Factors that influence natural menopause onset in China: a cross-sectional study

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Research article

Keywords: Age of onset, Epidemiologic factor, Menopause, Perimenopause

Posted Date: September 21st, 2020

DOI: https://doi.org/10.21203/rs.3.rs-59501/v1

Abstract

Background

This paper aimed to explore the average natural menopause age, the span of menopausal age, and the related factors that will probably affect the natural menopause age of Chinese women.

Methods

A large-scale random sampling of menopausal women aged 32-75 years in 18 provinces or municipalities throughout China was conducted using paper questionnaire surveys to investigate the menopause age, menarche age, fertility status, illness history, and living habits. The SPSS 24.0 software package was used to carry out *t* test, chi-square test, logistic regression, and other statistical analyses.

Results

A total of 5852 questionnaires were collected. After excluding questionnaires having no menopause, questionnaires with incomplete or invalid information, and questionnaires that may directly affect the age of menopause, such as hysterectomy, oophorectomy, and other factors that may affect natural menopause, a total of 4426 effective questionnaires have been collected, and the average age of natural menopause was 49.49 ± 3.67 years old.

Conclusion

Factors that may affect the age of natural menopause are weight, menarche age, marital status, drinking tea or not (often and daily), eating supplements, oral contraceptive contraception, and safe contraception.

Background

Studies have shown that the occurrence and development of many diseases, including malignant tumors, are related to estrogen levels in women [1–3]. The menstrual cycle, a normal physiological activity in women, is accompanied by periodic changes of estrogen and progesterone. The cyclical activity of estrogen affects not only the reproductive system and fertility but also the occurrence and development of various reproductive and non-reproductive system tumors and non-tumor diseases, such as breast, endometrial, ovarian, gastric, and liver cancer, liver cirrhosis, and osteoporosis [4–19]. Therefore, the study of the average age of menopause and its influencing factors can play an auxiliary role in understanding and treating such diseases. Additionally, the main factor affecting female physiological estrogen levels is menopause. However, there is a lack of data on Asian women. These women have a different physiological response to body fat (see the differing standards of BMI for Asians), which may influence estrogen levels[20]. Therefore, this study aimed to determine the average age of physiologic menopause and the span of menopausal age in Chinese women to provide a reference for health care, disease prevention, and possible intervention related to women's estrogen levels during the perimenopausal period.

1. Methods

1.1 Participants

Women aged 32-75 years who had already experienced natural menopause were recruited between January 2018 and February 2019 in 18 provinces and municipalities throughout China. They were recruited in community centers and were identified by clinicians with the following inclusion criteria: normal uterine status; no atypical endometrial hyperplasia or neoplastic lesions; intact ovaries; no cardiovascular, kidney, liver, and neurological diseases; no history of surgery; no history of hypothalamic diseases; and normal psychological status. Exclusion criteria included age below 32 or above 75 years, endocrine diseases (such as hyperthyroidism, diabetes mellitus, polycystic ovarian syndrome), and long-term hormone therapy (≥3 months) or other medications that could possibly interfere with menopausal phenomena. We obtained informed consent from the participants by written or verbal and obtained approval from the Guilin Medical college ethics review committees to conduct this research.

1.2 Study design and sampling method

A multicenter cross-sectional study was performed. Women were surveyed using a self-administered questionnaire. They were recruited in community centers and identified by clinicians. Data included current age; age of menarche and of last menstrual period; weight; marital status; number of pregnancies; frequency of drinking tea, smoking, eating fruit, and taking dietary supplements such as the donkey-hide gelatin; vegetarian status; sleep quality; and contraceptive methods. Women who had experienced the last menstrual period at least 1 year prior were defined as menopausal.

1.3 Statistical analysis

Statistical analysis was done using SPSS 24.0 (IBM, Armonk, NY). Measured data were expressed as mean ± SD; counted data were expressed by percentage (%). Comparison between two samples was done using Student's t-test. Non-normally distributed data or data with uneven variance were analyzed using the rank sum test. In addition, chi-square test was used in this research. Multiple logistic regression models were used to analyze potential influencing factors. Statistical significance was set at $\alpha = 0.05$, $P < 0.05$.

