

Knowledge, Perception and Attitude of Frankincense Effect on Reproductive and Sexual Health: A Cross-Sectional Study

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Abstract Background: Frankincense (*Boswellia sacra*) has been widely used in traditional medicine for its perceived health benefits, including potential effects on sexual and reproductive health. Despite its cultural significance, scientific evidence supporting these claims remains limited, particularly in human populations. **Objective:** To evaluate the knowledge, perceptions and attitudes regarding the use of frankincense for sexual and reproductive health among adults in Saudi Arabia. **Methods:** This descriptive cross-sectional study was conducted across all regions of Saudi Arabia from March to August 2024. A total of 822 participants aged ≥ 18 years were included using a non-probability convenience sampling technique. Data were collected through a pre-tested, self-administered questionnaire assessing awareness, usage patterns and perceptions of frankincense. **Results:** Among the participants, 25.1% were well-informed about frankincense, while 66.4% had some knowledge. The primary sources of information were relatives and friends (77.7%) and social media (63.6%). Approximately 23.6% of participants reported using or considering frankincense for sexual and reproductive health and 24.2% reported personal experience with perceived effects. While 53% believed frankincense could serve as a natural alternative to medical treatment, a large proportion of respondents expressed neutral attitudes toward its effectiveness. Marital status showed a significant association with exposure to and consideration of frankincense use ($p < 0.001$), with married and divorced individuals more likely to report use compared to single participants. **Conclusion:** There is substantial awareness and moderate acceptability of frankincense use among the Saudi population; however, its application in sexual and reproductive health remains limited.

Key Words Frankincense, Leban, Boswellia tree, Sexual, Reproductive, Saudi Arabia

INTRODUCTION

Sexual dysfunction and infertility are also important health problems in the world with extreme physical and mental effects [1]. Nutrition is gaining importance as an important determinant of fertility and reproductive outcome among both women and men. Frankincense as herbal and nutritional supplements have undergone a long period of use in traditional medicine to treat sexual dysfunction and infertility [2]. Frankincense is a resin of the Boswellia tree which is commonly referred to as Leban in the Middle East and North Africa and had been utilized in the past on the basis of its medicinal value [3]. Although it has extensive application and is anecdotally claimed to be effective, the scientific evidence of its effectiveness on sexual and

reproductive health is limited. It was reported that extracts of boswellia sacra and boswellia serrata have the potential to increase male reproductive functions in relation to antioxidative and hormone-modulating functions [4]. Further, in a number of areas, traditional healers still employ remedies based on Frankincense in the management of infertility both in men and women [2].

According to experimental research, the extracts of frankincense can be positively involved in the male reproductive system and these effects are based on antioxidant and anti-apoptotic processes [5]. Alharbi et al revealed that the methanolic extract of Boswellia sacra enhanced the functioning of the testicular by inhibiting oxidative stress and apoptosis in experimental models [6,7].

Likewise, Abdullah discovered that boswellia serrata resin extract positively affected reproductive and metabolic hormones in adult male rats with the prospects of raising their fertility. These results suggest that frankincense is a natural supplement biologically plausible to promote the health of male reproductive organs, although clinical trials need to be conducted to prove the effectiveness and safety of this compound in humans. The fact that cultural beliefs and traditional practices still play a major role in the usage of frankincense and other herbal remedies to treat reproductive health also contributes to the fact that the treatment is still being used today. In the rural setting, there is prevalence of the use of frankincense by traditional medicine practitioners in herbal preparation to address infertility conditions in both men and women [8,9]. The gap in the scientific research and traditional medicine may be bridged by understanding the people on what they know and their attitudes concerning the herbal treatments. Culturally competent health care might be improved by integrating conventional knowledge with contemporary medical evidence, which will inform future studies regarding natural treatment of infertility and sexual dysfunction [10].

Objective

To evaluate the knowledge, perceptions and attitudes regarding the use of frankincense for sexual and reproductive health among adults in Saudi Arabia.

