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The Impact of *Ginkgo biloba* Tablet and Aromatherapy Inhaler Combination on Sexual Function in Females During Postmenopausal Period: A Double-Blind Randomized Controlled Trial

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Abstract

Objectives: Due to enhanced life expectancy and an increasing elderly population, sexual and physical problems related to menopause are essential from the health point of view. This study was performed to evaluate the effect of *Ginkgo biloba* tablet and aromatherapy inhaler combination (lavender, fennel and geranium and rose) in decrement of sexual dysfunction in postmenopausal women.

Materials and Methods: This double blind randomized clinical trial was performed on 180 postmenopausal women with age range of 45-55 years referring to health care centers in Ardabil University of Medical Sciences, Iran. The participants were randomly divided into 3 groups of 60 subjects: *Ginkgo biloba* tablet and placebo aroma solution users, aroma solution with placebo *Ginkgo biloba* users, and placebo aroma with placebo *Ginkgo biloba* users who received 40 mg *Ginkgo biloba* either in tablet or placebo and 2-3 drops of aroma solution or placebo on the skin, 3 times a day for 6 weeks. The tool for collecting data was a questionnaire encompassed questions on the socio-demographical features and female sexual function index (FSFI). The primary outcome was the sexual function mean score after intervention in the research groups. The analysis was conducted according to intention-to-treat.

Results: The mean (SD) scores of total sexual function at baseline in aromatherapy, *Ginkgo biloba* and placebo groups were 18.4 (5.4), 17.5 (6.8) and 15.8 (5.7) that enhanced to 22.9 (3.3), 21.6 (4.5) and 17.2 (4.2) in the mentioned groups respectively after intervention. Analysis of covariance (ANCOVA) test indicated significant discrepancy after intervention in total ($P < 0.001$) and all sub-domains scores of sexual function ($P < 0.003$) with the exception of pain in *Ginkgo biloba* and aromatherapy groups compared to placebo with controlling of confounding factors.

Conclusion: Aromatherapy inhaler combination and *Ginkgo biloba* tablet improved sexual function in postmenopausal women.

Keywords: Aromatherapy, *Ginkgo biloba*, Menopause

Introduction

As defined by the World Health Organization (WHO), sexual health is a state of physical, mental and social well-being related to sexuality. Sexual dysfunction in postmenopausal women is defined as any disorder related to sexual desire, orgasm or arousal phase, which can affect the quality of life (2). The prevalence of sexual dysfunction in postmenopausal women is 4 times more than reproductive-age women (3). The risk of sexual dysfunction in older age women has increased and sexual satisfaction decreased which can be due to the postmenopausal hormonal changes (4). After menopause orgasm, arousal and lubrication are decreased with age; low estrogen and androgen levels, reduced blood flow to the vulva, vaginal dryness, dyspareunia reduce mental-sexual energy (5). Dennerstein et al indicated sexual dysfunction about 42% after one year and 88% after 8 years from menopause which was definitely associated with menopause (6). In Iran, several studies have also reported decreased libido and increased sexual dysfunction in postmenopausal women (7-9).

Estrogen can treat these disorders and improve sexual function, but studies are needed to determine the minimum effective treatment dose with the best results (10,11). Prescribing exogenous estrogen has complications such as stroke, pulmonary embolism and breast cancer (11,12). Over the past decade, the use of complementary medicine instead of hormone therapy has increased and more women are looking for natural alternative treatments to relieve menopausal symptoms (13). The use of alternative medicine has increased not only due to its low cost and proven effectiveness but also due to the recommended holistic care theory and various nursing theories (14). Ginkgo biloba is a phytoestrogen that contains flavone glycosides (15,16). It facilitates blood flow and has relaxant effect on smooth muscle tissues (17,18). A number of studies have shown improvement in sexual function after taking this plant (19,20). The possible side effects of this

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plant can be headache, skin irritation and gastrointestinal problems such as nausea, vomiting and stomach pain (21). A number of herbal aromatic essences in aroma such as fennel, angelica, sage and bergamot, lavender and geranium could reduce climacteric symptoms such as hot flashes, sexual dysfunction and depression (22-25).