2. Results

2.1 Background data

A total of 5,852 women were surveyed and completed the questionnaire, of whom 4,426 were effectively surveyed, with a valid completion rate of 75.6%. The age range was 32-75 (59.3 ± 6.98) years old. All participants were menopausal. A total of 1426 women were excluded, including those who had surgical removal of ovaries or uterus, those with endocrine diseases (e.g., hyperthyroidism, diabetes, polycystic ovary syndrome), and those who received hormone therapy (≥3 months) and other potentially interfering

medication. Finally, 4426 naturally menopausal women under physiological conditions were analyzed. The maximum age of menopause was 65 years, and the minimum age of menopause was 32 years, with a mean of 49.49 ± 3.67 years. Based on the average age of menopause, we divided the survey sample into the younger menopause group (<45 years old), the normal menopause group (45-55 years old), and the older menopause group (>55 years old).

2.2 Natural menopause age

The mean age of onset of natural menopause was 49.49 ± 3.67 years. Among the natural menopause population, there were 327 cases (7.4%) of early menopause (<45 years), 3927 cases (88.7%) of normal menopause (45-55 years), and 172 (3.9%) cases of late menopause (>55 years).

2.3 Factors that influence menopausal age

The distribution of early, normal, and late menopause and the possible influencing factors are shown in Table 1. Logistic regression analysis to determine which factors had a statistically significant influence on the age of menopause is shown in Table 2. Logistic regression analysis of relevant influencing factors of menopausal age is shown in Table 3.

The results of the chi-square test (Table 1) revealed that marital status, frequency of drinking tea, frequency of smoking, alcohol consumption, frequency of eating fruits, taking dietary supplements, sleep quality, and contraceptive method were statistically significant among the three groups, while the proportion of vegetarian habits had no significant difference.

Logistic regression analysis (Table 2) shows that body weight, age of menarche, marital status, tea drinking (often and daily), taking supplements, oral contraceptive use, and safe period contraception methods significantly influenced menopause age. However, fertility times, occasionally drinking tea, drinking wine, eating fruits, drinking milk, condom use, and ligation and intrauterine ring contraceptive methods showed no significant difference.

The results showed that for every increase in the number of pregnancies, the age of menopause was advanced by 0.71 years; an increase of 1 kg in body weight increased the age of menopause by 0.018 years; and the age of menopause of married women was delayed by 2.587 years compared with those unmarried. Compared with people who never drank tea, occasional tea drinking had little effect on the age of menopause. The menopause age of people who drink tea frequently was delayed by 0.863 years, while the menopause age of people who drink tea daily was delayed by 0.914 years. Compared with people who never take the donkey-hide gelatin supplements, the age of menopause in those who take supplements occasionally was delayed by 0.418 years, the menopause age of people who take regular supplements was delayed by 0.806 years, and the menopause age of people who take daily supplements was delayed by 1.548 years. Compared with people who had never used contraception, the age of menopause was 0.404 years earlier for those who use oral contraceptives and 0.603 years earlier for those who adopted safe period contraception. Logistic regression analysis demonstrated that body

weight and age of menarche were predictive for menopausal age, and the fertility times are not correlated with menopausal age (Table 3).

3. Discussion

The results of this study suggest that the natural age of menopause in Chinese women is 49.49 ± 3.67 years old, and factors that may affect the age of natural menopause include body weight, age of menarche, marital status, frequent tea drinking, dietary supplements, oral contraceptive use, and safe period contraception methods. Our research showed that weight may be related to the age of menopause, which is consistent with the report by other papers[21–24]. The age of menarche was significantly related to the age of menopause, similar to previous research in Norwegian women[25]. People with earlier menarche age have earlier menopause; those with later menarche age have relatively late menopause age. Delayed ovulation time and follicle exhaust time may lead some women to have later menopause age which may be correlated to later menarche age[21–24]. Due to the late menarche, the ovulation time is delayed, and the ovarian follicle exhaustion time is also delayed. Unexhausted follicles can continue to mature, secrete estrogen, and expel the ovum. Marital status, frequent tea drinking, dietary supplements, oral contraceptive, and safe period contraception were related to the age of menopause, which are also consistent with current reports [21–24, 26–28].

