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Detraining Neutralizes the Adaptation Effect of Aquatic and Land Based Exercise on Menopausal Symptoms During COVID-19

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ABSTRACT

Background & Objective: Some evidence has shown the beneficial effects of exercise on reducing menopausal symptoms. However, the effect of type of exercise (aquatic and land-based exercise) and cessation of exercise is still unknown. The aim of this study was to compare the menopausal symptoms in two aquatic and land-based trained groups before and after cessation of exercise due to COVID-19 outbreak.

Materials & Methods: 90 postmenopausal women participated in the study voluntarily. The daily and sport physical activities and menopausal symptoms were assessed through interviews three months after cessation of sport activities and qestions were designed and obtained from daily physical activity form and menopausal rating scale (MRS) questionnaire respectively.

Results: Before the cessation of exercise, the somatic, psychological, and sexual symptoms of menopause were lower in both active groups than the inactive group, while there was no significant difference in three categories of menopausal symptoms between aquatic and land-based exercise groups. After the cessation of exercise, menopausal symptoms in the two groups of previously active women increased significantly compared to the inactive group, so that there was no significant difference in menopausal symptoms between the exercise and inactive groups.

Conclusion: Aquatic and land-based exercise reduces the symptoms of menopause similarly, while the beneficial effects of exercise on menopausal symptoms can disappear after the cessation of exercise for three months.

Keywords: Swimming, Exercise Program, Post Menopause, Sedentary Lifestyle

Introduction

Coronavirus disease 2019 (COVID-19) has spread all over the world and has caused many health problems **(1)**. The closing of sport facilities reduced the likelihood of performing physical activity (PA) and exercise **(2)**. So, the risk of sedentary behavior increases which can impose harmful effects on health and increase the risk of some diseases **(3)**. In addition to disease, some physiological normal conditions such as menopausal symptoms can be affected by physical activity. Menopause is associated with vasomotor, physical and physiological problems **(4)**. Limited available studies have indicated direct association of sedentary behavior with menopausal symptoms **(5, 6)**. During COVID-19 outbreak inactivity, it is possible that the effect of previous exercise or physical activity on the health issues including menopausal symptoms can be maintained. Exercises can be performed on land or in water. However, considering the varieties of exercise programs in aspects of mode, intensity, and duration, the effects of exercise programs and the extent of their permanency may be different. A beneficial **(7)** or no significant effect of physical activity **(8, 9)** on menopausal symptoms has been observed. It has been found that reducing sitting time, and land-based exercise could alleviate menopausal symptoms **(10)**. The positive effect of walking as a common type of land-based exercise on menopausal symptoms has been found in various studies **(11)**.

Aquatic exercise (AQE) or exercises in water commonly performed as swimming can be used in the treatment of diseases for many years **(12)**. Water resistance may enhance muscular strength, reduce the possibility of injury, and protect against joint degradation, and therefore improve physical function and quality of life **(13)**. Water-based exercises are more effective on improving physical fitness compared to land-based exercises **(14)**. In older adults, water-based exercise was as effective as land-based exercise in improving physical functioning and improved muscular strength and endurance, balance, flexibility, and aerobic capacity **(15)**. However, Individuals who

participated in land-based aerobic activities indicated greater reduction in body fat compared to aquatic activities **(16)**.

Regarding the effect of water-based exercise during menopause, it has been shown that water-based exercise program is a safe and efficient way to improve physical function and to reduce falls among postmenopausal women **(17)**. However, no study was found to evaluate the effect of aquatic exercise on menopausal symptoms. The prominent anti-inflammatory and anti-oxidative effect of aquatic exercise compared to land-based exercise on inflammatory factors and functional ability in rheumatoid arthritis patients (18) has been found. Also, the comparable effect of aquatic and land-based exercise on osteoarthritis **(13)** as inflammatory condition is known. Besides, the relationship between inflammatory factors with depression **(19)** and vasomotor symptoms **(20)** of menopause has been shown. So, this question was aroused that do aquatic and land-based exercise induce different effects on menopausal symptoms, and how is the effect of a period COVID-19 induced inactivity on menopausal symptoms of women who previously participated in these two types of exercise?.

Methods

The study method was descriptive comparative. This study was performed at June 2020(3 months after epidemics of COVID-19 and initiation of outbreak). It was approved by the ethic committee at Shiraz University (by the code number of IR.SUMS.REHAB.REC.1400.003). All participants consented for participation by signing informed consent. The study was conducted according to the Declaration of Helsinki. In order to select participants, the researcher went to sports clubs, swimming pools and retirement centers at Shiraz city (third populated multicultural city in Iran) and according to the recorded information of those who referred to these centers, she called them and gave full explanations about the research program. The recruited participants included 90 postmenopausal women in the age range of 55 to 65 years who participated in the study voluntarily and were classified into two sports groups including aquatic and land-based trained groups and one non-athlete group.

To calculate the sample size, after completion of 50 questionnaires by participants the information of somatic symptoms was calculated and its effect size was 2.4025, then using G. Power software(version 3.1.9.7, Denmark) calculator **(21)** by inserting α error of 0.05 the total number of samples for three groups was estimated as 90.