METHODS

A descriptive cross-sectional study was conducted across all regions of Saudi Arabia from March to August 2024. The sample size will be calculated using an online sample size calculator (Raosoft), with a 95% confidence level and a 5% margin of error. The estimated sample size will be 822 participants. To account for possible non-response, a total of 840 individuals will be approached.

Inclusion Criteria

- Male and female participants aged 18 years or older
- Sexually active individuals residing in the Kingdom of Saudi Arabia
- Participants who signed informed consent

Exclusion Criteria

- Respondents who do not meet the inclusion criteria
- Participants who fail to complete the survey in its entirety
- Participants who do not signed informed consent

Data Collection Procedure

Data will be collected using a pre-tested, self-administered questionnaire designed to assess participants' knowledge, perceptions and attitudes regarding the use of frankincense for sexual and reproductive health. The questionnaire will be prepared in both Arabic and English to ensure accessibility.

It will include sections on demographic characteristics, awareness, sources of information, usage patterns and perceptions related to frankincense. A pilot test will be conducted on a small group of participants to ensure clarity and validity of the tool before full-scale data collection.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including mean and standard deviation, were used for quantitative variables, while frequencies and percentages were used for qualitative variables. Comparisons between study variables were performed using the Chi-square test and the t-test. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for this study was obtained from the Ethics Committee of Majmaah University on January 15, 2024 (Ref: MUREC-Ian.15/COM-2024I1-31). Informed consent was obtained from all participants after they were informed about the purpose of the study. All collected data were kept confidential and used solely for the purposes of this research.

RESULTS

Table 1 shows that in the present study, 822 participants responded to the questionnaire. The median age was 25 years and the age ranged from 18 to 80 years. Female respondents outnumbered males (61% vs. 39%, respectively). About half the participants were from the Central region of Saudi Arabia (55%), while 22% were from the Eastern region. About half the participants were single, whereas married respondents represented 42%.

Table 2 shows that respondents who admitted being well-informed about frankincense represented 25% and those having some knowledge were 66%. Meanwhile, 9% declared being unfamiliar with frankincense. The most reported sources of knowledge about frankincense were relatives and friends (78%), social media (64%), followed by reading and browsing (56%) and the least reported was media (27%). About one-third of respondents (32%) met or talked to anyone who used frankincense to improve their sexual health. About one-quarter of respondents (24%) used or considered using frankincense as a supplement to improve sexual and reproductive health.

Table 3 shows that according to the participants, the most common main reason for using frankincense was improving skin and complexion health (71%), followed by improving immunity (67%), treating inflammations and infections (58%) and enhancing wound healing (43%). The least reported reasons were improving reproductive and sexual health (34%). The most common method of administering frankincense as reported by the respondents was drinking its infusion (71%), followed by Chew it as is (52%) and burning it as incense and inhaling it (50%), while the least selected was using its extracted oil 326 (40%). Nearly half the respondents used frankincense as needed, while 18% never used it. Only 9% used frankincense daily.

Table 1: Responders' Demographic Characteristics (n = 822)

| | |
|---------------------------------------|--------------------|
| Responders demographic Characteristic | N = 822 |
| Age (years), Median [IQR] (Range) | 25 [21-36] (18-80) |
| Gender (n (%)) | |
| Male | 323 (39%) |
| Female | 499 (61%) |
| Geographical region (n (%)) | |
| Central | 456 (55%) |
| Western | 84 (10%) |
| Eastern | 180 (22%) |
| Southern | 44 (5%) |
| Northern | 58 (7%) |
| Marital status (n (%)) | |
| Single | 443 (54%) |
| Married | 343 (42%) |
| Widowed | 4 (0%) |
| Divorced | 32 (4%) |

