In recent years, the global pattern of smoking has changed so that despite a decline in the smoking rate, other types of smoking, especially hookah, have increased in many parts of the world. Today, smoking hookah has become a global epidemic and a serious threat to public health worldwide (1). According to the latest report of the World Health Organization (WHO), each year, smoking is estimated to cause the death of 8 million people worldwide (2). The prevalence of hookah use in a study was 17% and 6.2% among women and men in Iran (3). It seems that the use of hookah among women has an increasing trend and Iranian women have more restrictions on smoking than hookah (4). This prevalence rate is higher in southern Iran compared to other geographical areas (5) such that the prevalence of hookah use among women in Hormozgan province (10.3%) was estimated to be several times higher than that of other provinces (6).

One of the main reasons for the growing tendency to smoke hookah is the poor knowledge and the attitudes toward smoking hookah and exacerbation of COVID-19 symptoms. These findings can provide policymakers with valuable insights and information on the importance of community-wide training programs.

**Keywords:** Knowledge, Attitude, Tobacco, Hookah

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misconceptions of the community about the potential health risks of this social phenomenon. The results of a study in Iran showed that only 16% of hookah users have a high level of health literacy (7). The results of other studies in this field demonstrated that most hookah users think that the harms of the hookah are less than those of cigarettes. Some people even consider hookah as a healthy way to use tobacco and believe that the harmful substances of tobacco in hookah are purified when passing through water (7, 8).

Hookah use during the COVID-19 pandemic appears to be one of the potential risks in exacerbating the symptoms of the illness because parts of the hookah system (i.e., hoses, vase, and water) are potential sources of pathogens that can increase the transmission risk of infectious microorganisms such as respiratory viruses, bacteria, fungi, tuberculosis, and bacilli (9, 10). The WHO stated that the use of a common hose and mouthpiece can increase the risk of transmitting COVID-19 since hookah use is commonly performed in groups in public settings (11). Smoking hookah leads to the exacerbation of the symptoms of COVID-19 in addition to the increased risk of disease transmission (12). In some studies, smoking was significantly associated with the exacerbation of COVID-19 symptoms (13, 14). The relationship between COVID-19 and smoking was studied, and the results revealed that smoking is most likely associated with the negative symptoms of COVID-19 (15).

The high prevalence of hookah use among women in this region and the intensification of COVID-19 symptoms necessitate a study that can provide basic information for implementing initiatives to identify educational needs and improve routine methods so that to combat this epidemic and provide measures to control tobacco use. Therefore, the present study is the first one to focus on the aggravation of Corona symptoms and the role of some related socio-demographic factors aiming at determining the relationship between knowledge and attitude toward the effects of smoking hookah.

Materials and Methods
The current descriptive-analytical cross-sectional study has been conducted at the time of the COVID-19 pandemic in 2021 in Hormozgan province, southern Iran. The study population included all women over the age of 15 who used hookah and were present in social networks, and a questionnaire link was sent on these networks based on the study aim.

Data Collection Method
Due to the precautionary measures regarding the coronavirus, the intended questionnaire was provided to the research units via WhatsApp and Telegram following its preparation, the approval of the research, and obtaining the code of ethics. A convenience sampling method was used for this purpose. The sample size relied on the reception and willingness of individuals to participate in the study and the completion rate of the questionnaire. The link contained a brief introduction about the objectives, importance of voluntary participation, anonymity, the confidentiality of information, and the main questions of the questionnaire. The conditions were explained on the first page of the link, and the samples (who received the relevant link) were asked to answer the questionnaire items.

Inclusion and Exclusion Criteria
The inclusion criteria for the study were being over 15 years of age, showing a willingness to participate in the study experience of smoking hookah, having literacy, and residing in Hormozgan province. The incompletely returned questionnaires were considered as the exclusion criterion.