Given the prevalence of sexual problems during menopause, women's interest in taking complementary medicine to reduce the symptoms of menopause (13), use of herbal medicines with less side effects and accelerating the treatment procedure, positive impact of *Ginkgo biloba* in some studies, studying the plant in different doses and population (18,19) and the lack of research about the effects of aromatherapy on sexual function, this study aimed to evaluate the combined effect of herbal therapy by *Ginkgo biloba* and aromatherapy on sexual function in postmenopausal women.

Materials and Methods

This study was a double blind randomized controlled clinical trial conducted from August 2014 to March 2016 on 180 postmenopausal women referred to health centers in Ardabil, Iran to determine the combined effect of *Ginkgo biloba* tablet and aromatherapy inhaler pill on sexual function in postmenopausal women. The number of samples in each intervention and placebo groups was 60 at random allocation using a computer-generated randomization scheme with blocks 3 and 6 and allocation ratio of 1: 1: 1. Eligibility criteria were: women with natural menopause, not taking any effective drug on sexual response, lack of mental health problems or known systemic diseases affecting sexual function, no loss of smell declaring by the individual and other nasal disorders, lack of digestive disorders such as nausea, vomiting, abdominal pain and stomach cramps. After explaining the purpose of the study and signing an informed consent form by the eligible women, demographic characteristics questionnaire and Female Sexual Function Index (FSFI) were completed. This questionnaire was also completed once again by the participants after intervention. The validity and reliability of the questionnaire were confirmed by Mohammadi et al in Tehran in 53 women with sensitivity of 83% and specificity of 82% (26).

Sealed opaque envelope coded from 1 to 180 were used to keep the allocation concealment and drugs including 2 bottles of solution and 126 tablets that were put in the envelope on the basis of random allocation sequence by an uninvolved individual in the research. Enrolling the people to study and delivering packets from 1 to 180 respectively were done by the researchers themselves. The first intervention group took 40 mg *Ginkgo biloba* tablet and 2-3 drops of aroma of placebo 3 times a day for 6 weeks, the second intervention group took 2-3 drops of aroma solution (combination of lavender, fennel, geranium and rose) and 40 mg of *Ginkgo biloba* placebo 3 times a day for 6 weeks and placebo group took placebo tablets 40 mg and placebo aroma simultaneously. Aroma solution was used on the skin of forearm. The researcher contacted the participants to be ensured if they took their drugs. They were also given check lists for checking the use of the drugs by the end of the day. In this study *Ginkgo biloba* placebo tablets and aroma solution placebo were the same as original drug in shape, size and color, so the researcher and participants were all blind. However, the aroma solution placebo was without fragrance which was considered as the study limitation.

Descriptive statistics such as mean and standard deviation, frequency, percentage and inferred statistics were used after collecting data from all subjects. So that one-way analysis of variance (ANOVA) was used to compare total score of sexual function and its sub-domains among three groups before the intervention and analysis of covariance (ANCOVA) was used to compare the overall scores of sexual function and its sub-domains between the groups after the intervention with modulating basic variables and potential confounder (score of sexual function before intervention, education, income, family size, etc). Paired *t* test was used for within group comparison. Chi-square tests, one-way ANOVA and chi-square with trend were used to compare the demographic characteristics. The data were analyzed using SPSS 21 at the significant level of 0.05. The analysis was done based on intention-to-treat.

The sample size was calculated regarding to total score of sexual function in study by Amiri (19) using Pukak formula to compare differences between groups considering the increase in the average sexual function score of 30% with respect to the power of 85% and confidence of 95% and regarding the possibility of 20% loss of samples, 60 was considered for each group. The overall mean (SD) scores of sexual function before and after the intervention were 29.8 (16.2) and 38.7 (15.9), respectively.