Table 2: Evaluation of Knowledge, about Frankincense (n = 822)

| | |
|--|---------------|
| Are you familiar with frankincense? | No. (%) |
| Yes, I am well-informed about its details and benefits | 206.0 (25.1%) |
| Yes, I have some specific knowledge | 546.0 (66.4%) |
| No, I am not familiar with it | 70.0 (8.5%) |
| What is your source of knowledge about frankincense? | |
| Relatives and friends | 639.0 (77.7%) |
| Social media | 523.0 (63.6%) |
| Media (TV, radio, newspapers) | 224.0 (27.3%) |
| Reading and browsing | 463.0 (56.3%) |
| Have you met or talked to anyone who uses frankincense to improve their sexual health? | |
| Yes | 260.0 (31.6%) |
| No | 562.0 (68.4%) |
| Have you ever used or considered using frankincense as a supplement to improve sexual and reproductive health? | |
| Yes | 194.0 (23.6%) |
| No | 628.0 (76.4%) |
| Do you have personal experience using frankincense and have you noticed any effect on your sexual or reproductive health? | |
| Yes | 199.0 (24.2%) |
| No | 623.0 (75.8%) |
| Do you believe that frankincense can be an effective natural alternative to improve sexual and reproductive health compared to medical drugs? | |
| Yes | 436.0 (53.0%) |
| No | 386.0 (47.0%) |

Table 3: Evaluation of Frankincense Usage Among Responders (n = 822)

| | |
|--|-----------|
| Frankincense Usage Characteristic | N = 822 |
| What is the main reason for your use of frankincense? (n (%)) | |
| Improve skin and complexion health | 587 (71%) |
| Improve immunity | 548 (67%) |
| Treat inflammations and infections | 473 (58%) |
| For wound healing | 351 (43%) |
| Improve reproductive health | 280 (34%) |
| Improve sexual health | 283 (34%) |
| How do you prefer to use frankincense? (n (%)) | |
| Drink its infusion | 584 (71%) |
| Chew it as is | 429 (52%) |
| Burn it as incense and inhale it | 410 (50%) |
| Use its extracted oil | 326 (40%) |
| How frequently do you use frankincense? (n (%)) | |
| Daily | 78 (9%) |
| Weekly | 125 (15%) |
| Monthly | 75 (9%) |
| As needed | 399 (49%) |
| Do not use it | 145 (18%) |
| When do you use frankincense?, (n (%)) | |
| On an empty stomach | 218 (27%) |
| Before sleep | 247 (30%) |
| Anytime | 597 (73%) |

Most participants used frankincense at any time (73%), while 30% used it before sleep and 27% used it on an empty stomach.

Figure 1 shows that About 43% of respondents strongly agreed/agreed that frankincense should be recommended to improve sexual or reproductive health, while 49% were

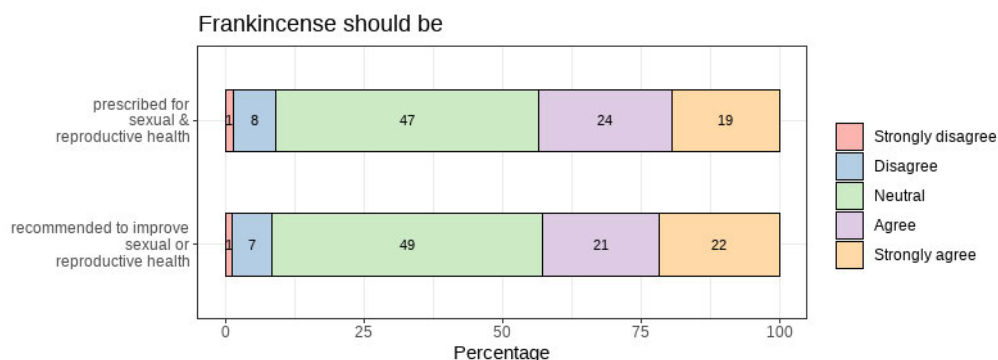


Figure 1: Recommendations Based on Personal Opinions for the Use and Prescription of Frankincense

