

Evaluation of efficacy of *Elaeagnus angustifolia* flower essential oil inhalation in improving sexual function in women of reproductive age: A randomized, controlled clinical trial

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Research Article

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Abstract

Background: Normal sexual function is an important part of women's sexual and mental health. The aim of this study was to determine the effect of inhalation of *Elaeagnus angustifolia* essential oil on sexual Function of women of reproductive age.

Materials and Methods: This study is a randomized, three-group clinical trial that was performed on 99 women referred to health centers in Mashhad. The first group used the essential oil by inhalation for 20 minutes three times a day for 4 weeks and the second group used the essential oil by inhalation 20 minutes before intercourse and the third group did not receive any intervention. Sexual function were assessed by FSFI questionnaire at baseline and after 4 weeks in all three groups.

Results: The mean and SD age of women were 33.7 ± 7.6 . The mean score of sexual function before the intervention in the first and second intervention group and control group were 23 ± 1.3 , 23.3 ± 6.4 and 23.1 ± 3.6 ($P=0.630$) respectively that was not statistically significant ($p=0.630$). The mean score of sexual function after 4 weeks in the first and second intervention group and control group were 25.2 ± 7.9 , 28.2 ± 4.9 and 23.1 ± 3.5 ($P<0.001$) respectively. Also after 4 weeks in the second intervention group improved sexual function in all areas, but in the first intervention Group improved all areas except pain and sexual Satisfaction ($P<0.001$).

Trial registration: The research project was registered in the Iranian Registry of Clinical Trials (IRCT) with a code (IRCT20191203045589N1) and the ethics committee of Mashhad University of Medical Sciences with a code (IR.MUMS.NURSE.REC.1398.07) and first registration in 11/12/2019.

Conclusion: Inhalation of *Elaeagnus angustifolia* oil, has had a beneficial effect on improving sexual function in women of reproductive age, so it can be used as an affordable herbal supplement to improve Sexual function in these women.

Background

Sexual function is the way the body reacts to different stages of the sexual response cycle, and a proper function results from functions of all physical, mental, psychological, social, and emotional factors that lead to proper mental understanding and enhance sexual desire(1). Sexual dysfunction refers to dysfunctions of sexual desire, arousal, orgasm, and dyspareunia leading to severe anxiety and problems in interpersonal and marital relationships(2). Any kind of stress, emotional disorders with ignorance of physiological and sexual functions can negatively affect the sexual function(3). There are numerous global statistics on the prevalence of sexual disorders. According to a study by Nappi (2016), 40–50% of women have at least a sexual dysfunction(4). In another study in Korea in 2020, the prevalence of this dysfunction was 37.2–39.5% among women of reproductive age(5). In a study by Ranjbaran et al. (2016), the overall prevalence of female sexual dysfunction in Iran was 42% in sexual desire, 38.5% in arousal, 30.6% in vaginal lubrication, 29.2% in orgasm, 21.6% in sexual satisfaction, and 40.1% in dyspareunia(6). In a comprehensive and systematic study, Ghiasi et al. (2018) found that the prevalence