Results

Participants were enrolled from July 2014 to March 2015 and were followed for 6 weeks. Three patients in the placebo group, 3 in aromatherapy and 1 in *Ginkgo biloba* withdrew during the study. As a result 57 in aroma, 59 in *Ginkgo biloba* and 57 in placebo group were analyzed (Figure 1). The majority of the participants in *Ginkgo biloba* (61.7%), aromatherapy (51.7%) and placebo group (65.0%) were in age range of 51-55, 51-55 and 50-55 years, respectively. The education level of majority of women was elementary in all 3 groups: *Ginkgo biloba* (43.3%), aroma (66.7%) and placebo (45%). The majority of participants' spouses were employees: *Ginkgo biloba* (66.7%), aroma (91.2%) and placebo (78.3%). The education level of majority of participants' spouses in *Ginkgo biloba* (33.3%), and aroma (66.7%) was elementary and in the placebo (28.3%) was high school education. The highest percentage of women in *Ginkgo biloba* (41.4%) and placebo (55.9%) reported their monthly income for living costs as "fairly adequate." However, it was "inadequate" in aroma group (55.2%). The mean (SD) of body mass index (BMI) in *Ginkgo biloba*, aroma and placebo groups were 26.2 (4.05%), 29.8 (5.6%) and 27.5 (3.5%), respectively. The mean (SD) number of

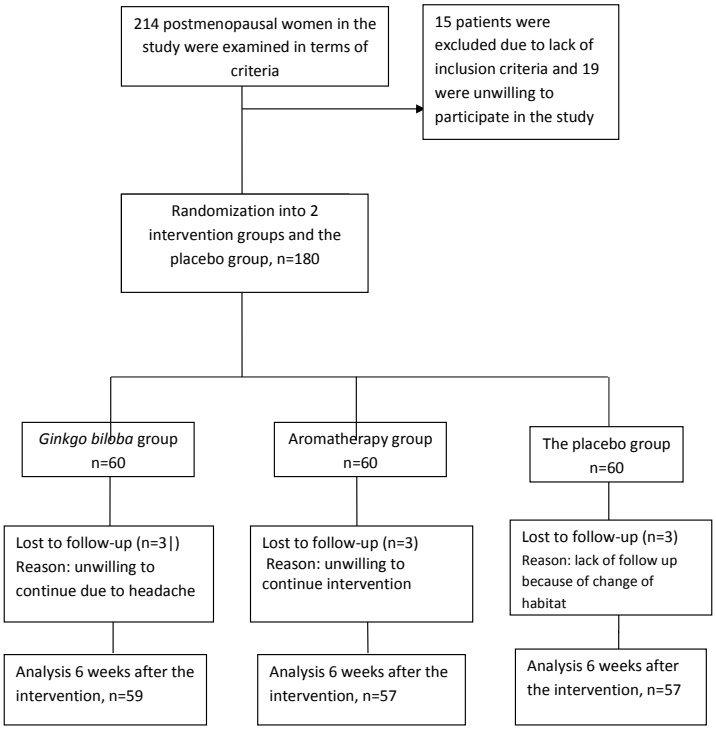

Figure 1. Participant Flowchart.

children in *Ginkgo biloba*, aroma and placebo groups were 4.1 (81.8%), 5.1 (2.1%) and 3.6 (1.7%), respectively. The mean (SD) number of family members in *Ginkgo biloba*, aroma and placebo groups were 2.9 (1.3%), 3.8 (1.6%) and 3.7 (1.2%), respectively. There was statistically significant difference among the three groups in terms of age, number of children, family size, spouse's job, spouse's education level and income adequacy ($P < 0.05$; Table 1).