Table 4: The association of marital status with variables of interest (n = 822)

| Characteristic | Marital status | | | | | p-value ^c |
|--|------------------------|------------------------|-----------------|-----------------------|-------------------|------------------------|
| | Single (N = 443) | Married (N = 343) | Widowed (N = 4) | Divorced (N = 32) | Overall (N = 822) | |
| Have you met or talked to anyone who uses frankincense to improve their sexual health? (n (%)) | | | | | | |
| Yes | 108 (24%) ^a | 139 (41%) ^a | 1 (25%) | 12 (38%) | 260 (32%) | <0.001*** ^b |
| No | 335 (76%) | 204 (59%) | 3 (75%) | 20 (63%) | 562 (68%) | |
| Have you ever used or considered using frankincense as a supplement to improve sexual and reproductive health? (n (%)) | | | | | | |
| Yes | 74 (17%) ^a | 107 (31%) ^a | 1 (25%) | 12 (38%) ^a | 194 (24%) | <0.001*** ^b |
| No | 369 (83%) | 236 (69%) | 3 (75%) | 20 (63%) | 628 (76%) | |
| Do you have personal experience using frankincense and have you noticed any effect on your sexual or reproductive health? (n (%)) | | | | | | |
| Yes | 90 (20%) | 97 (28%) | 1 (25%) | 11 (34%) | 199 (24%) | 0.025* ^b |
| No | 353 (80%) | 246 (72%) | 3 (75%) | 21 (66%) | 623 (76%) | |
| Do you believe that frankincense can be an effective natural alternative to improve sexual and reproductive health compared to medical drugs? (n (%)) | | | | | | |
| Yes | 234 (53%) | 183 (53%) | 3 (75%) | 16 (50%) | 436 (53%) | 0.867 ^b |
| No | 209 (47%) | 160 (47%) | 1 (25%) | 16 (50%) | 386 (47%) | |
| There is a positive effect on sexual health when using frankincense (n (%)) | | | | | | |
| Strongly disagree | 5 (1%) | 2 (1%) | 0 (0%) | 0 (0%) | 7 (1%) | 0.622 ^b |
| Disagree | 33 (7%) | 23 (7%) | 0 (0%) | 2 (6%) | 58 (7%) | |
| Neutral | 255 (58%) | 176 (51%) | 3 (75%) | 16 (50%) | 450 (55%) | |
| Agree | 99 (22%) | 92 (27%) | 0 (0%) | 11 (34%) | 202 (25%) | |
| Strongly agree | 51 (12%) | 50 (15%) | 1 (25%) | 3 (9%) | 105 (13%) | |
| There is a positive effect on reproductive health when using frankincense (n (%)) | | | | | | |
| Strongly disagree | 6 (1%) | 3 (1%) | 0 (0%) | 1 (3%) | 10 (1%) | 0.712 ^b |
| Disagree | 28 (6%) | 24 (7%) | 0 (0%) | 1 (3%) | 53 (6%) | |
| Neutral | 254 (57%) | 192 (56%) | 2 (50%) | 18 (56%) | 466 (57%) | |
| Agree | 91 (21%) | 66 (19%) | 2 (50%) | 9 (28%) | 168 (20%) | |
| Strongly agree | 64 (14%) | 58 (17%) | 0 (0%) | 3 (9%) | 125 (15%) | |

n (%), *p<0.05; **p<0.01; ***p<0.001, Fisher’s exact test, Chi-squared Test for Trend in Proportions, Significant adjusted p-value from pairwise comparison with the single group, Significant adjusted p-value from pairwise comparison with the married group, Significant adjusted p-value from pairwise comparison with the divorced group

neutral in their opinion and 8% strongly disagreed/disagreed. Likewise, about 43% strongly agreed/agreed that frankincense should be prescribed for sexual and reproductive health by specialists, while 47% were neutral and 9% opposed.