of sexual dysfunction was 52% in Iranian women(7). Therefore, this disorder is common and its incidence is higher in women. Sexual dysfunction, especially in women of reproductive age, may negatively affect the relations between couples, fertility, the family cohesion, and personal health, quality of life, interpersonal and social relationships. Therefore, the treatment of sexual disorders is very important(8, 9). Diagnosis and treatment of sexual dysfunction are complex in women and require careful evaluation, and there are different treatments according to disorder types. These treatments are divided into two categories, pharmacological and non-pharmacological. Pharmacological treatments include modern and alternative medicine. Some of chemical drugs affecting sexual function are sildenafil citrate, Aphrodit, and femoral gel (10–12). Given the side effects of chemical drugs, low acceptance of chemical drugs by people, and contraindications of these drugs for some people, and also the public tendency to alternative remedies, especially herbal medicines, and minimal side effects and non-invasive nature of most of these drugs, researchers have paid attention to alternative medicine. Aromatherapy is an alternative medicine method that means using essence and oils to promote health and improve diseases(13). When a scent (containing phytoestrogens) is breathed, the nerve cells of the olfactory center become activated, sending an olfactory message to the limbic system and the hypothalamus. This signal causes the release of various neurotransmitters (endorphins, noradrenaline, and serotonin) that can affect sexual emotion by affecting human emotions(14, 15). Furthermore, due to the relationship between the sense of smell and the human spirit and emotions, aromas can change emotions in humans with a physiological and psychological effect on the soul and body(16). *Elaeagnus angustifolia* is a traditional medicine that has a hot-dry temperament and has a pleasant smell. The traditional medicine books, including *Makhzan al-advieh*(17) consider this feature as its smell can sexually stimulate women(18, 19). This flower contains aromatic essential oil, the most important components of which are essential ingredients(20, 21). Ethyl cinnamate and Anethole have estrogenic properties (22–24). Due to the beneficial effects of capsules and oral extract of Elm flower on female sexual function (19, 25, 26), the lack of known side effects, and the possibility of better effectiveness of its essential oil due to a direct effect on the limbic system, its greater acceptance by individuals, the lack of systemic and gastrointestinal side effects of its oral form, ease of use of the essential oil, creating a pleasant feeling in the person, and cost-effectiveness(14, 16), and the lack of study on aromatherapy of this plant, the present study aimed to determine the effect of smelling *Elaeagnus angustifolia* essential oil on the sexual function of women at the reproductive age.

Methods

The present study was a three-group randomized parallel clinical trial on 99 women at 18–45 years of age who visited two health centers in Mashhad (Daneshamouz and Sadaf) east north of Iran and were selected by a simple random sampling from December 2019 to June 2020. In order to select the participants, the researcher, after giving the necessary explanations and obtaining informed written consent, sampling was done in an accessible manner. Inclusion criteria of the study were as follows: married and being at the childbearing age (18–45), literacy, Iranian nationality, the only husband's spouse, Female Sexual Function Index (FSFI) of less than 28, having normal vaginal sex at least once a week, absence of depression, stress and anxiety [not receiving a depression score of less than 21, anxiety

score less than 15, and stress score less than 26 in the Depression, Anxiety and stress Scale (DASS-21)], lack of non-normal vaginal bleeding and vaginal infections, and the lack of olfactory disorder based on the Pusswald Questionnaire for olfactory dysfunction (QOD). No sexual dysfunction in the spouse, no medical and psychological diseases affecting sexual function in a couple.

Drop out of the study were as follows: drug sensitivity, pregnancy during the study, use of drugs that affect sexual function during the study, lack of sex, experience of traumatic and stressful events, colds and olfactory disorders, and unwillingness to continue the research.

After giving the necessary explanations and obtaining informed written consent, the forms of selecting research units were first completed, and if the inclusion criteria were met, the personal-midwifery information questionnaire, Female Sexual Function Index (FSFI) and the Pusswald Questionnaire for olfactory dysfunction (QOD) were completed by all three groups, and the research units (n = 99) were randomly divided into first intervention group: three times a day (n = 33)), second intervention group: 20 minutes before intercourse (n = 33) and control group (n = 33) using random permuted blocks of sizes 4 or 6 and an allocation ratio of 1:1.. The sample size was considered equal to 27 based on the same study (2017) and taking into account the 5% error and 95% test power in each group (27). Due to the interventional nature of the study and the possibility of a loss of about 20%, the final sample size was 33 per group.

$$n = \frac{\left(z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right)^2 (\sigma_1^2 + \sigma_2^2)}{(\mu_2 - \mu_1)^2} = \frac{(1.96 + 0.84)^2 (1.1^2 + 1.1^2)}{(4 - 2.7)^2} = 27$$