The mean (SD) total scores of sexual function, libido, sexual arousal, vaginal lubrication, orgasms, pain during intercourse and sexual satisfaction in the three groups of aroma, *Ginkgo biloba* and placebo before the intervention were respectively as follows: total sexual function: 18.4 (5.4%), 17.5 (6.8%), 15.8 (5.7%); libido: 2.9(2.1%), 2.7 (2.1%), 2.4 (1.1%); sexual arousal: 2.7 (1.1%), 2.4 (3.1%), 2.02 (1.1%); vaginal lubrication: 3.3 (0.9%), 3.0 (4.1%), 2.4 (1.2%); orgasm: 3.1(1.1%), 2.8 (4.1%), 2.8 (1.8%); pain during intercourse: 3.5 (1.5%), 1.7 (3.8%), 2.9 (1.7%) and sexual satisfaction: 2.9 (1.4%), 2.7 (1.6%), 3.4 (1.6%). The results of one way ANOVA showed a significant difference among the three groups before the intervention in terms of the total score and all other sub-domains of sexual function except orgasm and libido sub-domains (Table 2).

After intervention, the mean (SD) total score of sexual function in aroma, *Ginkgo biloba* and placebo groups were 22.9 (0.4%), 21.6 (4.6%) and 17.2 (4.2%), respectively. In terms of the dimensions of sexual function scores among samples, the mean (SD) total scores of libido, sexual arousal, vaginal lubrication, orgasms, sexual satisfaction and pain during intercourse in the three groups of aroma, *Ginkgo biloba* and placebo after the intervention were respectively as follows: libido: 4.0 (1.1%), 3.6(1.0%), 2.7 (1.1%); sexual arousal: 3.8 (0.9%), 3.6 (1.1%), 2.4 (0.9%); vaginal lubrication: 3.7 (0.4%), 3.5 (0.7%), 2.6 (0.9%); orgasms: 3.9 (0.6%), 3.5 (0.9%), 2.7 (1.1%); sexual satisfaction: 4.3 (1.2%), 3.9 (1.3%), 3.5 (1.6%), and pain during intercourse: 3.2 (0.7%), 3.4 (1.1%), 3.2 (0.7%).

The results of ANCOVA test with the control of the effect of baseline sexual function score and the confounding variables showed significant differences among the three groups after the intervention in terms of the total scores and all sub-domains of sexual function except sexual satisfaction and pain during intercourse ($P < 0.003$; Table 2).

The results of ANOVA test with the control of the effect of sexual function score before the intervention and the confounder variables showed statistically significant differences between total score and all sub-domains of sexual function other than pain during intercourse among the study subjects in Ginkgo biloba with placebo (adjusted mean difference 3.89; 95% CI: 2.25 to 25.5), and aromatherapy with placebo (adjusted mean difference 4.78; 95% CI 3.26 to 6.48), ($P < 0.001$; Tables 3 and 4).

Headache was reported as the common side effect in the *Ginkgo biloba* group (7% of the samples). Among 7% of the subjects, forearm itching was the most common side effect of aromatherapy (Table 5). 38.9% percent of subjects were satisfied and 33.9% were very satisfied by taking *Ginkgo biloba*. 50.9% of the subjects were very satisfied and 31.6% satisfied with aromatherapy because of their sexual function improvement.

