared to those who are suffering from other diseases. The overall findings of this study at a glance reflect that respondents' current age, BMI, husbands' occupation, use of family planning method, preferred method, exercising habit, and disease presence are found statistically significant impact on menopausal age of the females. In the Omnibus test of goodness of fit of the model, ($-2\log$ likelihood=867.79 and $\chi^2= 107.41$, $p=0.000$), indicating that the overall multivariate regression model of the study fits the data well.

In sum, the overall mean age at menopause is found 47.07 years among the females in Chattogram metropolitan area with wide variations by background characteristics of the respondents. This value in the urban areas is relatively lower than the mean age at menopause found in other studies. The previous research conducted in Australia and Northern Iran reported that the average age of menopause is 50 years among adult women [21, 22]. Other studies on age at menopause reveal that natural menopause occurs at 51 years [7, 23, 24], and the median age at onset of perimenopause is 47.5 years [25, 26]. In addition to univariate analysis and its differentials the result of the Cox-proportional hazard model of this study illustrates that the respondents' current age has a significant impact on age at menopause. The age group 46-50 years has a higher chance of experiencing early menopause than other age groups. The findings of this study elucidate that body mass index has a significant effect on the age at menopause among urban women. The underweighted women are more susceptible to early menopause than normal and overweighted women. Biologically, acute underweighted women are considered to be malnourished with several physical problems and disabilities. These may cause the too early menopause of underweighted women. Thus, age at menopause is significantly influenced by the covariate BMI [27]. Similar to the findings of this

study, an earlier study found that the age of menopausal onset was found high for the high BMI index [28].

Likewise, underweighted women are more at risk at early menopause than the overweighed women [9], supporting the result of the present study. Similarly, a significant correlation was also found between the age of onset of menopause and body mass index in a study conducted among menopausal and postmenopausal females [29, 30]. Husbands' occupation significantly influences the age of onset of menopause among urban women in Bangladesh. A same type of study conducted in Australia found that the difference in age at menopause is significant in different occupational groups [7]. The present study reveals that the respondents who used contraceptive methods and preferring any method affect the age of menopausal onset significantly. Women using mixed contraceptive methods are at the risk of high menopausal symptoms [31]. The exercising habit of the adult respondents is one the significant covariates of the age of onset of menopause. The respondents who have exercising habits have a higher probability of early menopause compared to the respondents who do not have exercising habits. A previous study found that physical activity and the use of oral contraception significantly affect the age of onset of menopause [27]. Moreover, another study also reported that physical activity significantly negatively correlated with menopausal symptoms [30]. One of the most important factors found to significantly influence the age of onset of menopause is the presence to disease. Furthermore, the respondents with hypertension, low pressure, and diabetes have a greater hazard risk of early menopause than the respondents with other diseases. A study conducted in 2021 confirm that the respondents who have hypertension and cardiovascular disease are most at risk of early menopause, compared to diabetes and low pressure [32].

5. Limitations and Strength of the study

This study was conducted on the basis of the primary data collected from adult married women in an urban area of Bangladesh. The main limitation of this study is that the respondents were selected purposively due to the absence of a complete

frame of the adult married women in the study area. Since a cross-sectional survey was conducted to collect data rather than a longitudinal survey, inaccurate information may occur due to the memory lapse of the respondents and digit preference. Moreover, the exact date of relevant vital events may not be obtained due to the incomplete vital registration. The socio-economic, demographic and nutritional statuses in the study area are comparatively better due to the adequate urban facilities than other parts of the country; hence, selection bias can occur in the study. The mean age at menopause and its differentials obtained in this research work may vary if the respondents from rural and slum areas are included with urban respondents. However, the strength of the study is that the data was collected personally from the households by direct interview of the respondents, and field editing was carried out at the time of the survey accordingly rather than in-house editing. These made the research relatively more convenient and fruitful regarding the computation of menopausal age of women in such an urban area of Bangladesh.

6. Conclusions

Menopause is the complete end of last menstrual period of the human females, which implies the permanent cessation of womens' reproductive process. It is a biological universal phenomenon among human females. In this research study, the average age at menopause is found 47.07 years among the adult urban married women with wide variations by available background characteristics of the selected respondents. Age of respondent shows that the age group 46-50 years is more at risk of early menopause. The anthropometric variable body mass index of the respondents has a significant impact on age at menopause. Results of the study confirm that underweighted women are more susceptible to the early onset of menopause. The use of contraception and the preference of contraceptive methods are the significant covariates of age at menopause. The respondents who have physically exercising habit also have significant impact on the variation of the timing of menopause. As expected, the presence of the disease has a significant impact on the age at onset of menopause. This study found that the respondents who have diabetes, low pressure,

and hypertension are more vulnerable at the early onset of menopause. Thus, the policymakers may take necessary steps to ensure balanced nutrition, prevention of diseases, low parity, and increased awareness of proper contraception use for the betterment of the current scenario of menopausal incidence among adult premenopausal married women. Finally, it can be concluded that in addition to complete vital registration and longitudinal survey, the selection of respondents by random sampling scheme could be a better technique for in-depth study of age at menopause among adult married women in Bangladesh.