The Female Sexual Function Index Questionnaire had 19 questions on 6 subscales, including sexual desire, sexual arousal, vaginal lubrication, orgasm, dyspareunia, and sexual satisfaction. The scoring of this questionnaire is in a way that the scores of each domain are obtained by adding scores of questions of each domain and multiplying it by the factor number. Since the numbers of questions of domains are not equal to each other, first the scores of questions in each domain are added together and then multiplied by the factor number to equiponderate the domains. The factor numbers were 0.6 in sexual desire, and 0.3 in lubrication and arousal, and 0.4 in orgasm, sexual satisfaction, and dyspareunia. To obtain a total score of the questionnaire, we need to add scores of 6 domains. A higher score indicates better sexual function. The maximum score for this questionnaire was 36 and people with a score less than 28 were included in the study. The validity and reliability of questions were approved by Mohammadi et al. (2008) (28). In the present study, the reliability was approved using the internal consistency by Cronbach's alpha for sexual desire (0.866), sexual arousal (0.872), sexual lubrication (0.855), orgasm (0.804), sexual satisfaction (0.901), and dyspareunia (0.953).

After selecting participants, researcher asked the first group to pour 5–7 drops of *Elaeagnus angustifolia* essential oil on a mask three times a day for 4 weeks and inhale it for 20 minutes. We asked the second group to pour 5–7 drops of essential oil on the mask and inhale for 20 minutes before intercourse, and

we gave an educational pamphlet to the control group after the intervention for improving the female sexual function. At the end of each week, a telephone call was made to investigate possible complications and answer questions of the research units, and at the end of the fourth week, we considered dates for in-person visits of the participants to re-complete the sexual function questionnaire. The researcher, statistician, and participants were all kept blinded about the groups and drugs.

In this study, experimental research on plants including the collection of plant material, complied with relevant institutional, national, and international guidelines and legislation. To prepare the medicine, *Elaeagnus angustifolia* was purchased from the gardens of Birjand city, South Khorasan province, Iran. This tree is found in abundance in the mountain villages of Birjand. Then, in the next step, the blossoms of this plant were identified and confirmed by a skilled botanist at the Ferdowsi University of Mashhad Medicinal Plants Research Institute, and the herbarium code (13477) was registered for this plant at the Faculty of Pharmacy of Mashhad University of Medical Sciences.

The researcher prepared the dried *Elaeagnus angustifolia* blossoms from approved centers, powdered them, and then soaked them in base oil (sweet almond oil). The process took 7 days. After this period, it was filtered and the resulting oil was soaked again with the same amount as the original plant for a week. After the second week, these operations were repeated in the third week because the oil was not obtained from the saturation of essential oil. After filtering, the essential oil was poured into dark glasses to prevent its oxidation. After completion, we analyzed data with SPSS 25 software. The normality of the distribution of quantitative variables examined using the Shapiro-Wilk test. If the distribution of quantitative variables was normal, used the analysis of variance (ANOVA), otherwise, utilized the Kruskal-Wallis test. the Chi-square test used to evaluate the homogeneity of qualitative variables in the three groups. The Wilcoxon test used to compare the mean scores of sexual desire, arousal, lubrication, orgasm, sexual satisfaction and dyspareunia in groups at two stages of the beginning of the study and the fourth week after the study, the paired t-test to compare the total mean score of sexual function in each group at two stages, the beginning of the study and four weeks after the study. To interpret the results, we considered the significance level of $P < 0.05$.

Results

The average age of women participating in the study and their spouses were 33.86 ± 7.55 and 39.39 ± 8.71 years. Most of the women in the study were housewives and had a high school diploma (Table 1). Among 33 individuals in each group, three person excluded from the first intervention group (three times a day) due to the lack of spouses, lack of sex, allergies (runny nose and headache), and two person from the second intervention group (20 minutes before intercourse) due to their spouses' dissatisfaction, and dissatisfaction with the treatment (Fig. 1). The results of fitting statistical tests indicated that the three groups did not have any statistically significant difference and were homogeneous in terms of the demographic characteristics ($P > 0.05$). The results indicated that the mean scores of sexual function and its dimensions were not statistically significant in the three groups at base line but the difference was statistically significant after the intervention ($p < 0.001$)(Table 2).

