Introduction
Smoking is a growing public health issue as it is associated with illness, disability, and drug addiction in a number of smokers (1). Waterpipe smoking is increasing every day in different parts of the world. Among Eastern Mediterranean adults, waterpipe smoking is reported to be as high as 37.2%. In European regions and the United States, it is up to 22.7% and 11.4%, respectively (2). Global facts and figures show an increase in waterpipe consumption in women compared to men (3-5). Because as perceived by women, the social acceptability of waterpipe is higher than cigarette smoking (6), and women have a more positive attitude and dependence on using waterpipe compared to men (7, 8). At the same time, the side effects of waterpipe smoking are more severe in women than in men (8).

Waterpipe smoking in women is associated with an increased risk of premature menopause, decreased bone density, infertility, ectopic pregnancy, increased disease and infant mortality, intrauterine growth restriction, and an increase in some chromosomal incompatibilities and genital warts (9-11). Menopause is the permanent cessation of ovulation and menstruation due to ovarian failure, which occurs in women at the 45-54 age (Mean age: 51), yet premature menopause can occur in women in their early 40s (12). Women with early or premature menopause are at a higher risk of complications and mortality in older age, including cardiovascular diseases, osteoporosis, and type 2 diabetes (13-15). Several studies have confirmed the relationship between early...
Menopause and tobacco consumption (16-18).

The relationship between cigarette smoking and early menopause has been described as a decrease in the quality and quantity of ovarian follicles caused by smoking byproducts. Smoking causes fluctuations in reproductive hormone levels during the fertile period, leading to alterations in follicular growth patterns, and thus follicle-stimulating hormone levels. Furthermore, the effect of smoke exposure on the follicular reservoir affects the timing of menopause (19). Another side effect of smoking is osteoporosis in menopause. In a study by Bijelic et al, smoking was reported to be an independent risk factor for menopause (20). The increased risk of hyperlipidemia and cardiovascular diseases in postmenopausal women with smoking due to higher weight gain has been reported in a number of studies. There has been an increase in the population of menopausal women and the prevalence of waterpipe smoking in Iran has also increased significantly (12,13).

Therefore, it is more important to pay attention to smoking in postmenopausal women. Waterpipe smoking prevails more in the south of Iran than in other geographical areas (14). The prevalence of waterpipe smoking among women in Hormozgan province, a southern province of Iran, was estimated at 10.3%, which is significantly higher than in other provinces (15). In another study in this province, 28.4% of men and 45.2% of women smoked waterpipes. In addition, the rate of waterpipe smoking in women was 4.4 times as high as in men (16). As for the relationship between tobacco consumption and menopause, most of the existing literature has paid attention to the tobacco substance of cigarettes, and they mostly addressed the age of menopause variable (16-18). No study, to the best of our knowledge, has dealt with the relationship between waterpipe smoking and the characteristics of women’s menopause. Due to the high prevalence of waterpipe smoking in women and the menopausal side effects of waterpipe smoking, conducting a study on menopausal women who are smokers is necessary. Hence, the present research sought to explore the relationship between tobacco consumption and menopause characteristics in women in southern Iran.

Materials and Methods
The current cross-sectional study used the basic data of Bandar Kong Cohort (KCS) in southern Iran to test the relationship between tobacco consumption and menopause-related characteristics. Bandar Kong is located in the central part of Bandarlange above the Persian Gulf. This city is one of the ports of Hormozgan province. KCS is a part of the Persian cohort whose protocol was described elsewhere (17). Briefly, KCS is a prospective cohort study conducted in 2016 with the aim of investigating the epidemiology and risk factors of non-communicable diseases in Bandar Kong in the south of Iran. Among 4,063 adults aged 40-70 who participated in KCS during 2016-2018, 3448 non-smokers entered KCS. There were about 800 postmenopausal women in this cohort study, of whom about 236 were smokers. Overall, 123 were cigarette smokers or exposed to cigarette smoking and 113 were waterpipe smokers or exposed to waterpipe smoke. In addition, 564 were non-smokers. A cross-sectional analysis was conducted on these 800 postmenopausal women. Each interview was based on a questionnaire held by a trained KCS interviewer who collected the respondents’ demographic information, several socio-economic status indicators, and smoking history. The conditions of attendance for the eligible participants were explained comprehensively. If they were willing to participate, they were supposed to sign a written letter of informed consent.

Inclusion and Exclusion Criteria
Only menopausal women were included in the study who lived in the area of interest. Postmenopausal women in this study were selected according to the definition of the World Health Organization following the cessation of menstrual bleeding for 12 months.

The inclusion criterion for immigrants from other cities or countries was at least one year of living in the area. Non-immigrants were supposed to reside in that area for at least 9 months of the year. On the other hand, people who were not willing to participate in the study despite hearing the benefits of the research project and those who were unable to communicate the answers were excluded from the study.

Data Collection Instrument
A questionnaire was utilized for data collection based on a review of the related literature, actual experiences, and the existing instruments used in cohort studies in Iran and foreign countries. The validity and reliability of the questionnaire were substantiated (17).

Statistical Analysis
The interval variables were analyzed and reported using means and standard deviations. Categorical variables were measured and reported by frequencies (percentages). The chi-square test was used to check whether there was a statistically significant relationship between two categorical variables in a contingency table. Further, the independent-sample t test was utilized to compare the mean scores of interval variables in two separate groups to determine whether there was statistical evidence for the statistically significant difference between the mean scores or not. Finally, a logistic regression analysis was run to test the adjusted odds of osteoporosis, having a fracture and back pain for menopausal women who smoked waterpipes or at least one type of cigarette/waterpipe/
opium/alcohol compared with their counterparts. All analyses were performed in SPSS 26, and \( P < 0.05 \) was considered as statistically significant.

