





# Age at Natural Menopause and Influencing Factors in Women Attending the Gynecological Outpatient Clinic at a Tertiary Care Hospital

Khadija Yusuf Ali <sup>1</sup>, Umut Erkok <sup>1</sup>, Nur Adam Mohamed <sup>2</sup>, Nasra Mohamud Hilowle<sup>3</sup>, Hodan Abdi Hassan Elmi <sup>1</sup>, Rahma Yusuf Haji Mohamud<sup>4</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, Mogadishu Somalia Türkiye Recep Tayyip Erdogan Training and Research Hospital, Mogadishu, Somalia; <sup>2</sup>Department of Psychiatry and Behavioral Sciences, Mogadishu Somalia Türkiye Recep Tayyip Erdogan Training and Research Hospital, Mogadishu, Somalia; <sup>3</sup>Department Anesthesiology and Reanimation, Mogadishu Somali Turkey, Recep Tayyip Erdogan Training and Research Hospital, Mogadishu, Somalia; <sup>4</sup>Department of Education, Mogadishu Somalia Türkiye Recep Tayyip Erdogan Training and Research Hospital, Mogadishu, Somalia

Correspondence: Khadija Yusuf Ali, Mogadishu Somalia Türkiye Recep Tayyip Erdogan Research and Training Hospital, Department of Obstetrics and Gynecology, Mogadishu, Somalia, Email khadiijo13@hotmail.com

**Background:** Menopause is the irreversible cessation of menstruation that results from the lack of ovarian follicular function and is diagnosed after 12 consecutive months of amenorrhea without reasonable cause. This study aims to determine the average age at natural menopause and identify its associated factors among Somali women.

**Methods:** This is a cross-sectional study conducted at the Mogadishu Somalia Türkiye Recep Tayyip Erdogan research and training hospital's Obstetrics and Gynecology outpatient clinic between June 1 and July 1, 2023. Data was collected from subjects during the data collection period using face-to-face interviews with structured questionnaires consisting of sociodemographic, lifestyle, dietary, and reproductive characteristics. A multivariate logistic regression analysis was conducted to find the association between menopause age and target variables.

**Results:** Out of the 188 participants recruited for the study, the median age of menopause was 45.00 (95% CI = 44.50–45.62), and 48.9% had either premature or early menopause. The majority (53.7%) of the participants had a minimum of eight children. In Spearman's rank correlation analysis, we found a significantly positive correlation between menopausal age and age at first ( $p < 0.01$ ), last childbirth ( $p < 0.01$ ), number of parities ( $p < 0.05$ ), and age at marriage ( $p < 0.05$ ). In multivariate logistic regression, we found that the odds of developing premature or early menopause among unemployed women were 59% lower than those of employed women (AOR = 0.41, 95% CI = 0.18–0.93).

**Conclusion:** In this study, we established that the age of natural menopause was lower than the findings reported by previous authors. We also found that employment status, education, history of contraceptive use, BMI, age at first and last childbirth, and parity were associated with age at natural menopause, suggesting that social, lifestyle, and reproductive factors may have an impact on menopausal age.

**Keywords:** age at menopause, parity, associated factors, postmenopausal women, Somalia

## Introduction

Menopause is a permanent natural cessation of menstruation that occurs for all women who live past the age of 40. It happens as a result of a complete halt in ovarian activity as well as changes in hypothalamic-pituitary function, which in turn cause the ovaries to stop producing both estrogen and gonadotropin hormones. Menopause is confirmed after 12 months of ongoing amenorrhea without any other apparent pathological or physiological reasons.<sup>1–3</sup> Menopause can develop spontaneously as a natural occurrence or be artificially induced through surgical removal of the uterus or the ovaries and through gonadotoxic therapies such as radiation therapy and chemotherapy.<sup>3,4</sup>

Globally, the average age range of menopause is 45 to 55 years, with an estimated age of between 50 and 52 years, as documented in various studies worldwide, although there are slight variations according to nations.<sup>1,2</sup> According to

a study conducted by the WHO in 13 centers across 11 countries on different continents around the world, the median age of the last menstrual period (LMP) was 50 years.<sup>5</sup> Menopause can be classified as “early” if it occurs before the age of 45 and “premature” if it starts before the age of 40.<sup>1,6</sup> The time of natural menopause has attracted much attention since menopausal age has considerable negative effects on health, in addition to fertility. According to several studies, premature or early menopause is linked to cardiovascular disease, osteoporosis, type 2 diabetes, early cognitive function impairment, lower life expectancy, and increased mortality from all causes.<sup>6–13</sup> There are slight variations in the onset of natural menopause between ethnic groups, which are strongly influenced by genetics.<sup>2,14</sup> Other studies have shown that it is affected by ethnicity, region, and geographical country. Moreover, socioeconomic level, environment, lifestyle, reproductive, or early childhood factors are related to menopausal age.<sup>15</sup>