Table 1
Demographic characteristics of the research sample for three groups

Variable	Intervention group 1	Intervention group 2	control group	Test result
	Standard deviation $\pm$ mean	Standard deviation $\pm$ mean	Standard deviation $\pm$ mean	
Female age (years)	2/7 $\pm$ 4/33	8/7 $\pm$ 2/34	8/7 $\pm$ 6/33	913/0 = P*
Spouse age (years)	0/8 $\pm$ 0/39	2/9 $\pm$ 1/40	8/8 $\pm$ 8/38	P* =202/0
Duration of marriage (years)	5/7 $\pm$ 4/13	0/9 $\pm$ 8/14	3/6 $\pm$ 4/13	P* =280/0
Body mass index (kg / m2)	8/3 $\pm$ 6/26	9/3 $\pm$ 6/25	0/3 $\pm$ 1/25	P* =275/0
Number of sex per week	1/1 $\pm$ 0/1	1/1 $\pm$ 9/0	1/1 $\pm$ 8/0	P** =557/0
Number of normal deliveries	8/0 $\pm$ 6/0	7/0 $\pm$ 5/0	9/0 $\pm$ 6/0	783/0 = P**
Number of cesarean sections				P**=790/0
Level of education:	(3/3) 1	(2/3) 1	(0/0) 0	310/0 = P***
Elementary	(7/26) 8	(9/12) 4	(2/18) 6	
Under high school diploma	(7/46) 14	(2/45) 14	(3/30) 10	
Diploma	(3/23) 7	(7/38) 12	(5/51) 17	
University				
Female job:	(3/83) 25	(5/93) 29	(7/72) 24	085/0 = P****
Housewife	(7/16) 5	(5/6) 2	(3/27) 9	
Employed				
Method of family planning:	(3/63) 19	(3/61) 19	(6/63) 21	138/0 = P***
withdrawal	(7/16) 5	(3/32) 10	(2/18) 6	
Condom IUD	(3/3) 1	(2/3) 1	(1/12) 4	
OCP	(7/16) 5	(0/0) 0	(0/3) 1	
Vasectomy	(0/0) 0	(0/3) 1	(0/0) 0	
Tobectomy	(0/0) 0	(0/0) 0	(0/3) 1	

*One-way analysis of variance **Kruskal Wallis ***Fisher's exact test ****Accurate chi-square

Variable	Intervention group 1 Standard deviation ± mean	Intervention group 2 Standard deviation ± mean	control group Standard deviation ± mean	Test result
Separate bedrooms of children:	(7/76) 23	(1/87) 27	(8/75) 25	476/0 = p****
Yes	(3/23) 7	(9/12) 4	(2/24) 8	
No				
love affairs before the intercourse:	(0/80) 24	(1/87) 27	(8/78) 26	854/0 = p****
Yes	(0/20) 6	(9/12) 4	(2/21) 7	
No				
*One-way analysis of variance **Kruskal Wallis ***Fisher's exact test ****Accurate chi-square				

Table 2

Comparison of sexual function score and its dimensions before and after the intervention in three groups