Data Collection Tools and Their Validity and Reliability
Data were collected from February 19, 2021, to April 19, 2021, using a researcher-made questionnaire. The tool was designed by the researcher after reviewing extensive texts on the subject and included three sections. The first part included demographic variables such as age, marital status, level of education, occupation, economic status (including the number of family members/number of rooms at home), age of the onset of hookah smoking, duration of smoking hookah, and whether other family members smoke a hookah. The second part of the knowledge items was related to the impact of smoking hookah on COVID-19 symptoms including eight 3-choice items (right, wrong, and do not know and score 1 was considered for the first item while 0 was selected for the other two items). The score range was from 0 to 8. Attitude items were related to the beliefs of the individual about the effects of hookah use on the symptoms of COVID-19 disease and included 8 items that were scored based on a Likert-type scale (Strongly agree, agree, no idea, disagree, and strongly disagree). The score of each attitude item and the range of the attitude questionnaire score varied between 1 and 5, as well as 8 and 40, respectively. To check content validity, the questionnaire was prepared using valid sources and books, along with related scientific articles. In addition, the necessary corrections were qualitatively and quantitatively made using the provided opinions by 3 experts in health education and promotion. In a qualitative area, experts were asked to review the tool in terms of grammatical rules, use of appropriate words, correct placement of items, and proper scoring, and to provide the necessary feedback. In the present study, the internal correlation of variables (Cronbach’s alpha coefficient) was used to measure the reliability of the questionnaire. Thus, with a sample size of 20 subjects in a pilot test, the Cronbach’s alpha for knowledge and
attitude items was 0.86 and 0.83, respectively and the questionnaire was approved accordingly.

Knowledge classification was based on the mean of the cut-off point so that a score lower and greater than the mean indicated inadequate and adequate knowledge, respectively. Further, the attitude classification was based on the mean of the cut-off point in a way that a score lower than the mean represented a negative attitude while a score greater than the mean indicated a positive attitude.

**Data Analysis**

After data collection, the mean and standard deviation (SD), as well as the frequency and relative frequency were used to describe quantitative (i.e., age, knowledge, and attitude), qualitative (i.e., age group, occupation, marital status, level of education, economic status, the experience of smoking hookah, and age of the onset of smoking Hookah) variables, respectively. Before performing statistical tests, Kolmogorov-Smirnov and Levin tests were applied to check the presumptions of parametric tests such as normality and equality of variances, and then independent t-test and one-way analysis of variance were employed to compare the mean scores of knowledge and attitudes at different levels of qualitative variables. Using SPSS software (version 20), univariate logistic and multivariable regression analyses were performed to determine the relationship between categorized knowledge and attitude among qualitative variables, respectively.

**Results**

| Variables                  | Category   | Frequency | Percent | Awareness Score M (SD) | Test Statistic | Odds Value | Attitude Score M (SD) | Test Statistic | Odds Value |
|----------------------------|------------|-----------|---------|------------------------|----------------|------------|-----------------------|----------------|------------|
| Age                        | <20        | 171       | 20.3    | 5.00 (1.97)            | F=7.697        | P<0.001    | 24.94 (3.96)          | F=1.299        | P=0.274    |
|                            | 20-35      | 402       | 47.7    | 5.48 (2.21)            |                |            | 25.02 (5.16)          |                |            |
|                            | 35-50      | 181       | 21.5    | 4.68 (2.42)            |                |            | 25.45 (4.46)          |                |            |
|                            | >50        | 88        | 10.5    | 4.64 (1.68)            |                |            | 25.97 (4.79)          |                |            |
| Marital status             | Single     | 286       | 34.0    | 5.32 (1.99)            | T=1.930        | 0.054      | 24.61 (4.25)          | T= -2.594      | P=0.010    |
|                            | Married    | 556       | 66.0    | 5.02 (2.28)            |                |            | 25.50 (4.97)          |                |            |
| Educational status         | High school| 269       | 31.9    | 4.53 (2.28)            | F=28.854       | P<0.001    | 25.16 (4.60)          | F=1.546        | P=0.201    |
|                            | Diploma    | 230       | 27.3    | 5.34 (2.10)            |                |            | 25.68 (4.78)          |                |            |
|                            | College education | 201 | 23.9    | 6.14 (1.74)            |                |            | 24.80 (4.79)          |                |            |
| Employment status          | Employed Housewife | 179 | 21.3    | 5.46 (1.80)            | T=2.370        | 0.018      | 25.08 (4.20)          | T= -0.360      | P=0.719    |
|                            | Housewife | 663       | 78.7    | 5.03 (2.27)            |                |            | 25.23 (4.89)          |                |            |
| Economic situation         | Upper      | 143       | 17.0    | 5.40 (2.08)            | F=9.711        | P<0.001    | 25.26 (5.10)          | F=13.76        | P<0.001    |
|                            | Middle     | 430       | 51.1    | 5.33 (2.21)            |                |            | 25.92 (5.40)          |                |            |
|                            | Low        | 269       | 31.9    | 4.64 (2.12)            |                |            | 24.01 (4.73)          |                |            |
| History of smoking         | <5         | 407       | 48.3    | 5.39 (2.03)            | F=16.776       | P<0.001    | 25.22 (4.44)          | F=0.019        | P=0.982    |
|                            | 5-15       | 242       | 28.7    | 5.30 (2.55)            |                |            | 25.21 (5.02)          |                |            |
|                            | >15        | 193       | 22.9    | 4.34 (2.12)            |                |            | 25.14 (5.06)          |                |            |
| Age of smoking             | <15        | 137       | 16.3    | 4.22 (1.97)            | F=17.181       | P<0.001    | 23.40 (4.75)          | F=13.31        | P<0.001    |
|                            | 15-30      | 655       | 77.8    | 5.24 (2.21)            |                |            | 25.47 (4.77)          |                |            |
|                            | >30        | 50        | 5.9     | 6.00 (1.71)            |                |            | 26.56 (3.17)          |                |            |