It has been shown that women in developed nations are less likely to undergo menopause earlier than women in developing nations.<sup>8,14,16</sup> Therefore, this study aims to determine the average age at natural menopause among Somali women and identify the factors associated with the average age at natural menopause in this target population, with the hope that the results will foster a better understanding of the risk factors associated with age at menopause and assist in improving the quality of life of middle-aged women since, according to studies, menopausal age is considered a health indicator.<sup>17</sup>

## Methods

### Study Design and Population

This study used a cross-sectional descriptive design and was conducted at the Mogadishu Somalia Türkiye Recep Tayyip Erdogan research and training hospital, which is a public tertiary care hospital in the capital city of Somalia. The sample for the study was selected from women who had an appointment at the hospital’s Obstetrics and Gynecology outpatient clinic from June 1 to July 1, 2023.

### Sample Size Calculation

Based on the months before the data collection, we estimated the total number of patients with the age of menopause who could visit the outpatient clinic to be around 390 postmenopausal women. We determined the required sample size using Yamane’s formula of  $n = N / (1 + Ne^2)$ , where  $n$  is the required sample size,  $N$  is the population size, and  $e$  is the margin of error, which is 0.05 in the research study. We calculated a sample size of 197 subjects. After eliminating subjects who were unable to remember the date of their last menstrual period, 188 postmenopausal women were included in the study.

### Sampling Procedure

Systematic random sampling was used to collect data from the respondents within every two intervals while visiting the outpatient clinic of the hospital. There were roughly 390 postmenopausal women who visited the hospital on a monthly basis. The sampling interval was determined by dividing the total population who had follow-up during the month of data collection in the outpatient clinic by the sample size. Therefore, the skip interval was  $390/197 \approx 2$ .

### Inclusion and Exclusion Criteria

Patients who had attained menopause (ie, had at least 12 consecutive months of amenorrhea without breastfeeding, contraception, pregnancy, or any other reason) who were willing to participate and provided consent were included. Women who had undergone induced menopause by either hysterectomy or oophorectomy or through drugs such as radiation or chemotherapy, and those with uncontrolled medical problems, were excluded.

### Data Collection Method

The data were collected from 188 postmenopausal women using a self-administered questionnaire developed following a comprehensive literature study.<sup>16,18,19</sup> Individual interviews were conducted with the assistance of professional workers from June 1 to July 2023. All interviews were conducted in the Somali language using the face-to-face interview technique.

## Study Variables

The questionnaire is divided into three sections. The first section consists of sociodemographic and lifestyle characteristics, including participant age, marital status, education level, monthly income, smoking status, physical activity, body mass index, and other variables. The second section consisted of nutritional status or dietary-related data in which participants were asked their weekly frequency of use to assess the consumption of meat, sea food, fresh eggs, and other carbohydrate-rich foods, including refined carbohydrates such as white bread, white sugar, white flour pasta, and sugar-sweetened foods and beverages, as well as vitamins and mineral intake. The third section consisted of reproductive history and included menstrual patterns, parity, age at the last menstrual period, age at marriage, age at the first and last births, and average duration of breastfeeding per child in months.

## Statistical Analysis

All statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS) Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY). Prior to data analysis, the distribution of the data was evaluated using histograms, Q-Q plots, and box plots and tested with the Shapiro–Wilk test of normality. Descriptive statistics for the categorical and continuous variables are presented using frequencies, percentages, medians, and the interquartile range (IQR). The differences between dichotomous independent variables and variables with three or more groups were analyzed using the Mann–Whitney *U*-test and the Kruskal–Wallis *H*-test, respectively. The correlation between dependent and independent variables was conducted using Spearman’s rank correlation analysis. A bivariate logistic regression analysis was performed to examine the statistical association between dependent and independent variables. Independent variables with  $p < 0.25$  at a 95% confidence interval in bivariate logistic regression were then analyzed with a multivariate logistic regression to control the confounding effects. Independent variables with  $p < 0.05$  in multivariate logistic regression were considered significantly associated with the age of menopause.

## Ethical Approval

We obtained ethical approval for the study from the hospital’s Ethics Review Board with the following reference number: MSTH/14298. The study adhered to the protocols and guidelines of the hospital and was conducted in accordance with the Declaration of Helsinki. Before the start of data collection, written informed consent was obtained from all participants, and this consent process was approved by the ethics committee of the hospital.