Variable	Intervention group 1 Standard deviation $\pm$ mean	Intervention group 2 Standard deviation $\pm$ mean	control group Standard deviation $\pm$ mean	Test result
Sexual desire	7/0 $\pm$ 1/3	8/0 $\pm$ 2/3	4/0 $\pm$ 3/3	*H = 907/0-P = 635/0
Before intervention	6/0 $\pm$ 1/4	7/0 $\pm$ 4/4	3/0 $\pm$ 5/3	*H = 026/31-p < 001/0
After intervention	4/0 $\pm$ 0/1	5/0 $\pm$ 2/1	4/0 $\pm$ 1/0	
difference between after and before	Z = 813/4- p < 001/0	Z = 837/4- p < 001/0	Z = 332/2- P = 020/0	*H = 585/46- p < 001/0
Intragroup test results	6/0 $\pm$ 3/3	7/0 $\pm$ 4/3	5/0 $\pm$ 5/3	*H = 073/3-P = 215/0
Sexual arousal	7/0 $\pm$ 0/4	6/0 $\pm$ 5/4	5/0 $\pm$ 5/3	*H = 419/28- p < 001/0
Before intervention	5/0 $\pm$ 6/0	5/0 $\pm$ 0/1	1/0 $\pm$ 0/0	
After intervention	Z = 232/4- p < 001/0	Z = 652/4- p < 001/0	Z = 000/1- P = 317/0	*H = 846/50- p < 001/0
difference between after and before				
Intragroup test results				
lubrication	8/0 $\pm$ 4/4	0/6 $\pm$ 6/4	5/0 $\pm$ 4/4	*H = 367/3- P = 186/0
Before intervention	8/0 $\pm$ 7/4	5/0 $\pm$ 2/5	5/0 $\pm$ 4/4	*H = 767/22- p < 001/0
After intervention	5/0 $\pm$ 3/0	6/0 $\pm$ 6/0	1/0 $\pm$ 0/0	
difference between after and before	Z = 315/3- P = 001/0	Z = 956/3- p < 001/0	Z = 000/1- P = 317/0	*H = 190/24- p < 001/0
Intragroup test results				
Orgasm	7/0 $\pm$ 8/3	9/0 $\pm$ 9/3	7/0 $\pm$ 8/3	*H = 034/1-P = 596/0
Before intervention	6/0 $\pm$ 2/4	7/0 $\pm$ 7/4	6/0 $\pm$ 9/3	*H = 260/24- p < 001/0
After intervention	4/0 $\pm$ 3/0	6/0 $\pm$ 8/0	2/0 $\pm$ 0/0	
difference between after and before	Z = 624/3- 001/0p<	Z = 584/4- 001/0p<	Z = 000/1- P = 317/0	*H = 426/40- p < 001/0
Intragroup test results				

*Kruskal Wallis **ANOVA

Sexual satisfaction	7/0 ± 1/4	7/0 ± 2/4	5/0 ± 8/3	*H = 483/1-P = 114/0
Before intervention	7/0 ± 2/4	9/0 ± 7/4	5/0 ± 8/3	
After intervention	3/0 ± 1/0	6/0 ± 5/0	1/0 ± 0/0	*H = 841/20- p < 001/0
difference between after and before	Z = 890/1- P = 059/0	Z = 558/3- 001/0p<	Z = 000/1- P = 317/0	*H = 300/23- p < 001/0
Intragroup test results				
Dyspareunia	8/0 ± 3/4	9/0 ± 2/4	8/0 ± 0/4	*H = 084/2-P = 353/0
Before intervention	8/0 ± 3/4	7/0 ± 7/4	8/0 ± 0/4	
After intervention	2/0 ± 0/0	6/0 ± 5/0	1/0 ± 0/0	*H = 136/11-P = 004/0
difference between after and before	Z = 342/1- P = 180/0	Z = 447/3- P = 001/0	Z = 000/1- P = 000/1	*H = 372/26- p < 001/0
Intragroup test results				
Total sexual function	3/0 ± 1/23	4/3 ± 6/23	6/1 ± 3/23	**F = 464/0-P = 630/0
Before intervention	9/2 ± 7/25	9/2 ± 4/28	5/1 ± 3/23	
After intervention	7/1 ± 6/2	4/2 ± 7/4	6/0 ± 2/0	**F = 130/32- p < 001/0
difference between after and before	t= -254/8 001/0p<	t= -822/10 001/0p<	t= -477/2 P = 019/0	**F = 305/52- p < 001/0
Intragroup test results				
*Kruskal Wallis **ANOVA				

The results indicated that the mean sexual desire score process significantly increased in the intervention groups four weeks from the baseline ($p < 0.001$). The test result was also statistically significant in the control group ($P = 0.02$). However, the upward trend was higher in the intervention groups than in the control group. The mean scores of sexual arousal, lubrication, and orgasm in groups at two stages of the beginning of the study and the fourth week after the study, indicated that the mean sexual desire score process significantly increased in the intervention groups four weeks from the baseline ($p < 0.001$), but there was no statistically significant change in the control group ($P = 0.317$). The upward trend was higher in the second intervention group than the first intervention group. The results indicated that the mean sexual desire score process significantly increased only in the second intervention group four weeks from the baseline ($p < 0.001$), but there was no statistically significant change in the control and first intervention groups. The results indicated that the mean sexual function score process significantly increased in the intervention groups 4 weeks after the study ($p < 0.001$). The test result was statistically significant in the control group ($P = 0.0199$). However, the upward trend was higher in the intervention groups than the control group.