Table 4 shows that the marital status showed a significant association with the participants’ talking or meeting someone who used frankincense to improve sexual health (p<0.001) and adjusted pairwise comparisons between the categories of marital status showed that the significant difference was only between married and single participants (41 vs. 24%, respectively). As regards having ever used or considered using frankincense as a supplement to improve sexual and reproductive health, the percentage of single participants (17%) was significantly lower than that of married and divorced categories (31 and 38%, respectively).

DISCUSSION

Worldwide, there is a growing trend in the use of herbs and other supplements to treat male infertility. Hundreds of herbal and nutritional supplements are sold on the market to treat male sexual dysfunction and a growing list of complementary and herbal treatments are utilized to treat the condition worldwide [11]. Frankincense (*Boswellia sacra* Fluck.) (*B. sacra*) has long been used in numerous nations to address male fertility issues [12]. This study evaluates the knowledge, perceptions and attitudes regarding the effects of frankincense on sexual and reproductive health among the Saudi Population.

Our study showed a high respondent rate in assessing the knowledge, perception and usage of frankincense among the Saudi population. The central region was among the high respondents. most of the respondents were married and there were more female respondents than male (Table 1). Studies

found that women were more likely than men to use complementary and alternative medicine (CAM) [13]. However, multiple national and international research has documented this gender disparity [14]. According to our data, most of respondents stated varying degrees of knowledge regarding frankincense, ranging from being well-informed to having some information. In comparison to earlier research, our study found that participants had a high level of knowledge about frankincense (Table 2). For example, items derived from *Boswellia oleo gum resin* are marketed globally for varied effects [15]. Frankincense is a widely utilized herb in several Arab and African countries [16]. One of the reasons for its appeal is that its benefits are mentioned in religious writings and other old publications [10].

In our study we have found that the main source of knowledge about frankincense were relatives and friends. The percentages of respondents who learned about frankincense through the interaction with relatives and friends, media and reading and browsing differed considerably between all levels of familiarity with the substance, the most significant percentages were recorded in people who are more familiar with the substance. This observation is in line with the social orientation of the Saudi society where interpersonal communication and online media have strong influence in developing the health-related knowledge and behaviors [17]. Past researches in Saudi Arabia have also indicated that family, friends and media are some of the most frequently used sources of information about CAM, which is indicative of the role of social networks and cultural connectedness on the awareness of the general population about their health [16,17].

Other potential causes are insufficient formal training on CAM in schools and colleges and unstructured population-wide campaigns on safer and evidence-based use of herbal and natural medicines [13,17]. It is thus relevant that there is a demand on accessible, reliable and up-to-date information regarding CAM to enable informed decision-making in patients and their families as misinformation about it continues to be common [18].

Concerning the awareness of the respondents on the potential of frankincense to improve sexual and reproductive health, the gaps in the number of participants who personally use frankincense, who have acquaintances who use it and those who contemplate whether to use it as a supplement is moderate (Table 2). In spite of the traditional assumptions regarding its possible reproductive advantages, there is still a lack of scientific evidence [12]. Despite the protective effects of *Boswellia* species on testicular tissue in experimental literature involving antioxidant and anti-apoptotic effects, complete human research has not been done on the reproductive benefits of this species [14]. In our study, the majority of participants used frankincense at any time. The most common method of administration was drinking its infusio, followed by chewing it as isurning it as incense and inhaling it. In the food industry, frankincense is used in the production of beverages, candies,

chewing gums, gelatins, nut products, puddings and canned vegetables [19,20]. In Saudi Arabia, approximately 500 tons of Somali frankincense are imported for the manufacturing of chewing gum, with a similar quantity being used for home incense burning [21]. These results indicate that marital status affects exposure to and the readiness to use frankincense more than belief in its efficacy, potentially due to married and divorced individuals experiencing heightened sexual and reproductive health issues and participating in related discussions more frequently. Studies indicate that relational and social aspects influence the use of herbal therapies for sexual health [22]. Experimental research corroborates the biological feasibility of frankincense's advantages, as *Boswellia sacra* extract elevates testosterone levels, sperm count and motility in animal models [6]. Nevertheless, systematic reviews underscore that empirical evidence regarding frankincense's influence on sexual or reproductive health is still scarce, with the majority of favorable results being from preclinical investigations [23].