## Results

### Sociodemographic Variables of the Participants

One hundred eighty-eight respondents were recruited for the study; the median age of menopause was 45.00 (95% CI = 44.50–45.62), with a minimum of 34 and a maximum of 55 years, and 51.1% of them had the normal average range of natural menopause. The majority (69%) were illiterate, 80.3% were unemployed, and 51.6% had a monthly income of less than 200 USD. The results are presented in [Table 1](#).

### Reproductive and Lifestyle Variables of the Participants

Of the respondents, the majority (63.3%) were only married once in their lifetime, with the majority (53.7%) of them having a minimum of eight children. More than one-third (41.5%) were obese, with the majority being in class 1. Almost two-thirds (61.2%) were physically inactive, and 99.5% did not smoke cigarettes. The results are presented in [Table 1](#).

### Comparison of the Average Age of Menopause with Independent Variables

A Mann–Whitney *U*-test revealed a significant difference in the age of natural menopause between the unemployed (Md = 45, n = 151) and employed (Md = 43, n = 37),  $U = 2069.50$ ,  $z = -2.45$ ,  $p = 0.01$ ,  $r = 0.18$ . A Kruskal–Wallis test revealed a statistically significant difference in the age of natural menopause across three different education levels,  $\chi^2(2, n = 188) = 7.62$ ,  $p = 0.022$ . The group with primary-level education recorded a higher median score (Md = 46) than the other two education levels. The results are presented in [Table 2](#).

**Table 1** Sociodemographic, Lifestyle, and Reproductive Characteristics of the Study Population

Variables	Description	Frequency	(%)
Age (in years)	52 (13.00) *	188	100%
Education status	Illiterate Primary Secondary and above	111 44 33	59.0 23.4 17.5
Marital status	Married Divorced Widowed	124 37 21	66.5 19.7 13.8
Occupation	Unemployed Employed	151 37	80.3 19.7
Monthly income	< 200 201–499 500–1000 >1000	97 59 27 5	51.6 31.4 14.4 2.7
Smoking	No Yes	187 1	99.5 0.5
BMI	Normal weight Overweight Obesity class 1 Obesity class 2 Obesity class 3	40 70 57 18 3	21.3 37.2 30.3 9.6 1.6
Parity	≤7 ≥8	86 101	45.7 53.7
Age at menarche	14.00 (2.00) *	188	100
Age at marriage	17.00 (5.00) * Missing	187 1	99.5 0.5
Age at first childbirth	19.00 (4.00) * Missing	185 3	98.4 1.6
Age at last childbirth	39.00 (5.00) * Missing	185 3	98.4 1.6
Prior oral contraceptive use	No Yes	166 22	88.3 11.7
Physical activity pattern	Non-active Active ≥ 1 hour/week	115 73	61.2 38.8
Breastfeeding per child (months)	≤12 months >12 months	149 39	79.3 20.7
Previous menstrual cycles	Always regular Sometimes regular Irregular	97 55 36	51.6 29.3 19.1
Meat intake	<1 day per week 1–3 days per week ≥4 days per week	9 40 139	4.8 21.3 73.9

(Continued)

**Table 1** (Continued).

Variables	Description	Frequency	(%)
Fresh fruits intake	<1 day per week	106	56.4
	1–3 days per week	53	28.2
	≥4 days per week	29	15.4
Vitamins and Minerals intake	No	132	70.2
	Yes	56	29.8

**Note:** \*Median (Interquartile range).

**Table 2** Comparison of the Average Age of Menopause with Sociodemographic, Lifestyle, and Reproductive Variables

Variable	Parameters	Median (IQR)	Test Statistics	p value
Occupational status	Unemployed	45.00 (5.00)	2069.50 <sup>§</sup>	0.014
	Employed	43.00 (5.00)		
Residency	Urban	45.00 (6.00)	2492.00 <sup>§</sup>	0.487
	Rural	45.00 (7.00)		
History of contraceptive use	No	45.00 (5.00)	2181.50 <sup>§</sup>	0.023
	Yes	43.00 (4.00)		
Physical activity	Active	44.00 (6.00)	3708.50 <sup>§</sup>	0.177
	Non-active	45.00 (5.00)		
Number of live childbirths	≤7 parity	44.00 (6.00)	4962.50 <sup>§</sup>	0.092
	≥8 parity	45.00 (6.00)		
Education status	Illiterate	44.00 (5.00)	7.621 <sup>‡</sup>	0.022
	Primary	46.00 (5.00)		
	Secondary and above	43.00 (6.00)		
Monthly family income	<200	44.00 (6.00)	5.433 <sup>‡</sup>	0.143
	200–500	46.00 (6.00)		
	500–1000	44.00 (5.00)		
	1000–1500	47.00 (10.0)		
Marital status	Married	45.00 (6.00)	4.390 <sup>‡</sup>	0.222
	Divorced	44.00 (6.00)		
	Widowed	46.00 (5.00)		
Breastfeeding per child	≤12 months	44.00 (6.00)	0.821 <sup>‡</sup>	0.844
	>12 months	45.50 (6.00)		