**Results**

In general, 869 postmenopausal women with an average age of 57.42 ± 6.34 years participated in the study, including 694 (79.9%) urban and 173 (19.9%) rural women. The majority of the participants (91.7%, \( n = 797 \)) were housewives. Their average body mass index (BMI) was 27.59 ± 5.03, and about 69.3% (\( n = 602 \)) had a BMI greater than 25. Among the participants, 46.8% (\( n = 407 \)), 18.9% (\( n = 164 \)), and 33.6% (\( n = 292 \)) had a poor, average, and good economic status, respectively.

Moreover, 119 women (13.7%) were exposed to cigarette smoking at home, and 5.8% (\( n = 50 \)) reported they had been exposed to cigarette smoking in the family during their childhood. Additionally, 159 women (18.3%) stated that they used one type of substance such as waterpipe, cigarette, opium, or alcohol, 154 of whom (17.7%) reported that they smoked waterpipes.

According to Table 1, those who used at least one tobacco product such as cigarettes, waterpipe, opium, or alcohol had a lower level of education and BMI, compared to those who did not, and the difference was statistically significant (\( P = 0.011 \) and \( P = 0.007 \), respectively).

In the present study, the widows, divorcees, and others used at least one tobacco product such as cigarettes, waterpipe, opium, or alcohol to a greater extent than the married (25% and 15.7%, respectively, \( P = 0.008 \)). In addition, the consumption of tobacco products in women with a BMI < 24.9 was higher than the overweight (22.3% vs. 15.6%, \( P = 0.013 \)). In the current study, there was a significant difference between the economic status of postmenopausal women and their tobacco consumption. The rate of tobacco consumption in women who had a lower socioeconomic level was higher than those with an average and higher level (24.8%, 12.2%, and 11%, respectively, \( P < 0.001 \), Table 2).

Based on the multivariable logistic regression analysis (Table 3), after adjusting for other variables, the odds of osteoporosis, having a fracture, and backache in menopausal women who smoked waterpipes or at least one type of cigarette/waterpipe/opium/alcohol were higher than those in non-smoking peers; however, these associations were not statistically significant (\( P > 0.05 \)).

**Discussion**

The results of the present study showed there was no relationship between the age of menopause and tobacco consumption. Although some studies suggested that women with tobacco smoking experience menopause one year earlier than non-smokers, some studies did not confirm this relationship (18). This finding may be justified considering the small sample size of the smoker.
group compared to non-smokers and the differences in the studies. However, there is a need to examine the limitations of studies that relate smoking and menopause because a number of studies may have not provided a specific definition of menopause or may have not controlled the confounding factors.

Based on the findings, postmenopausal women who used at least one tobacco product such as cigarettes, waterpipe, opium, or alcohol had lower levels of education and BMI than non-smokers, and this difference was statistically significant. In another study, Dadipour et al found that low education had an effect on smoking, which is consistent with the findings of the current study. Poverty and economic problems were the other determinants of waterpipe smoking in women, and a favorable economic status was considered beneficial and effective in quitting and reducing waterpipe consumption (19). BMI was decreased in postmenopausal women smokers. Smoking is a significant risk factor for cardiovascular diseases, chronic obstructive pulmonary disease, and lung cancer, as well as a history of gastric, pancreas, renal, and uterus cancers. Several studies reported that smoking causes skeletal muscle dysfunction. Smoking has direct harmful effects on muscle protein metabolism. As previously reported, men and women smokers have more muscle breakdown than their peers (21-24).

In the present study, widows, divorcees, and the like smoked at least one tobacco product such as cigarettes, waterpipe, opium, or alcohol to a greater extent than the married. The sense of loneliness is effective in individuals’ tendency to smoke. The findings of a study conducted by Peltzer and Pengpid on perceived loneliness and the health variable in Indonesia demonstrated that having low education, low economic status, bad childhood experience, low trust in others, one or two chronic diseases, and communication disabilities was significantly and positively correlated with a high perceived loneliness. Furthermore, health variables, including unhealthy cognitive function, depressive symptoms, sleep disorders, dissatisfaction with life, and smoking, were significantly and positively correlated with a more intense sense of loneliness (25). These findings confirm the results of the present study. In the current study, there was a significant difference between the economic status of postmenopausal women and their tobacco consumption. The rate of tobacco consumption was higher in participants with lower socioeconomic status compared to those of an average and higher level. Economic variables can affect tobacco consumption. Wealthier families have a lower average consumption of unhealthy products due to their social status. Owning a house reduces the chances of smoking, and families owning a house are less likely to smoke (26). Another limitation of the present study was the self-reported data provided by the participants.

**Conclusion**

The findings of the current study revealed no significant relationship between smoking and menopause. Nonetheless, there was a significant relationship between the level of education and BMI and smoking in postmenopausal women. Moreover, postmenopausal women with a lower economic status and widows/divorcees consumed tobacco more than the married. Considering the increase in life expectancy in women and the aging of the population in recent years, the number of postmenopausal women has increased in society. Thus, it is necessary to hold training for lifestyle modification for menopausal women so that women have a better quality of life during their menopause. It is also necessary to conduct more comprehensive studies with a large sample size on smoking in postmenopausal women.

**Authors’ Contribution**

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**Competing Interests**

None.
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Ethical Approval
This study was approved by the Ethics Committee of Hormozgan University of Medical Sciences (1399.158.IR.HUMS.REC.).

References