Discussion

The present study showed that inhalation of *Elaeagnus angustifolia* essential oil for 4 weeks, especially 20 minutes before intercourse, improved total score of sexual function and in all domains (libido, arousal, moisture, orgasm, sexual satisfaction, and pain). Since when a scent (containing phytoestrogens) is inhaled, the nerve cells of the olfactory center are activated, sending an olfactory message to the limbic system and the hypothalamus. This signal causes the release of different neurotransmitters (endorphins-noradrenaline- serotonin), and these neurotransmitters indirectly increase the secretion of estrogen and can affect sexual disorders(14, 15). In this regard, Malakouti et al. (2015) conducted a study titled "A combined inhalation aromatherapy (lavender, fennel, geranium, and rose) on the sexual function of postmenopausal women", and their results indicated that aromatherapy improved all domain of the sexual function, except for dyspareunia during intercourse in menopausal women(29). In this regard, it was inconsistent with a part of the present study on dyspareunia. The reason for the inconsistency was the difference between target groups of the two studies. In menopausal women, various factors such as urogenital atrophy, infections, and vaginal dryness can cause dyspareunia; hence, this contradiction in the results can be justified. The reason for the consistency with another part of the present study was that the aromatic essential oils in aroma contained phytoestrogens that were effective in reducing menopausal symptoms and improving sexual function by activating nerve cells in the olfactory center and secreting various neurotransmitters. According to studies, Ethyl cinnamate and Anethole in *Elaeagnus angustifolia* have estrogenic properties, and the essential oil from plants containing phytoestrogens affects sexual functions (22–24). In a study by Shinohara(2016), who examined the effects of 10 essential oils containing phytoestrogens (lavender, rose, chamomile, sage, orange blossom, geranium, orange, and Ylang-ylang) on the salivary estrogen levels in women near the menopause period, only geranium and rose increased estrogen and improved menopausal symptoms(30). For plants such as lavender, there are contradictory results, but rose, which has compounds similar to *Elaeagnus angustifolia*(31) improved sexual functions in both studies. Furthermore, *Elaeagnus angustifolia* has Linalool and linoleic acid, which has anti-fatigue, anti-stress, antidepressant and sedative properties as a sign of its superiority over roses in improving sexual functions(32). In a study by Tufan et al. (2018) in Turkey on plants affecting sexual functions, flowers and essential oils obtained from *Elaeagnus angustifolia* blossom were introduced as a drug affecting sexual disorders(33). Khadivzadeh (2018) conducted a systematic review and meta-analysis study titled "Aromatherapy in sexual problems of postmenopausal women" and found that aromatherapy with lavender oil and a combination of oil and lavender, fennel, geranium, and rose improved sexual functions in all domain in menopause women(34) and the results were consistent with the present study and the researcher considered the presence of phytoestrogens in the oils as the reason for improving sexual functions. In an inconsistent study in Rasht titled "the study of the effects of Chaste tree on sexual dysfunction in women of reproductive age", Heirati (2020) argued that using the plant pill for four weeks could not increase scores of sexual function in women, and the result was inconsistent with our study(8). The reason for the inconsistency maybe was the difference in the method of drug administration (oral vs. inhalation), drug doses in the two studies, and geographical and cultural differences. Furthermore, Heirati studied women who visited Al-Zahra Health Center in Rasht for Pap smear test, but our sampling had a convenience type and included all women at childbearing age who visited Daneshamouz and Sadaf centers. The inhalation method also

has advantages such as greater effectiveness due to direct impact on the brain, more acceptance, pleasant feeling, and no systemic and gastrointestinal side effects of the oral form; hence, these factors may to some extent respond to the difference between the findings of the two studies(14, 16). In a study by Khayatan (2019) and Abedi (2019), who studied the effect of phytoestrogens such as red clover and fennel on sexual functions of postmenopausal women, there was a statistically significant difference between total scores of sexual function in the intervention and control groups(35, 36). The reason for the consistency of these studies was the presence of phytoestrogens (flavonoids, and lignans) in fennel and red clover, indicating that phytoestrogens could improve sexual dysfunction even though the mechanisms of action were different.