Discussion

The results of this study showed that there was significant

Table 1. Socio-Demographical Characteristics of Study Groups

Personal Information	Aromatherapy (n=60)	*Ginkgo biloba* (60 = n)	The Placebo Group (n=60)	*P*
Age				0.01[a]
45-50	29 (48.3)	21 (35.0)	37 (61.7)	
51-55	31 (51.7)	39 (65.0)	23 (38.3)	
Mean (SD)	51.5 (4.3)	51.8 (3.4)	48.8 (6.5)	0.002[b]
Education				0.27[c]
Elementary	40 (66.7)	26 (43.3)	27 (45)	
Junior high school	8 (13.3)	19 (31.7)	20 (33.3)	
Senior high school	5 (8.3)	9 (15.0)	8 (13.3)	
Diploma and university	7 (11.7)	96 (10)	5 (8.3)	
Spouse job				0.008[a]
Worker	52 (91.2)	40 (66.7)	47 (78.3)	
Employee	3 (5.3)	18 (30)	13 (21.7)	
Others	2 (3.3)	2 (3.3)	0 (0.0)	
Spouse education level				0.001[c]
Elementary	40 (66.7)	20 (33.3)	16 (26.7)	
Junior high school	11 (18.3)	14 (23.3)	17 (28.3)	
Senior high school	2 (3.3)	13 (21.7)	17 (28.3)	
Diploma	3 (5.0)	8 (13.3)	6 (10.0)	
University	4 (6.7)	5 (8.4)	4 (6.7)	
Sufficient monthly income				0.01[c]
Adequate	2 (3.4)	13 (21.7)	7 (11.9)	
Relatively adequate	24 (41.4)	30 (50.0)	33 (55.9)	
Inadequate	32 (55.2)	17 (28.3)	19 (32.2)	
BMI*	29.8 (5.6)	36.2 (4.05)	27.5 (3.5)	< 0.001[b]
Number of children*	51 (2.1)	4.1(1.8)	3.6 (1.7)	< 0.001[b]
Family size*	3.8 (1.6)	2.9 (1.3)	3.7 (1.2)	0.001[b]

Abbreviations: BMI, Body Mass Index; SD, standard deviation.
All numbers except those specified as "star sign" are shown in frequency (%).
[a]Chi-square test; [b]one-way analysis of variance (ANOVA); [c]Chi-square trend test.

Table 2. Comparison of Sexual Function Total Score and its Dimensions in the Study Groups at the Time of Inclusion

Items	The Placebo Group n = 60		*Ginkgo biloba* Group n= 60		Aromatherapy Group n = 60		P_0	P_1
	Before Intervention	After Intervention	Before Intervention	After Intervention	Before Intervention	After Intervention		
Total score	15.8 (5.7)	17.2 (4.2)	17.5 (6.8)	21.6 (4.5)	18.4 (5.4)	22.9 (3.3)	0.04	< 0.001
Libido	2.4 (1.1)	2.7 (1.1)	2.7 (1.2)	3.6 (1.0)	2.9 (1.2)	4.0 (1.1)	0.06	0.002
Sexual arousal	2.02 (1.10)	2.4 (0.9)	2.4 (1.3)	3.6 (1.1)	2.7 (1.1)	3.8 (0.9)	0.01	0.001
Vaginal lubricating	2.4 (1.2)	2.6 (0.9)	3.0 (1.4)	3.5 (0.7)	3.3 (0.9)	3.7 (0.4)	< 0.001	0.001
Orgasms	2.8 (1.8)	2.7 (1.1)	2.8 (1.4)	3.5 (0.9)	3.1 (1.1)	3.9 (0.6)	0.05	0.004
Pain	2.9 (1.7)	3.2 (0.7)	3.8 (1.7)	3.4 (1.1)	3.5 (1.5)	3.2 (0.7)	0.01	0.80
Sexual satisfaction	3.4 (1.6)	3.5 (1.6)	2.7 (1.6)	3.9 (1.3)	2.9 (1.4)	4. 3 (1.2)	0.04	0.07

All numbers except those specified are shown in mean (standard deviation).
P_0: One-Way ANOVA.
P_1: ANOVA with controlling the effect of sexual function score and control confounding variables such as BMI, age, number of children, family size, income.

statistical difference among the mean total scores related to sexual function, sexual arousal, vaginal lubrication, orgasm and sexual satisfaction between the placebo group and the other two groups of *Ginkgo biloba* and aromatherapy after intervention by controlling baseline values and confounder variables ($P<0.003$). While Oh et al were trying to determine the estrogenic activity of *Ginkgo biloba*, they found that the main compounds of *Ginkgo biloba* had the poor estrogenic activity, which could be used as hormone replacement therapy instead of estrogens (16). In their study, Cohen and Bartlik showed that a daily intake of 120 to 240 mg *Ginkgo biloba* among men and women under age of 65 could lead to sexual function improvement (27). Ito et al in a double-blind clinical trial among women over 21 years showed that arginine max supplementation contains extract of *Ginkgo biloba*, Ginseng, Damyana, Al arginine, multivitamins and minerals improved sexual satisfaction, libido, vaginal dryness, frequency of sexual activity, orgasm and clitoral sensitivity after 4 weeks of consumption (28). Another