**Notes:** <sup>§</sup>Mann–Whitney U-test; <sup>‡</sup>Kruskal Wallis H-test.

**Abbreviation:** IQR, Interquartile range.

## Factors Associated with the Age of Natural Menopause

A Spearman correlation was performed to determine the relationship between the age of menopause and the study variables, and seven variables were found to be significantly associated with the age of menopause. A significantly positive correlation was found between menopausal age and age at first and last childbirth, both with a statistical significance of  $p < 0.01$ . Similarly, a significantly positive correlation was found between menopausal age, number of parities ( $p < 0.05$ ), and age at marriage ( $p < 0.05$ ). The results are presented in [Table 3](#).

**Table 3** Correlation Between Age of Menopause and Independent Variables

Variable	Median (IQR)	Correlation Coefficient	P value
Occupational status	1.00 (0.00)	-0.179	<0.05
BMI	2.00 (1.00)	0.144	<0.05
History of OCP use	0.00 (0.00)	-0.167	<0.05
Age at marriage	17.00 (5.00)	0.151	<0.05
Age first childbirth	19.00 (4.00)	0.194	<0.01
Age at last childbirth	39.00 (5.00)	0.420	<0.01
Number of live childbirths	8.00 (5.00)	0.149	<0.05

**Abbreviations:** IQR, Interquartile range; OCP, Oral contraceptive pill.

In the bivariate logistic regression analysis model, eight factors were found to be associated with having the normal age of natural menopause: occupation, age at menarche, age at marriage, age of first childbirth, history of contraceptive use, age of last childbirth, meat intake, and duration of breastfeeding per child. These variables were candidates for multivariate logistic regression, and three factors were associated with having the normal age of natural menopause. The odds of developing premature or early menopause among employed women were 59% lower than those of unemployed women (AOR = 0.41, 95% CI = 0.18–0.93). As the age of the last childbirth increases by one unit, the odds of having the outcome of the normal average of the natural age of menopause increase by 12%. The results are presented in Table 4.

**Table 4** Bivariate and Multivariate Logistic Regression Analysis to Identify Factors Associated with Age at Menopause

Variables	Categories	Age at Menopause		COR (95% CI)	AOR (95% CI)
		≤44 (%)	≥45 (%)		
Occupational status	Unemployed	67 (35.6)	84 (44.7)	1	1
	Employed	25 (13.3)	12 (6.4)	0.38 (0.18–0.82)	0.41 (0.18–0.93)*
History of oral contraceptive use	No	77 (41.0)	89 (47.3)	1	
	Yes	15 (8.0)	7 (3.7)	0.40 (0.16–1.04)	
Age at menarche	Median (IQR)	14.00 (2.00)	14.00 (2.00)	1.24 (1.01–1.53)	
Age at marriage	Median (IQR)	17.00 (3.00)	18.00 (5.00)	1.14 (1.03–1.27)	
Age at first childbirth	Median (IQR)	18.00 (4.00)	19.00 (4.00)	1.12 (1.03–1.22)	1.16 (1.06–1.28)*
Breastfeeding per child (months)	≤12 Months	75 (39.9)	74 (39.4)	1	
	>12 Months	17 (9.0)	22 (11.7)	1.59 (0.76–3.35)	
Meat intake	<1 day per week	3 (1.6)	6 (3.2)	1	
	1–3 days per week	16 (8.5)	24 (12.8)	0.75 (0.16–3.44)	
	≥4 days per week	73 (38.8)	66 (35.1)	0.64 (0.37–1.09)	
Age at last childbirth	Median (IQR)	38.00 (4.00)	41.00 (6.00)	1.10 (1.03–1.17)	1.12 (1.04–1.20)*

**Notes:** 1=indicate for reference group; \*Significant level at p-value <0.05.

**Abbreviations:** COR, Crude odds ratio; AOR, Adjusted odds ratio; CI, Confidence interval; IQR, Interquartile range.

## Discussion

To our knowledge, this is the first study that aims to examine the average age of natural menopause and its related factors among Somali women. In the present study, the overall mean age at natural menopause was 45.06 years, which is slightly lower than in previous studies in both developed and developing countries.<sup>18,20–23</sup> This earlier age at which menopause naturally occurs in our population may be related to racial, lifestyle, and socioeconomic variations that affect menopausal age. A recent Indian study reported comparable results.<sup>9,19</sup> In a recent systematic review and meta-analysis on the average age of menopause in Iranian women, which included 40,042 participants from 28 papers published over the course of almost two decades, the average age of menopause was found to be higher than our findings.<sup>24</sup> According to evidence, the age at menopause is a complicated genetic feature with a heritability estimate that ranges between 31% and 87%.<sup>25</sup> Genome-wide association studies have linked numerous prospective gene candidates to common genetic loci influencing a variety of molecular processes, including neuroendocrine circuits of ovarian function, mitochondrial biogenesis, immunological function, and DNA repair.<sup>26–29</sup> Additionally, our results revealed that almost half of the participants had premature or early menopause, which is much higher than the findings reported in previous studies.<sup>18,23,30</sup>