Note: SD: Standard deviation.

**Sociodemographic Characteristics of the Participants**

In this study, 933 participants were included and completed the questionnaire. After reviewing the obtained questionnaires, 91 of them were excluded from the final analysis due to their incompleteness. The mean (±SD) of the participants’ age was 32.14 (± 12.10) with a minimum of 15 years and a maximum of 56. The majority of participants (556 or 66%) were married, 663 (78.7%) of them were housewives, and 430 (51.1%) cases had moderate economic status. Moreover, 269 (31.9%) women had a high school degree, and the onset age of smoking use in most women (n=655, 77.8%) was between 15 and 30. The experience of hookah use in 407 (48.3%) cases was under 5 years. Other demographic characteristics are listed in Table 1.

**Knowledge**

The mean score (±SD) of participants’ knowledge was 5.13 (± 2.19 in the range of 0-8). The correct answer to knowledge questions was between 59.3% and 71.7%. Based on the results, 457 subjects (65%) obtained a score of 5 or higher, which is considered as adequate knowledge while 295 (35%) of them obtained a score less than 5, which is regarded as inadequate knowledge. Figure 1 separately displays the participants’ knowledge for each question.

**Attitude**

The mean score (± SD) of the attitude among the participants was 25.20 (± 4.75 within the range of 8-40). Most participants (432 or 51.3%) had a score of less than
25 (43.51%), which was considered a negative attitude whereas 410 of them (48.7%) scored higher than 25, which was considered a positive attitude. The attitude of the participants is shown in Figure 2 by each item.

Multivariate analysis demonstrated that the following subjects had more adequate knowledge: subjects over the age of 50 compared to those in the age group of 35-50, [1.975 (1.029-3.794)], subjects with university degrees compared to those with primary school, high school or diploma degrees [3.991 (1.981-8.042)], [5.508 (3.305-9.178)], [2.445 (1.476-4.049)], subjects with good economic status compared to those with poor financial
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Hookah use causes lung tissue loss, and inflammation, and reduces the ability of the lungs to respond to Corona

|                | Correct | False | Don't Know |
|----------------|---------|-------|------------|
| Percent        | 69.6    | 20.9  | 9.5        |

Hookah use is a risk factor for corona and reduces the likelihood of body response to the virus

|                | Correct | False | Don't Know |
|----------------|---------|-------|------------|
| Percent        | 66.2    | 14.6  | 19.2       |

Hookah smoking reduces inhaling in respiration. Thus, one gets to experience a severe case of COVID-19

|                | Correct | False | Don't Know |
|----------------|---------|-------|------------|
| Percent        | 59.7    | 21.6  | 18.6       |

Hookah use can affect the immune system and especially the respiratory system, and increase mortality from corona

|                | Correct | False | Don't Know |
|----------------|---------|-------|------------|
| Percent        | 62.8    | 22.7  | 14.5       |