In a review study in 2019 on sexual satisfaction and functions of postmenopausal women treated with herbs, it was found that herbs containing phytoestrogens could improve sexual function and satisfaction as an effective and selective drug(37). Given that the essential oil obtained from *Elaeagnus angustifolia* flower also had phytoestrogenic properties, the effectiveness of the essential oil on sexual function could be approved, and the result was consistent with the results of the present study. Lari et al. (2018) conducted a review study titled "Aromatherapy in sexual dysfunction (an overview of traditional Iranian medicine)" and emphasized the effects of fragrances in various forms on the treatment of sexual disorders and infertility and pointed out that hot odors increased Sexuality and potency(38).

The strengths of the present study to our knowledge were its first investigation of inhalation of *Elaeagnus angustifolia* essential oil on sexual function of women at the reproductive age, and also the three-group nature of the intervention that greatly reduced the possibility of the effects of intervening variables on the results. The research limitations included the lack of control over all factors affecting sexual function, including mental states and personal characteristics of the samples, which had no definite cure, but they were partially eliminated with random allocation of individuals and a checklist of inclusion criteria, in addition to undiagnosed mental and physical illnesses of research units, which affected sexual functions and might not have been studied due to self-report of questionnaires and cultural-religious barriers to sexual expression. There were differences in the individuals' immune and physiological systems that could affect the response to the intervention, and its control was beyond the researcher's control, and the researcher sought to control it by randomly assigning individuals to three groups. The researcher should ensure the essential oil consumption based on trust. To control this limitation, we used telephone calls and drug control checklists. Due to the research nature and the difference in drug use, blinding was impossible in the intervention groups. Due to the lack of known side effects of *Elaeagnus angustifolia* essential oil because of its direct effect on the limbic system, the absence of systemic and gastrointestinal side effects of the oral form of this product, the ease of use of the essential oil, creating a pleasant feeling in people, and its cost-effectiveness, we suggest using this product as a complementary therapy to help improve sexual function in women of reproductive age with sexual dysfunction.

Conclusion

The results indicated that inhaling flower essences 20 minutes before the intercourse in women at childbearing age improved their sexual function scores through activating the nerve cells of the olfactory system and sending a nerve message to the limbic system and hypothalamus and the release of various neurotransmitters such as endorphins, serotonin, and noradrenaline.

According to the results, we suggest conducting a study on the impact of inhalation of *Elaeagnus angustifolia* essential oil on sex hormones in women at childbearing age.

Abbreviations

FSFI: Female Sexual Function Index Questionnaire;

QOD: Pusswald questionnaire for olfactory dysfunction;

DASS21: depression, anxiety and stress Questionnaire.

Declarations

In this study, all methods were carried out in accordance with relevant guidelines and regulations and all experimental protocols were approved waived by the ethics committee of Mashhad University of Medical Sciences.

Also in this study, informed consent was obtained from all subjects.

Consent for publication: Not applicable.

Availability of data and materials: The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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Authors' contributions: RB, HH and BJ inception designed the proposal, data analysis, interpretation, manuscript draft, revised the manuscript and wrote the paper. HH and BJ participates in data collection and entry. HH and JJ participate in analysis. All authors read and approved the final manuscript.

Competing interests: The authors declare that they have no conflict of interest regarding publication of this paper.

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(IR.MUMS.NURSE.REC.1398.07) and first registration in 11/12/2019 . We are deeply grateful to the esteemed research council and the ethics committee of Mashhad University of Medical Sciences, the Faculty of Nursing and Midwifery of Mashhad, and the research units for their cooperation in the present project.