Table 3. Comparison of Mean Total Score and Dimensions of Sexual Function in *Ginkgo biloba* and Placebo Groups

Sexual Function	*Ginkgo biloba* group n = 59		The Placebo Group n = 57		P_1	Adjusted MD1 (95% CI)	P_0
	After Intervention	Before Intervention	After Intervention	Before Intervention			
Total score	21.6 (4.6)	17.5 (6.8)	17.2 (4.2)	15.8 (5.6)	*< 0.001	-3.89 (-5.52.5 to -2.25)	0.27
MD_0 (CI 95%)	4.16 (2.24-6.09)		1.52 (0.85-2.20)				
P^a	<0.001		<0.001				
Libido	3.6 (1.1)	2.7 (1.2)	2.7 (1.1)	2.4 (1.1)	*< 0.001	0.82 (0.45 to1.18)	0.34
MD_0 (CI 95%)	0.88 (1.23-0.53)		0.27 (0.12-0.41)				
P^a	<0.001		0.01				
Sexual arousal	3.6 (1.1)	2.4 (1.3)	2.4 (0.9)	2.0 (1.1)	*< 0.001	1.09 (0.72 to 1.47)	0.21
MD_0 (CI 95%)	1.13 (0.71-1.54)		0.36 (0.23-0.49)				
P^a	<0.001		<0.001				
Vaginal lubricating	3.5 (0.7)	3.0 (1.4)	2.6 (0.9)	2.3 (1.2)	*< 0.001	0.77 (0.45 to1.08)	0.08
MD_0 (CI 95%)	0.47 (0.1-0.84)		0.25 (0.06-0.45)				
P^a	0.01		0.91				
Orgasms	3.5 (0.9)	2.8 (1.4)	2.7 (1.1)	2.5 (1.2)	*< 0.001	0.88 (0.46 to1.20)	0.43
MD_0 (CI 95%)	0.68 (0.27-1.08)		0.11 (-0.05-0.28)				
P^a	0.001		0.18				
Sexual satisfaction	3.9 (1.3)	2.7 (1.6)	3.5 (1.6)	3.4 (1.6)	0.002	0.87 (0.32 to1.41)	0.04
MD_0 (CI 95%)	1.25 (0.69-1.80)		0.07 (-0.12-0.28)				
P^a	<0.001		0.46				
Pain during intercourse	3.4 (1.1)	3.7 (1.7)	3.3 (1.6)	2.9 (1.73)	0.99	-0.02 (-0.51 to0.50)	0.09
MD_0 (CI 95%)	-0.29 (-0.78-0.20)		0.37 (0.02-0.72)				
P^a	0.24		0.04				

All numbers except those specified are shown in frequency (%).

P^a: Paired *t* tests within groups; P_0: *t* test between the groups before the intervention.

P_1: ANOVA with controlling the effect of sexual function score and control confounding variables such as BMI, age, number of children, family size, income.

MD_0 (95% CI): mean difference (95% CI) within the group.

Adjusted MD_1 (95% CI): mean difference (95% CI) among groups with controlling the effect of sexual function score and control confounding variables such as BMI, age, number of children, family size, income.

study conducted in 2006 also indicated that the use of arginine max supplement in pre-menopausal and post-menopausal periods improved sexual satisfaction, libido, vaginal dryness and frequency of sexual activity (20). Amiri et al carried out a study on 40 postmenopausal women in health centers of west part of Tehran and demonstrated that taking Ginkgo biloba capsule improved libido, sexual activity, satisfaction, pleasure and orgasm (19). The results of our study are consistent with the cited studies.