Cardiovascular and lung diseases resulting from hookah use lead to severe Corona symptoms

|                | Correct | False | Don't Know |
|----------------|---------|-------|------------|
| Percent        | 71.7    | 16.5  | 11.8       |

The risk of severe corona symptoms is higher in hookah users compared to non-users

|                | Correct | False | Don't Know |
|----------------|---------|-------|------------|
| Percent        | 60.5    | 19.6  | 20.0       |

The capacity of the lungs to fight corona is lower in hookah users in comparison with non-users

|                | Correct | False | Don't Know |
|----------------|---------|-------|------------|
| Percent        | 59.3    | 24.0  | 16.7       |

Hookah use increases the risk of transmitting the corona virus through the mouth

|                | Correct | False | Don't Know |
|----------------|---------|-------|------------|
| Percent        | 62.8    | 19.7  | 17.5       |

Figure 2. Participants’ Attitude Toward COVID-19. Note: COVID: Coronavirus disease.

status [1.966 (1.218-3.175)], subjects who began smoking hookah after the age of 30 compared to those who began smoking between 15 and or those who began smoking below 15 [2.563 (1.030-6.379)], [6.308 (2.249-17.693)] (Table 2).

The odds of single individuals were lower than that of married individuals regarding positive attitudes (the effect of hookah use on exacerbating COVID-19 symptoms, 0.707 (0.531-0.943) in the univariate analysis while in multivariate analysis, the odds ratio was reversed although it was not statistically significant. Additionally, none of the included variables in the model had a statistically significant relationship with the symptoms (positive or negative attitude). Nonetheless, when comparing the subjects with university degrees and those with primary school degrees, the odds ratio was 0.973, meaning that the odds of a positive attitude in educated subjects was 3% lower than that of subjects with primary school degrees. Compared to high school degree owners, the odds ratio was 0.663. In other words, the odds of a positive attitude in educated subjects was 34% lower than that of those with high school degrees. Additionally, the odds ratio was 0.782 compared to diploma education, implying that the odds of a positive attitude in educated subjects was 22%
Discussion

This study examined the level of knowledge and attitudes toward the relationship between smoking hookah and exacerbation of COVID-19 symptoms and the impact of some effective sociodemographic factors. Based on the results, higher age, university education, good economic situation, and higher age of the hookah use onset were predictors of good knowledge while none of the demographic variables could predict attitudes.

The mean score of participants’ knowledge in this study was 5.13 out of a maximum of 8, indicating the acceptable level of knowledge of these subjects about the effects of smoking hookah on exacerbating the COVID-19 symptoms. Further, the mean attitude score of the participants was 25.20 out of a maximum of 40, representing the negative attitude of these people towards the relationship between smoking hookah and the COVID-19 symptoms. The comparison of the results of the present study with those of other studies revealed higher knowledge and more negative attitudes of participants in this study toward smoking a hookah. There was a higher score of knowledge and attitude in our study (16, 17). In one study, the attitude score was almost similar to the present study (16). This difference in the results of various studies can be attributed to a large extent to the purpose of the study, socio-demographic characteristics of the target group, level of questions, and study conditions (normal conditions vs. COVID-19 pandemic). Regarding study conditions, under critical conditions of COVID-19, subjects were looking for information in this area probably due to the fear of contracting the disease. Therefore, they had relatively good knowledge, but it is worth mentioning that women’s knowledge can be claimed to be desirable only when their knowledge of COVID-19 could affect their behaviors. Unfortunately, the present study did not focus on women’s performance, thus no comment cannot be mentioned in this regard. However, the researchers of the present study believe that if women’s knowledge increases effectively, it is likely to decrease hookah consumption during the COVID-19 pandemic. The findings of a study revealed that people who reported being more highly aware of the association between smoking and exacerbation of COVID-19 symptoms were twice as likely as others to quit smoking hookah (18). It seems that an increase in knowledge in this area can be an effective step in reducing this unhealthy behavior.

Based on the results, although women were well aware of this issue, most of them still had a negative viewpoint on the effects of smoking hookah regarding the COVID-19 symptoms. This indicates that individuals’ awareness and knowledge do not necessarily lead to a lower (Table 3).