Researchers have shown that the number of pregnancies is related to the age of menopause[21–24, 26–29]. However, our study shows that there is no correlation between the times of fertility and the age of menopause. After analysis, the reason may be related to the strict family planning in China since the early 1980s. Due to the strict implementation of the family planning policy, the majority of participants had only one child, which may limit our results. As the birth policy changes, the relationship between the number of pregnancies and the age of menopause may also change. Further research is needed.

This study is an initial summary of menopausal age and possible influencing factors of women in urban districts in China. Nevertheless, there are some limitations. First, there was an insufficient sample size and limited sources of respondents with comparison of about 1.4 billion Chinese populations. These both may have introduced bias. Second, there was an incomplete consideration of influencing factors, since not all factors that may affect menopausal age were analyzed, such as education level and economic status. Therefore, future research should include women with a larger geographical distribution and a larger sample size that considers more potential influencing factors.

Conclusions

This study showed that the average age of natural menopause was 49.49 ± 3.67 years old in provinces in China. Weight, menarche age, marital status, drinking tea or not (often and daily), eating supplements, oral contraceptive contraception, and safe contraception are all factors that could influence the age of natural menopause. Thus, women should pay attention to these factors to keep the age of natural menopause in the normal scope to avoid relevant diseases.

Declarations

- Ethics approval and consent to participate

We obtained informed consent from the participants by written or verbal and obtained approval from the Guilin Medical college ethics review committees to conduct this research.

- Consent to publish

We all agree to publish this paper.

- Availability of data and materials

The data in this paper can be available freely.

- Competing interests

The authors have declared that no competing interests exist. This work was supported by the Guangxi Natural Science Foundation (grant no. GUIKEAD19110071), the National Natural Science Foundation of China (grant no. 81470110), and the Guangxi College Students' Innovative Entrepreneurial Training Plan Program (grant nos. 20190601019, 20190601017, and 20190601098). This study was also supported by High-level Hospital Construction Research Project of Maoming People's Hospital.

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- Authors' Contributions

Xuming Wang and Huawei Gui were responsible for thesis writing and experimental design. Chunyan Yuan and Lijiang Liu were responsible for data processing. Jianguo Wei, Helin Huang, Zhaohui Qiu, and Xiaolu Yuan performed the data collection. All authors read and approved the final manuscript.

- Acknowledgements

This work was supported by the Guangxi Natural Science Foundation (grant no. GUIKEAD19110071), the National Natural Science Foundation of China (grant no. 81470110), and the Guangxi College Students' Innovative Entrepreneurial Training Plan Program (grant nos. 20190601019, 20190601017, and 20190601098). This study was also supported by High-level Hospital Construction Research Project of Maoming People's Hospital.

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Tables

Table 1 The analysis between the average age of natural menopause and related factors

Group	Early menopause	Normal menopause	Late menopause	Chi-square	P
Married or not				11.400	0.003
No	8 (2.4)	19 (0.5)	1 (0.6)		
Yes	319 (97.6)	3908 (99.5)	171 (99.4)		
Frequency of drinking tea				18.005	0.006
Never	123 (37.6)	1195 (30.4)	43 (25.0)		
Occasional (> once a month and <once a week)	134 (41.0)	1765 (44.9)	73 (42.4)		
Often (> once a week and <once a day)	47 (14.4)	751 (19.1)	45 (26.2)		
>=once a day	23 (7.0)	216 (5.5)	11 (6.4)		
Smoking frequency				48.471	0.000
Never	291 (89.0)	3571 (90.9)	125 (72.7)		
Occasional (> one pack a month and <one pack a week)	29 (8.9)	291 (7.4)	41 (23.8)		
Often (> one pack a week and <one pack a day)	5 (1.5)	51 (1.3)	3 (1.7)		
>=one pack a day	2 (0.6)	14 (0.4)	3 (1.7)		
Drinking frequency				26.309	0.000
Never	212 (64.8)	2268 (57.8)	86 (50.0)		
Occasional> 100ml per month and <100ml per week	88 (26.9)	1467 (37.4)	69 (40.1)		
Often> 100ml per week and <100ml per day	24 (7.3)	172 (4.4)	15 (8.7)		
>100ml per day	3 (0.9)	20 (0.5)	2 (1.2)		
Frequency of eating fruit				17.187	0.009
Never	27 (8.3)	231 (5.9)	2 (1.2)		
Occasional> 250g per month and <250g per week	111 (33.9)	1535 (39.1)	79 (45.9)		
Often> 250g per week and <250g per day	161 (49.2)	1780 (45.3)	80 (46.5)		
>250g per day	28 (8.6)	381 (9.7)	11 (6.4)		
A vegetarian or not				1.472	0.479