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Figures

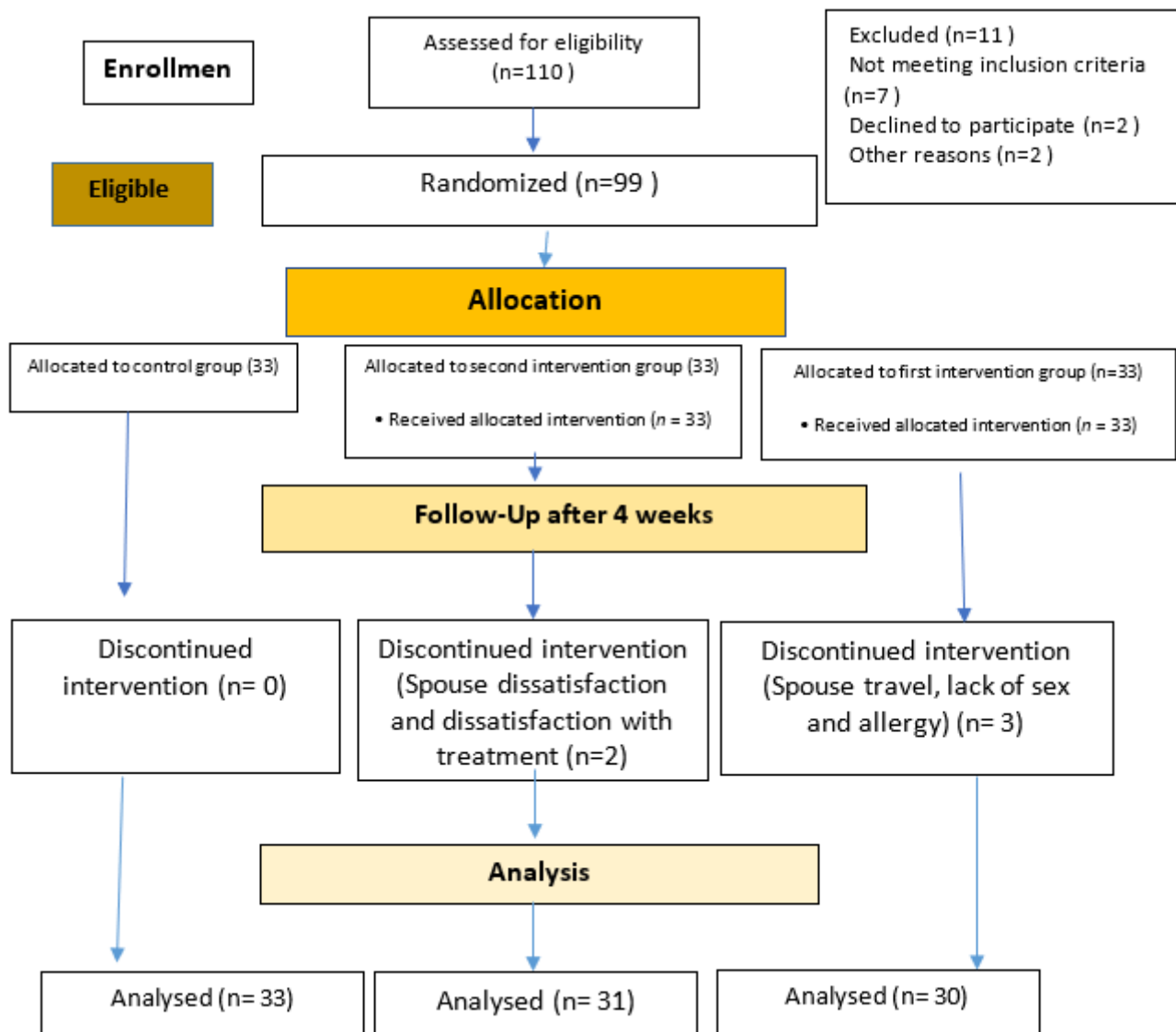


Figure 1

CONSORT Flow Diagram