In this study, we found that women who had jobs were more likely to have an early age at menopause compared to their unemployed female counterparts, which is similar to previous studies.<sup>31,32</sup> Wang et al stated that housewives consistently had greater probabilities of both premature and early menopause, which is in contrast to our findings.<sup>32</sup> Our results reported no association between marital status and menopausal age, which is in line with previous studies.<sup>33–35</sup> but against several other studies.<sup>19,32,36–38</sup> Similarly, no correlation was found between physical activity and menopausal age, which is consistent with previous studies<sup>19,33,34</sup> but contradicts other studies findings,<sup>18,39</sup> which found that physical activity will increase the risk of early menopause.

According to the available data, exercise causes a large reduction in serum female sex hormone levels, which could result in an early onset of menopause.<sup>40</sup> Similar to a previous study,<sup>34</sup> our results did not find a relationship between household income and menopausal age. In contrast to our findings, a recent South Korean study showed that lower household income was associated with early menopause.<sup>31</sup>

One of the most well-established and frequently noticed risk factors for younger women going through menopause is smoking cigarettes. In this study, since the percentage of smokers was very small, there was no correlation between smoking and the age of menopause, which is consistent with previous studies.<sup>16,33–35</sup> In contrast to our results, several recent studies reported that smoking was correlated with the premature and/or early age of menopause.<sup>18,20,23</sup> Our findings highlighted that there is a significant positive association between BMI and age at menopause, which is in line with previous studies conducted in India<sup>41</sup> and China<sup>18</sup> but contradicts studies from Poland<sup>33</sup> and Iran.<sup>34</sup> Additionally, a meta-analysis of nine articles with a total of 313,482 participants reported that as the BMI of the women increased, the age at menopause also increased.<sup>42</sup> Similarly, a recent study looking into the relationship between BMI and age at natural menopause in eleven prospective studies with a total of 24,196 women showed that underweight women were at increased risk of early menopause, while overweight and obese women were at increased risk of late menopause.<sup>43</sup>

In the present study, no association was found between age at menarche and age at menopause, which is congruent with a previous study.<sup>16</sup> In contrast to our findings, a Polish study,<sup>33</sup> a Burkina Faso study,<sup>36</sup> and a recent systematic review and meta-analysis,<sup>44</sup> all revealed that there was a relationship between age at menarche and age at menopause. In this study, we discovered that age at first marriage was positively and significantly associated with menopausal age, which is inconsistent with previous studies,<sup>16,35</sup> and that a higher age at first marriage was linked to a later menopausal age. Additionally, our results found that age at first childbirth was positively and significantly associated with menopausal age, which is in line with a previous study<sup>16</sup> but contradicts studies from Poland,<sup>33</sup> Iran,<sup>35</sup> and Burkina Faso<sup>36</sup> that reported no relation between age at first pregnancy and/or first live birth with the age at menopause.

We did not find a connection between menopausal age and the average length of breastfeeding per child, in contrast to Iranian,<sup>16</sup> Indian,<sup>37</sup> and Polish studies.<sup>33</sup> Similarly, a recent published cohort study conducted in the USA that monitored more than 100,000 premenopausal women for more than two decades discovered that breastfeeding at levels that are in accordance with the current recommendations may have an extra advantage of reducing the chance of early menopause.<sup>45</sup>

Age at last childbirth was also positively and significantly correlated with menopausal age, which is in line with a previous study.<sup>19,37</sup> Our study revealed that among reproductive variables, there was a significant relationship between the number of live births and the age at menopause, which is in line with previous studies.<sup>16,21,33,45</sup> Similarly, we found a negative association between a history of OCP use and menopausal age, which is comparable with several previous studies.<sup>19,46</sup> In contrast to our findings, a recent systematic review and meta-analysis<sup>44</sup> and a recent cohort study<sup>23</sup> both found that the use of OCP during the reproductive period was associated with later menopause. Similarly, a Polish study found that women who had ever used OCP were more likely to experience menopause 0.7 years later than women who had never used it.<sup>33</sup> The mechanism by which both parity and oral contraceptives reduce the FSH level and thus delay menopause might be one possible physiological explanation for this connection.