Yes	44 (13.5)	507 (12.9)	17 (9.9)		
No	283 (86.5)	3420 (87.1)	155 (90.1)		
Frequency of eating supplements such as the donkey-hide gelatin				37.023	0.000
Never	185 (56.6)	1935 (49.3)	54 (31.4)		
Occasional (> once a month and <once a week)	122 (37.3)	1575 (40.1)	98 (57.0)		
Often (> once a week and <once a day)	19 (5.8)	376 (9.6)	16 (9.3)		
>=once a day	1 (0.3)	41 (1.0)	4 (2.3)		
Sleep quality				23.098	0.001
Poor	159 (48.6)	2364 (60.2)	110 (64.0)		
Good	168 (51.4)	1563 (39.8)	62 (36.0)		
Contraception				32.109	0.000
Never use	79 (24.2)	944 (24.0)	46 (26.7)		
Oral contraceptive	99 (30.3)	1155 (29.4)	53 (30.8)		
Safe period	99 (303)	1160 (29.5)	40 (23.3)		
Condom	4 (1.2)	282 (7.2)	6 (3.5)		
ligation	15 (4.6)	134 (3.4)	9 (5.2)		
Intrauterine ring	31 (9.5)	252 (6.4)	18 (10.5)		

Table 2. The Correlation analysis of all impacts

Impacts	Non-standard coefficient		Standard coefficient	t	Significance
	B	Standard error	Beta		
Fertility times	-.071	.048	-.024	-1.476	.140
Weight□□Kg□	-.018	.003	-.038	-2.515	.012
Married or not 0 no 1 yes	2.587	.697	.056	3.711	.000
Menarche age	.077	.029	.041	2.624	.009
Drink tea occasionally	.198	.139	.027	1.418	.156
Drink tea often	.863	.169	.092	5.101	.000
Drink tea everyday	.914	.256	.058	3.577	.000
Drink wine occasionally	.004	.122	.000	.031	.975
Drink wine often	-.479	.263	-.028	-1.820	.069
Drink wine everyday	-1.417	.735	-.029	-1.928	.054
Eat fruit occasionally	.026	.249	.004	.106	.916
Eat fruit often	-.214	.257	-.029	-.835	.404
Eat fruit everyday	-.439	.305	-.035	-1.437	.151
Eat supplements everyday	.418	.133	.056	3.156	.002
Eat supplements often	.806	.214	.064	3.765	.000
Eat supplements everyday	1.548	.557	.043	2.778	.005
Oral contraceptive	-.404	.159	-.050	-2.539	.011
Safe period	-.603	.155	-.075	-3.896	.000
Condom	.083	.250	.006	.334	.739
ligation	-.351	.315	-.018	-1.115	.265
Intrauterine ring	-.359	.244	-.025	-1.469	.142
Drink milk occasionally	-.153	.143	-.021	-1.071	.284
Drink milk often	.345	.185	.035	1.860	.063

Drink milk everyday	.277	.324	.014	.854	.393
(constant)	46.942	.907		51.738	.000

Dependent variable：age of menopause

Table 3：The logistic correlation regression analysis

Group	Early menopause group	Normal menopause group	Late menopause group	F	P
Body weight	116.12±16.06	113.49±15.77*	110.92±18.66*	6.648	0.001
Menarche age	13.82±2.26#	13.97±1.90#	14.37±2.37	4.667	0.009
Fertility times	2.39±1.17	2.35±1.24	2.38±1.28	0.166	0.847

Table 3 * Compared with the early menopause group, P <0.05; #Compared with the late menopause group, P <0.05.

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