Table 2. Bivariate and Multivariate Logistic Regression Analysis Showing Factors Associated With Knowledge

| Variables                      | Category       | Good knowledge | Poor knowledge | COR(95% CI) | AOR(95% CI) |
|--------------------------------|----------------|----------------|----------------|-------------|-------------|
| Age                            | <20            | 102(18.6%)     | 69(23.4%)      | 1.376(0.803-2.360) | 2.322(0.783-6.884) |
|                                | 20-35          | 281(51.4%)     | 121(41.0%)     | .876(0.535-1.434) | 1.958(0.825-4.644) |
|                                | 35-50          | 105(19.2%)     | 76(25.8%)      | 1.473(0.864-2.511) | 1.975(1.029-3.794) |
|                                | >50            | 59(10.8%)      | 29(9.8%)       | ref          | ref         |
| Marriage status                | Never married  | 190(34.7%)     | 96(32.5%)      | 1.103(0.817-1.490) | .856(0.534-1.372) |
|                                | Ever married   | 357(65.3%)     | 199(67.5%)     | ref          | ref         |
| Education                      | Primary school | 83(15.2%)      | 59(20.0%)      | 4.216(2.517-7.063) | 3.991(1.981-8.042) |
|                                | High school    | 131(23.9%)     | 138(46.8%)     | 6.248(3.943-9.901) | 5.508(3.305-9.178) |
|                                | Diploma        | 161(29.4%)     | 69(23.4%)      | 2.542(1.566-4.125) | 2.445(1.476-4.049) |
|                                | University degree | 172(31.4%) | 29(9.8%) | ref          | ref         |
| Employment                     | Employed       | 133(24.3%)     | 46(15.6%)      | 1.739(1.201-2.518) | .962(0.592-1.564) |
|                                | Housewife      | 414(75.7%)     | 249(84.4%)     | ref          | ref         |
| Economic status                | upper          | 101(18.5%)     | 42(14.2%)      | ref          | ref         |
|                                | middle         | 295(53.9%)     | 135(45.8%)     | .532(0.345-.820) | 1.141(0.724-1.798) |
|                                | low            | 151(27.6%)     | 118(40.0%)     | .586(0.427-.803) | 1.966(0.218-3.175) |
| Experience of smoking          | <5             | 284(51.9%)     | 123(41.7%)     | ref          | ref         |
|                                | 5-15           | 155(28.3%)     | 87(29.5%)      | .132(0.196-.925) | 1.311(0.835-2.058) |
|                                | >15            | 108(19.7%)     | 85(28.8%)      | .001(0.017-1.275) | 1.721(0.800-3.703) |
| Hookah smoking onset age       | <15            | 57(10.4%)      | 80(27.1%)      | 7.368(1.217-16.879) | 6.308(2.249-17.693) |
|                                | 15-30          | 448(81.9%)     | 207(70.2%)     | 2.426(1.119-5.259) | 2.563(1.030-6.379) |
|                                | >30            | 42(7.7%)       | 80(27.2%)      | ref          | ref         |

Note: COR: Crude odds ratio; CI: Confidence interval; AOR: Adjusted odds ratio.
change in attitudes at all because some studies showed that despite being aware of the health effects of smoking, people still have a positive attitude towards it (19, 20). The researchers of the present study believe that implementing long and continuous training programs by experienced experts is necessary for changing the attitude of women. It is possible that if women are well trained during the COVID-19 pandemic to change their attitudes, we can be optimistic about the reduction of hookah use by women during the crisis.

The results of the present study demonstrated a statistically significant relationship between higher age and adequate knowledge. In line with the results of our study, other studies reported a statistically significant relationship between age and knowledge (16, 21). Contrary to the results of this study, there was no statistically significant relationship between age and level of women’s awareness in another study (22). However, the purpose of the study, socio-demographic characteristics of the participants, and the level of questions limited the detailed comparison of the above-mentioned studies. Overall, people’s experiences and knowledge increase with increasing age. Due to the existence of high-risk behaviors at younger ages and the lack of knowledge and awareness in these groups, it is necessary to look forward to educational programs for lower-aged groups.