The evidence available in the literature on the connection between diet and the age of onset of menopause is controversial. In Somalia, the main diet sources are carbohydrate-rich foods such as rice, spaghetti, bread, cereals, potatoes, red meat, and canjeero. In spite of that fact, in the present study, we did not find any connection between different kinds of dietary products and menopausal age, which is inconsistent with the findings of several previous studies.<sup>18,32,47,48</sup> According to a recent systematic review and meta-analysis of 15 papers with 298,413 postmenopausal women, an earlier age of onset of natural menopause was associated with increased consumption of yellow and green vegetables, while high use of several dairy products, such as skimmed and low-fat milk, and low consumption of alcohol were connected with a later onset of natural menopause.<sup>49</sup>

Our study has certain limitations. First, we relied on self-reported information such as the onset of menopause, the age of menarche, and the duration of breastfeeding, which can cause recall bias and in turn lead to miscategorization. Second, the study was cross-sectional in design, so we cannot exactly establish a cause-and-effect relationship. Third, in contrast to previous studies on this subject, the sample size is very small, so the findings cannot be generalized to the population at large. Despite these limitations, this study is the first of its kind in Somalia to analyze the average age at onset of menopause and its associated factors.

## In Conclusion

We found that the age of natural menopause was lower than the findings reported by previous authors. We also found that employment status, education, history of contraceptive use, BMI, age at first and last childbirth, and parity were associated with age at natural menopause, suggesting that social, lifestyle, and reproductive factors may have an impact on menopausal age. Additionally, in this study, we failed to find an association between dietary factors and age at natural menopause.

## Abbreviations

LMP, Last menstrual period; BMI, Body Mass Index; USA, United States of America; OCPs, Oral Contraceptive Pills.

## Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon request.

## Ethics Approval and Consent to Participate

Ethical clearance was obtained from the ethical review board of the Hospital. Either oral or written informed consent was obtained from each participant before participation. Information obtained in due course was kept confidential.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

## Disclosure

The authors reported no conflicts of interest related to this article.