References

- [1] S. Sherman: *The American journal of medicine*, 2005, **118**, 3-7.
- [2] M. Bustami, K. Z. Matalka, Y. Elyyan, Hussein, N. N. Hussein, and N. A. Safieh : *Risk Management and Healthcare Policy*, 2021, **14**, 199-207.
- [3] M. E. Ossewaarde and M. L. Bots: *Epidemiology*, 2005, **16**, 556-562.
- [4] K. Triebner, I. Markevych and S. Hustad: *Environmental International*, 2019, **132**, 1050-1088.
- [5] M.J. de Kleijn: *American Journal of Epidemiology*, 2002, **155**, 339-345.
- [6] F. Atsma, Bartelink, D. Grobbee and Y. Van der Schouw: *Menopause*, 2006, **13**, 265-279.
- [7] K. S. Do, Treloar, N. Pandeya, D. Purdie, A. Green and A. Heath: *Human Biology*, 1998, **70**, 1073-1091.
- [8] R. Cui, H. Iso, H. Toyoshima and C. Date: *Journal of Epidemiology*, 2006, **16**, 177-184.
- [9] D. Zhu, H. Chung, N. Pandeya and A. Dobson: *European Journal of Epidemiology*, 2018, **33**, 699-710.
- [10] E. Løkkegaard, Z. Jovanovic, B. Heitmann and Keiding: *Maturitas*, 2006, **53**, 226-233.
- [11] D. Kritz-Silverstein and E. Barrett-Connor: *American Journal of Public Health*, 1993, **83**, 983-988.
- [12] N. Hidayet, S. Sharaf, S. Aref, T. Tawfik, and I. Moubarak: *National Library of Medicine*, 1999, **5**, 307-319.
- [13] Correlates of Age at Natural Menopause: “A community-based study in Alexandria”, 2021, PubMed n.d. <https://pubmed.ncbi.nlm.nih.gov/10793807/> (accessed March 19, 2021).

- [14] O. Özdemir and M. Çöl: *Maturitas*, 2004, **49**, 211-219.
- [15] R. Gosden: *Human Reproduction*, 1987, **2**, 617-621.
- [16] A. Holte: *Maturitas*, 1992, **14**, 127-141.
- [17] M. Hunter and I. O'Dea: *Psychological Health & Medicine*, 2001, **6**, 65-76.
- [18] L. Sievert, D. Waddle and K. Canali: *American Journal of Human Biology*, 2001, **13**, 479-485.
- [19] F. Thomas, F. Renaud, E. Benefice and T. De Meeüs: *Human Biology*, 2001, **73**, 271-290.
- [20] M. Ahuja: *Journal of Midlife Health*, 2016, **7**, 126-131.
- [21] S. E. Mc Nagny: *Annals of Internal Medicine*, 1999, **131**, 605-616.
- [22] M. A. Delavar and M. Hajiahmadi: *Iranian Red Crescent Medical Journal*, 2011, **13**, 192-198.
- [23] S. M. McKinlay, D.J. Brambilla and J. G. Posner: *American Journal of Human Biology*, 1992, **4**, 37-46.
- [24] E. B. Gold: *American Journal of Epidemiology*, 2001, **153**, 865-874.
- [25] R. Luoto, J. Kaprio and A. Uutela: *American Journal of Epidemiology*, 1994, **139**, 64-76.
- [26] J. L. Stanford, P. Hartge, L.A. Brinton, R.N. Hoover and R. Brookmeyer: *Journal of chronic Diseases*, 1987, **40**, 995-1002.
- [27] B. Ceylan and N. Özerdoğan: *Türk Jinekoloji ve Obstetrik Dernegi Dergisi*, 2015, **12**, 43-49.
- [28] L. Maru, R. Verma, M. Verma and M. Shrimal: *International Journal of Research in Medical Sciences*, 2016, **4**, 2206-2209.
- [29] N. Singh, M. Shinde, H. Dafal, A. Trivedi and Y. Chouhan: *International Journal of Medical Science and Public Health*, 2018, 994-1012.
- [30] A. El Hajj, N. Wardy, S. Haidar, D. Bourgi, M. El. Haddad and D. El. Chammas: *PLoS One*, 2020, **15**, e0230515.
- [31] S.H. Bakour, A. Hatti and S. Whalen: *The Obstetrician & Gynaecologist*, 2017, **19**, 289-297.
- [32] M. Bustami, K.Z. Matalka, Y. Elyyan, N. Hussein, N. Hussein and N. Abu Safieh: *Risk Management and Healthcare Policy*, 2021, **14**, 199-207.