The clinical studies in the literature were limited, animal studies Comparing Frankincense extract-administered rats to cyclophosphamide-treated animals revealed dose-dependent increases in blood testosterone levels, antioxidant enzyme activities and sperm count with enhanced sperm quality [24]. Additionally, the human Leydig cells were shielded against lipopolysaccharide-induced damage by the *Boswellia sacra* extract, which also increased Bcl-2 gene expression and decreased caspase-3 gene expression [25]. The study's findings indicate that *B. sacra* extract shields the male reproductive system [26]. Other animal studies demonstrated that feeding male rats with frankincense for a complete spermatogenic cycle resulted in a significant increase in sperm density and motility [27]. The authors also reported that histological and histometry analyses revealed a significant increase in the nuclear diameter of Leydig cells and the height of the epithelial lining of the epididymis and seminal vesicles [28]. In a human study, frankincense and other plants are used in traditional medication to treat male infertility according to the case report of a patient with severe Oligoasthenoteratozoospermia (OAT), which reported significant improvement in his sperm characteristics, resulting in the creation of eight embryos in the intracytoplasmic sperm injection cycle [14]. However, this case report did not report the pregnancy or paternity rate [18]. A randomized, placebo-controlled, clinical trial reported that Frankincense (*Boswellia serrata*) and ginger might be effective in treating heavy menstrual bleeding due to their anti-inflammatory properties [27]. Menstrual bleeding duration decreased in the frankincense (-1.77 ± 2.47 days, $p = 0.003$) and ginger (-1.8 ± 1.79 days, $p = 0.001$) groups but not in the placebo group (-0.52 ± 1.86 days, $p = 0.42$). The groups who received frankincense (-25.7 ± 3.1 ; $p < 0.001$) and ginger (-29.2 ± 3.7 ; $p < 0.001$) showed a greater improvement in their quality of life when compared to the placebo group (-15.07 ± 3.52 ; $p < 0.001$) [28]. Derivates of boswellic acid are found in frankincense. Boswellic acid and its derivatives have anti-

inflammatory properties by inhibiting prostaglandins, lipoxygenase (LOX), nitric oxide synthase and cyclooxygenase-2 (COX-2) [30].

CONCLUSIONS

It is concluded that there is a high level of awareness and cultural acceptance of frankincense (*Boswellia sacra*) among the Saudi population; however, its use specifically for sexual and reproductive health remains limited. Although a considerable proportion of participants expressed positive perceptions regarding its potential benefits, the majority demonstrated neutral attitudes, reflecting uncertainty about its effectiveness. Marital status was significantly associated with exposure to and consideration of frankincense use, suggesting that social and relational factors play an important role in health-related behaviors. Despite promising findings from experimental studies indicating possible biological benefits, robust clinical evidence in human populations is still lacking. Therefore, while frankincense continues to be widely used as a traditional remedy, there is a need for well-designed clinical trials to establish its efficacy and safety for sexual and reproductive health before it can be recommended for routine clinical use.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, due to its cross-sectional design, causal relationships between variables cannot be established and the results only reflect associations at a single point in time. Second, the use of a non-probability convenience sampling technique may introduce selection bias and limit the generalizability of the findings to the wider population. Third, data were collected through a self-administered questionnaire, which may be subject to recall bias and social desirability bias, particularly given the sensitive nature of sexual and reproductive health topics. Additionally, the study relied on self-reported perceptions and experiences without clinical or biological verification of the effects of frankincense, which may affect the accuracy of reported outcomes. Furthermore, although the questionnaire was pre-tested, it may not fully capture the complexity of knowledge and attitudes regarding herbal medicine.

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