## References

1. Honor JW. Biochemistry of the menopause. *Ann Clin Biochem.* 2018;55(1):18–33. doi:10.1177/0004563217739930
2. World Health Organization. *Research on the Menopause in the 1990s: Report of a WHO Scientific Group.* World Health Organization; 1996.
3. Perlman B, Kulak D, Goldsmith LT, Weiss G. The etiology of menopause: not just ovarian dysfunction but also a role for the central nervous system. *Global Reprod Health.* 2018;3(2):e8. doi:10.1097/GRH.000000000000008
4. Isabu AC, Agunwa EU. Demystifying the dread of menopause among the aging women: the role of the nurse. *Niger J Health Promot.* 2020;13:1.
5. Morabia A, Costanza MC. International variability in ages at menarche, first livebirth, and menopause. world health organization collaborative study of neoplasia and steroid contraceptives. *Am J Epidemiol.* 1998;148(12):1195–1205. doi:10.1093/oxfordjournals.aje.a009609
6. Mishra GD, Chung HF, Cano A, Chedraui P, Goulis DG. EMAS position statement: predictors of premature and early natural menopause. *Maturitas.* 2019;123:82–88. doi:10.1016/j.maturitas.2019.03.008
7. Zhu D, Chung HF, Dobson AJ, Pandeya N, Brunner EJ, Kuh D. Type of menopause, age of menopause and variations in the risk of incident cardiovascular disease: pooled analysis of individual data from 10 international studies. *Human Reprod.* 2020;35(8):1933–1943. doi:10.1093/humrep/deaa124
8. Zhu D, Chung HF, Dobson AJ, Pandeya N, Giles GG. Age at natural menopause and risk of incident cardiovascular disease: a pooled analysis of individual patient data. *Lancet Public Health.* 2019;4(11):e553–e564. doi:10.1016/S2468-2667(19)30155-0
9. Ahuja M. Age of menopause and determinants of menopause age: a PAN India survey by IMS. *J Midlife Health.* 2016;7(3):126–131. doi:10.4103/0976-7800.191012
10. Moir ME, Corkery AT, Senese KA, Miller KB. Age at natural menopause impacts cerebrovascular reactivity and brain structure. *American journal of physiology. Regul Integr Compar Physiol.* 2023;324(2):R207–R215. doi:10.1152/ajpregu.00228.2022
11. Tschiederer L, Peters S, van der Schouw YT, van Westing AC. Age at menopause and the risk of stroke: observational and Mendelian randomization analysis in 204,244 postmenopausal women. *medRxiv.* 2023;2023:1.
12. Shuster LT, Rhodes DJ, Gostout BS, Grossardt BR, Rocca WA. Premature menopause or early menopause: long-term health consequences. *Maturitas.* 2010;65(2):161–166. doi:10.1016/j.maturitas.2009.08.003
13. Gold EB. The timing of the age at which natural menopause occurs. *Obstet Gynecol Clin North Am.* 2011;38(3):425–440. doi:10.1016/j.ogc.2011.05.002
14. Schoenaker DA, Jackson CA, Rowlands JV, Mishra GD. Socioeconomic position, lifestyle factors and age at natural menopause: a systematic review and meta-analyses of studies across six continents. *Int J Epidemiol.* 2014;43(5):1542–1562. doi:10.1093/ije/dyu094
15. Reynolds RF, Obermeyer CM. Age at natural menopause in Spain and the United States: results from the DAMES project. *Am J Hum Biol.* 2005;17(3):331–340. doi:10.1002/ajhb.20121
16. Zamaniyan M, Moosazadeh M, Peyvandi S, et al. Age of natural menopause and related factors among the tabari cohort. *J Menop Med.* 2020;26(1):18–23. doi:10.6118/jmm.19004
17. Sun X, Li W, Zhang R, et al. Effects of parity on the age at menopause and menopausal syndrome: a cross-sectional study in Northwest China. *medRxiv.* 2020:2020:4.
18. Wang M, Gong WW, Hu RY, et al. Age at natural menopause and associated factors in adult women: findings from the China Kadoorie Biobank study in Zhejiang rural area. *PLoS One.* 2018;13(4):e0195658. doi:10.1371/journal.pone.0195658
19. Singh P, Vyas S, Vallabh V, Nautiyal R, Srivastava A. Age at natural menopause and factors affecting its onset: a cross-sectional study among postmenopausal females in District Dehradun. *Indian J Community Health.* 2022;34(2):241–247. doi:10.47203/IJCH.2022.v34i02.018
20. Bustami M, Matalka KZ, Elyyan Y, Hussein N. Age of natural menopause among Jordanian women and factors related to premature and early menopause. *Risk Manag Healthc Policy.* 2021;14:199–207. doi:10.2147/RMHP.S289851
21. Diongue FB, Faye A, Niang K, et al. Study of factors associated with the age of natural menopause in menopausal women aged 30 to 80 years from the Keur massar health district in 2015 (Senegal). *Health.* 2020;12(10):1333. doi:10.4236/health.2020.1210095
22. Yasui T, Hayashi K, Mizunuma H, et al. Factors associated with premature ovarian failure, early menopause and earlier onset of menopause in Japanese women. *Maturitas.* 2012;72(3):249–255. doi:10.1016/j.maturitas.2012.04.002
23. Vatankhah H, Khalili P, Vatanparast M, Ayoobi F, Esmaili-Nadimi A, Jamali Z. Prevalence of early and late menopause and its determinants in Rafsanjan cohort study. *Sci Rep.* 2023;13(1):1847. doi:10.1038/s41598-023-28526-y
24. Naz MSG, Sayehmiri F, Kiani F, Ozgoli G. A systematic review and meta-analysis on the average age of menopause among Iranian women. *J Evid Bas Care.* 2018;8:4.
25. Voorhuis M, Onland-Moret NC, van der Schouw YT, Fauser BC, Broekmans FJ. Human studies on genetics of the age at natural menopause: a systematic review. *Hum Reprod Update.* 2010;16(4):364–377. doi:10.1093/humupd/dmp055
26. Sarnowski C, Kavousi M, Isaacs S, Demerath EW, Broer L. Genetic variants associated with earlier age at menopause increase the risk of cardiovascular events in women. *Menopause.* 2018;25(4):451–457. doi:10.1097/GME.0000000000001017
27. Stolk L, Perry JR, Chasman DI, He C, Mangino M. Meta-analyses identify 13 loci associated with age at menopause and highlight DNA repair and immune pathways. *Nat Genet.* 2012;44(3):260–268. doi:10.1038/ng.1051
28. Shi J, Zhang B, Choi JY, et al. Age at menarche and age at natural menopause in East Asian women: a genome-wide association study. *Age.* 2016;38(5–6):513–523. doi:10.1007/s11357-016-9939-5
29. Laven JSE, Visser JA, Uitterlinden AG, Vermeij WP, Hoijmakers JHJ. Menopause: genome stability as new paradigm. *Maturitas.* 2016;92:15–23. doi:10.1016/j.maturitas.2016.07.006
30. Mishra GD, Pandeya N, Dobson AJ, Chung HF. Early menarche, nulliparity and the risk for premature and early natural menopause. *Human Reprod.* 2017;32(3):679–686.
31. Lim YM, Jeong K, Lee SR, Chung HW, Lee W. Association between premature ovarian insufficiency, early menopause, socioeconomic status in a nationally representative sample from Korea. *Maturitas.* 2019;121:22–27. doi:10.1016/j.maturitas.2018.12.004