Although some studies showed a positive effect of *Ginkgo biloba* on sexual activity, some others did not report any improvement in sexual activity. In a clinical trial study conducted by Wheatley in the United Kingdom to determine the effect of *Ginkgo biloba* on sexual function in men and women aged at 18-65 yrs under depression treatment, taking 240 mg Ginkgo biloba extract caused no change in sexual activity improvement (29). Failure to consist with our study could be due to the differences in health status of the subjects because their samples were men and women treated for depression, while our samples were only healthy postmenopausal women. Meston et al in the United States reported no improvement in sexual satisfaction of women taking 300 mg *Ginkgo biloba* (18). Lack of consistent with the present study could be due to racial-geographical difference among study samples. The mechanism of action of *Ginkgo biloba* is because of phytoestrogens. Phytoestrogens act as estrogen agonists and may cause effects similar to estrogen (30).

A number of aromatic herbal essences like fennel, angelica, sage and bergamot, lavender and geranium containing phytoestrogens in aroma can reduce climacteric symptoms such as hot flashes, sexual dysfunction and depression by activating neurons in the olfactory center that affect human emotions by releasing different neurotransmitters (endorphins, noradrenalin and serotonin) (22-24). Geranium extract reduces menopausal symptoms and depression (25). Aroma therapy reduces climacteric symptoms such as hot flashes, depression and pain during intercourse (25,31). In a study by Malakoti et al on the effect of aromatherapy on sexual function of lactating women, improvement was observed in lactating women 40 days after the use of aroma (32). No study was found to show the effects of aromatherapy only on sexual function in postmenopausal women in order to be compared with this study.

In study by Hur et al on 25 postmenopausal women in Korea showed that massage with aromatic oils of lavender, Geranium, jasmine, almond and evening primrose oil reduces climacteric symptoms such as depression, hot flashes and pain during intercourse. The participants had used aromatherapy massage 30 minutes a week for 8 weeks (31). In a study by Marzouk et al on nursing students

Table 4. Comparison of Mean Total Score and Dimensions of Sexual Function in Aromatherapy and Placebo Groups

Sexual function	Aromatherapy group n = 57		The placebo group n = 57		P_1	Adjusted MD_1 (95% CI)	P_0
	After Intervention	Before Intervention	After Intervention	Before Intervention			
Total score	22.9 (0.4)	18.5 (5.4)	17.2 (4.2)	15.8 (5.6)	*< 0.001	4.78(3.26-6.48)	0.03
MD_0 (CI 95%)	4.39 (2.26-6.01)		1.52 (0.85-2.20)				
P^a	<0.001		0.001				
Libido	4.0 (1.1)	2.9 (1.9)	2.7 (1.1)	2.4 (1.1)	*< 0.001	1.11(0.72-1.49)	0.04
MD_0 (CI 95%)	1.07(0.71-1.42)		0.27(0.12-0.41)				
P^a	<0.001		0.01				
Sexual arousal	3.8 (0.9)	2.7 (1.1)	2.4 (0.9)	2.0 (1.1)	*< 0.001	1.21(0.73-1.51)	0.07
MD_0 (CI 95%)	1.08(0.75-1.40)		0.36(0.23-0.49)				
P^a	<0.001		<0.001				
Vaginal lubricating	3.7 (0.4)	3.3 (0.9)	2.6 (0.9)	2.3 (1.2)	*< 0.001	0.84(0.51-1.17)	>0.001
MD_0 (CI 95%)	0.33(0.05-0.60)		0.25(0.06-0.45)				
P^a	<0.001		0.91				
Orgasms	3.9 (0.6)	3.1 (1.1)	2.7 (1.1)	2.5 (1.2)	*< 0.001	1.01(0.7-1.28)	0.03
MD_0 (CI 95%)	0.80(0.48-1.12)		0.11(-0.05-0.28)				
P^a	<0.001		0.18				
Sexual Satisfaction	4.3 (1.2)	2.9 (1.4)	3.5 (1.6)	3.4 (1.6)	*< 0.001	1.15(0.05-1.71)	0.15
MD_0 (CI 95%)	1.49(0.98-1.99)		0.07(-0.12-0.28)				
P^a	0. 16		0.46				
Pain during intercourse	3.2 (0.7)	3.5 (1.5)	3.3 (1.6)	2.9 (1.7)	0.60	-0.13(-0.64-0.37)	0.06
MD_0 (CI 95%)	0.3(-0.74-0.13)		0.37(0.02-0.72)				
P^a	<0.001		0.04				