In the present study, a statistically significant relationship was found between education and knowledge so that people with higher education were more knowledgeable. It seems that higher education has led to an increase in knowledge among women. In another study, the number of hookah users among women decreased with increasing education (23), which corroborates with the finding of the current study. Contrary to the results of the present study, another study reported that education has a preventive effect on the rate of hookah use (24). This discrepancy can partly be attributed to the characteristics of the target group, including education, the purpose of the study, and type of culture that governs society in various studies. There may be a significant direct relationship between education and knowledge because more highly educated people are further prepared to learn more and have a greater opportunity to participate in training sessions.

The findings of our research showed that there was a statistically significant relationship between knowledge and economic status in such a way that people with high economic status were more knowledgeable. In general, people with good economic status have more access to communication channels such as newspapers, television, and cyberspace (25). On the other hand, it was found that most people with good economic status have higher education degrees, indicating more educational opportunities for people with higher economic status.

According to our findings, people who started using hookah at a younger age had a lower level of knowledge. Previous research represented that people smoking hookah had less knowledge about hookah use compared to non-users (26). Based on the results of Farah’s study,
women starting smoking hookah at a young age and using it for a long time may not feel the negative side effects, and consequently, do not think about their health risks. This is because they believe that despite using hookah for consecutive years, they have not yet contracted a specific disease, thus smoking hookah is not harmful and its continuation is unimpeded (27). Higher knowledge will probably keep these people away from smoking. It can be further explained that people, who started using hookah at a younger age, had probably educational problems and dropped out of school, and as a result, they did not have higher education, resulting in poorer knowledge and more frequent use of hookah. In this regard, another study reported a significant relationship between poor academic performance and hookah use (28). On the other hand, this relationship may be reversed, namely, smoking can lead to poor academic performance because it may increase communication with peers who discourage people from academic activities (29). In our study, people, who started using hookah at a younger age, had lower education levels, which may partly justify this finding.

Based on multivariate regression analysis in our study, no statistically significant relationship was observed between any of the demographic variables and attitude. Hence, the use of hookah in Bandar Abbas has cultural roots and has become a model and value among the people of the region. In a review study, cultural factors were mentioned as the most important reasons behind hookah use among women (30). It can be acknowledged that women have a positive attitude toward hookah, showing that despite the corona pandemic and knowledge of the effects of hookah use on the aggravation of the COVID-19 symptoms, none of the above socio-demographic factors could predict a positive attitude. Our findings indicate that attitudes can be probably influenced by factors beyond mere awareness and knowledge. In this regard, a similar study showed that people’s attitudes are also affected by personality and the social environment (31). Moreover, Özkan et al reported that attitudes can be influenced by cultural contexts including values and norms (32). Accordingly, other influential reasons such as personality factors, perceived social pressures, and cultural components of individuals should not be neglected in changing attitudes.

Limitations
The electronic questionnaire was only available to subjects who could read and had access to the Internet, and a large number of people were excluded from the study. This study was performed among women in Bandar Abbas, thus the results cannot be generalized to other women and population groups. The cross-sectional nature of the study, the lack of clarity of the exact causal relationships, and the lack of investigation of hookah use behavior were other limitations of the present study.

Conclusion
According to our findings, poor economic status, education level, young age, and hookah use onset age were among the risk factors for poor knowledge in women. Despite a high level of knowledge, women’s attitudes toward the effects of hookah use on exacerbating the Corona symptoms remained negative. Accordingly, increasing knowledge and changing attitudes about the relationship between hookah use and exacerbation of the COVID-19 symptoms can be an effective step in reducing the above-mentioned behavior. These findings can provide policymakers with good insights into the importance of community-wide training programs.

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Authors’ Contributions
S.D designed the study, supervised data collection, analyzed the data, and reviewed the manuscript. A.Z.A designed the study, collected data, analyzed the data, drafted the manuscript, and critically reviewed the manuscript. H.F designed the study and reviewed the manuscript. S.H.M analyzed the data and reviewed the manuscript. H.K, reviewed the manuscript, and all authors read and approved the final manuscript.

Conflict of Interest Disclosures
The authors have no competing interests to declare.

Ethical Statement
This research was approved by Hormozgan University of Medical Sciences with the ID 990763 and with the ethics code IR.HUMS.REC.1400.089. No demographic information (i.e., the first and last name and mobile number) was recorded, and participation in the study was voluntary.

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