32. Wang M, Kartsonaki C, Guo Y, Lv J, Gan W, Chen ZM. Factors related to age at natural menopause in China: results from the China Kadoorie Biobank. *Menopause*. 2021;28(10):1130–1142. doi:10.1097/GME.0000000000001829
33. Kaczmarek M. The timing of natural menopause in Poland and associated factors. *Maturitas*. 2007;57(2):139–153. doi:10.1016/j.maturitas.2006.12.001
34. Abdollahi AA, Qorbani M, Asayesh H, Rezapour A. The menopausal age and associated factors in Gorgan, Iran. *Med J Islam Repub Iran*. 2013;27(2):50–56.
35. Golshiri P, Akbari M, Abdollahzadeh MR. Age at natural menopause and related factors in Isfahan, Iran. *J Menop Med*. 2016;22(2):87–93. doi:10.6118/jmm.2016.22.2.87
36. Faye A, Nikiema C, Tal-Dia A. Socioeconomic adversities during life course and menopause onset in a developing country. *Epidemiology*. 2017;7:3.
37. Sinha I, Sen J. Factors affecting menopause among Rajbanshi women of North Bengal. *Human Bio Rev*. 2017;6:4.
38. Lay AAR, Duarte YAO, Filho ADPC. Factors associated with age at natural menopause among elderly women in São Paulo, Brazil. *Menopause*. 2019;26(2):211–216. doi:10.1097/GME.0000000000001186
39. Park CY, Lim JY, Park HY. Age at natural menopause in Koreans: secular trends and influences thereon. *Menopause*. 2018;25(4):423–429. doi:10.1097/GME.0000000000001019
40. Ennour-Idrissi K, Maunsell E, Diorio C. Effect of physical activity on sex hormones in women: a systematic review and meta-analysis of randomized controlled trials. *Br Cancer Res*. 2015;17(1):139. doi:10.1186/s13058-015-0647-3
41. Maru L, Verma R, Verma M, Shrimal M. Correlation of body mass index and age of menopause in women attending medicine and gynaecology department of a tertiary care centre. *Int J Res Med Sci*. 2016;4:2206–2209. doi:10.18203/2320-6012.ijrms20161787
42. Tao X, Jiang A, Yin L, Li Y, Tao F, Hu H. Body mass index and age at natural menopause: a meta-analysis. *Menopause*. 2015;22(4):469–474. doi:10.1097/GME.0000000000000324
43. Zhu D, Chung HF, Pandeya N, Dobson AJ, Kuh D. Body mass index and age at natural menopause: an international pooled analysis of 11 prospective studies. *Eur J Epidemiol*. 2018;33(8):699–710. doi:10.1007/s10654-018-0367-y
44. Roman Lay AA, Do Nascimento CF, Horta BL, Chiavegatto Filho A. Reproductive factors and age at natural menopause: a systematic review and meta-analysis. *Maturitas*. 2020;131:57–64. doi:10.1016/j.maturitas.2019.10.012
45. Langton CR, Whitcomb BW, Purdue-Smithe AC, Sievert LL. Association of parity and breastfeeding with risk of early natural menopause. *JAMA Net Open*. 2020;3(1):e1919615. doi:10.1001/jamanetworkopen.2019.19615
46. Arinkan SA, Gunacti M. Factors influencing age at natural menopause. *J Obstet Gynaecol Res*. 2021;47(3):913–920. doi:10.1111/jog.14614
47. Nagel G, Altenburg HP, Nieters A, Boffetta P, Linseisen J. Reproductive and dietary determinants of the age at menopause in EPIC-Heidelberg. *Maturitas*. 2005;52(3–4):337–347. doi:10.1016/j.maturitas.2005.05.013
48. Sapre S, Thakur R. Lifestyle and dietary factors determine age at natural menopause. *J Midlife Health*. 2014;5(1):3–5. doi:10.4103/0976-7800.127779
49. Grisotto G, Farago JS, Taneri PE, Wehrli F, Roa-Diaz ZM. Dietary factors and onset of natural menopause: a systematic review and meta-analysis. *Maturitas*. 2022;159:15–32. doi:10.1016/j.maturitas.2021.12.008

International Journal of Women's Health

Dovepress

Publish your work in this journal

The International Journal of Women's Health is an international, peer-reviewed open-access journal publishing original research, reports, editorials, reviews and commentaries on all aspects of women's healthcare including gynecology, obstetrics, and breast cancer. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/international-journal-of-womens-health-journal>