P_0: t-test between the groups before the intervention
P_1: ANOVA with controlling the effect of sexual function score and control confounding variables such as BMI, age, number of children, family size, income.
MD_0 (95% CI): mean difference (95% CI) within the group.
Adjusted MD_1 (95% CI): mean difference (95% CI) among groups with controlling the effect of sexual function score and control confounding variables such as BMI, age, number of children, family size, income.
P^a: Paired *t* tests within groups.

Table 5. Comparing the Side Effects of Drugs in Study Groups

Side Effects	Aromatherapy Group n = 57, n (%)	*Ginkgo biloba* Group n = 59, n (%)	Placebo Group n=57, n (%)
Skin redness	3 (5.1)	0 (0)	0 (0)
Itching of forearm	4 (7.0)	0 (0)	3 (5.3)
Nausea	0 (0)	3 (5.1)	0 (0)
Abdomen pain	0 (0)	2 (3.4)	0 (0)
Headache	0 (0)	4 (6.8)	0 (0)
Gripe	0 (0)	2 (3.4)	3 (5.3)

showed that aromatherapy decreased dysmenorrhea (33). In a study by Darsareh et al on the impact of aromatherapy massage with geranium extract on menopausal symptoms, reduced menopausal symptoms and depression (25) which is consistent with this study. Essential oils in aromatherapy usually affect through 2 different ways (34): 1) through sense of smell, so that by inhaling the odor molecules, olfactory receptors send impulses to the olfactory area of brain. This area is closely related with other controlling systems such as memory, emotions, hormones, sexual feelings and heart rate. Impulses trigger the release of hormones substances that are capable of stimulating, incubation, calming or creating euphoria and lead to physical and mental changes. And 2) by skin absorption: volatile oils in the skin are very penetrating and can pass through the blood capillaries and reach the derma to exert their effects. The analgesic effects of essential oils are applied through four mechanisms including (30) oil chemical complex effects on memory and behavioral areas (31), the effect of these extracts on brain dopamine, serotonin and nor epinephrine (33), stimulate the endocrine opioid system (25) and impact on touch interaction with sensory fibers of the skin.

Since questionnaires were filled by samples themselves they may have got the wrong impression and not answered correctly. In addition, as a number of participants complained from drugs' side effects such as headaches and gastric pain, it could be recognized as one of the limitations of the study. Another weakness of the study was the impossibility of providing aroma placebo with

same odor. Meanwhile double-blindness in terms of the drugs and analysis were the strengths of the study.

Conclusion

Regarding the findings indicating the positive impact of combination of aromatherapy inhaler in improving sexual performance without any side effects in postmenopausal women, it is recommended that midwives could suggest the use of aroma to resolve sexual dysfunction in postmenopausal women. Aromatherapy in all sub-domains of sexual function other than "pain during intercourse" was effective in improving sexual function in postmenopausal women. Results revealed that *Ginkgo biloba* tablet also had a positive effect on improvement of sexual function, however, future study with higher doses of drugs as well as long follow-up are needed to see its effect. Other studies are recommended to compare aroma solution and *Ginkgo biloba* with other effective herbal compounds in the treatment of sexual dysfunction in postmenopausal women.

Ethical Issues

This study was the result of a research project No. 5.55.1199 registered in by IRCT database (registration number: IRCT201111248170N2). Also informed consent form was signed by the eligible women.

Conflict of Interests

The authors declare no conflict of interest.

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