The active groups participated in sport activities in sports centers, including gyms and swimming pools, for at least one year and at most 3 years prior to COVID-19 pandemic and stopped any regular sport activities for 3 months because of COVID-19 outbreak, and the non-active group referred to retirement centers. Participants contributed to the study voluntarily. Among the qualified volunteers to participate in this study, 90 women, including 30 women in each group, were selected as study participants. Inclusion criteria were normal menopause, at least 12 months and at most 10 years occurring of the last menstrual bleeding, age range 55 to 65 years, absence of specific diseases (such as cancer), not affecting with COVID-19, functional ability to perform physical activity, not application of hormonal therapy to treat menstrual symptoms and not participating in any kind of exercise for three months during the cessation of exercise due to COVID-19 induced outbreak. Participants responded to questions through interview.

2.1. Physical activity

Exercise activities characteristics (mode, intensity, frequency, duration and date) which were performed by active participants before COVID-19 were recorded by related questions. Daily physical activity of two days (weekend and during week) was recorded in a form and its guidelines were according to the IPAQ International Questionnaire to measure the energy expenditure of daily physical activity and sports activity **(22)**. The participants were asked to report every kind of activity and its intensity including sport, job-related, transportation, and household physical activity, and sedentary behaviors. The energy cost in terms of the met was calculated for each section separately, and finally the total energy cost for one week was calculated. To evaluate this questionnaire, the energy expenditure of walking regarded 3.3 met, moderate physical activity is 4 met and intense physical activity is 8 met. To calculate the energy cost of each activity, the given value was multiplied by the duration of the activity in minutes and its frequency on weekdays. Also, in some questions, participants were asked to report any changes in daily activities during COVID-19.

2.2. Menopausal rating symptoms (MRS) questionnaire

The International MRS Questionnaire was used to assess and rank menopausal symptoms.

This questionnaire deals with 11 questions in 3 parts: somatic (4 questions), psychological (4 questions) and sexual (3 questions) menopausal symptoms. Each question has five points (zero without points, 4 highest points) **(23)**. These symptoms were recorded in two parts before COVID-19 outbreak (cessation of exercise due to staying home) and current symptoms (3 months after complete cessation of exercise).

2.3. Statistical analysis

SPSS software (version 22) was used to analyze the findings. Kolmogorov-Smirnov test was used to evaluate the normality of the data distribution. Due to approval of the normality, one-way analysis of

variance was used to compare the three groups and in the case of homogeneity of variances LSD test was used to compare pairs of groups. Repeated measure and multivariate analysis of variance were used to assess the difference between groups over time. Chi-square test was used to compare frequencies of some variables between groups

Results

3.1. Descriptions

The demographic and descriptive characteristics of participants (measured during the COVID-19 outbreak) as well as their comparisons between the study groups are presented in Table 1. As indicated in Table 1, there were no significant difference between the study groups considering age, menopausal duration, menarche age, weight, height, body mass index (BMI) of participants (P >0.05). However, exercise volume was different between the study groups (P <0.001). There was a significant difference between land-based and aquatic exercise groups with inactive group (P <0.001). However, there was no significant difference between aquatic and land-based exercise groups (P =0.063).

Table 1. Demographic and descriptive characteristics of participants

	Land-based exercise (n=30)	Aquatic exercise(n=30)	Control(n=30)	p
Age (year)	57.5333(3.20273)	59.06(3.40)	57.46(3.50)	0.121
Menopausal duration (year)	8.03(3.47884)	8.73(4.04)	9.20(3.79)	۰.۴۸۷
Menarche age (year)	13.56(1.00)	13.16(1.39)	13.40(1.24)	0.450
Weight (kg)	69.23(11.50)	73.83(12.80)	74.83(13.22)	0.188
Height (cm)	160.97(4.72)	161.43(9.08)	160.13(10.91)	0.840
BMI (kg/m^2)	26.76(4.52)	28.71(6.90)	29.50(6.72)	٥.129
Exercise volume(met/min/week)	37684.00(3729.99)	25116.00(24614.84)	0.00(0.00)	<0.001*

*significant difference between land based and aquatic exercise groups vs. control group.
BMI: body mass index

3.2. Assessments

Menopausal symptoms, sleeping and sitting time before outbreak were compared between three groups using ANOVA and LSD post hoc tests. Findings indicated that:

There was as significant difference between groups considering somatic (F=26.072, P <0.001), psychological (F=30.485, P <0.001) and sexual (F=12.704, P <0.001) symptoms. While there was no significant between group difference in sleeping (F=2.647, P =0.077) and sitting (F=1.038, P =0.359) time. Paired group comparisons indicated that Somatic, psychological and sexual symptoms were significantly lower in land-based (P <0.001) and aquatic (P<0.001) groups compared to the control group, and there was not any significant difference between land-based and aquatic exercise groups considering somatic (P =0.463), psychological (P =0.366) and sexual (P =0.959) symptoms of menopause. Table 2 shows that somatic symptoms increased significantly in post outbreak compared to pre outbreak in land-based exercise (P <0.001) and aquatic exercise (P <0.001) groups. The percentage of these changes was greater in the aquatic exercise group. However, in the control (non-exercise) group, somatic symptoms did not change significantly following outbreak compared to pre outbreak (P = 0.595) (Figure 1).

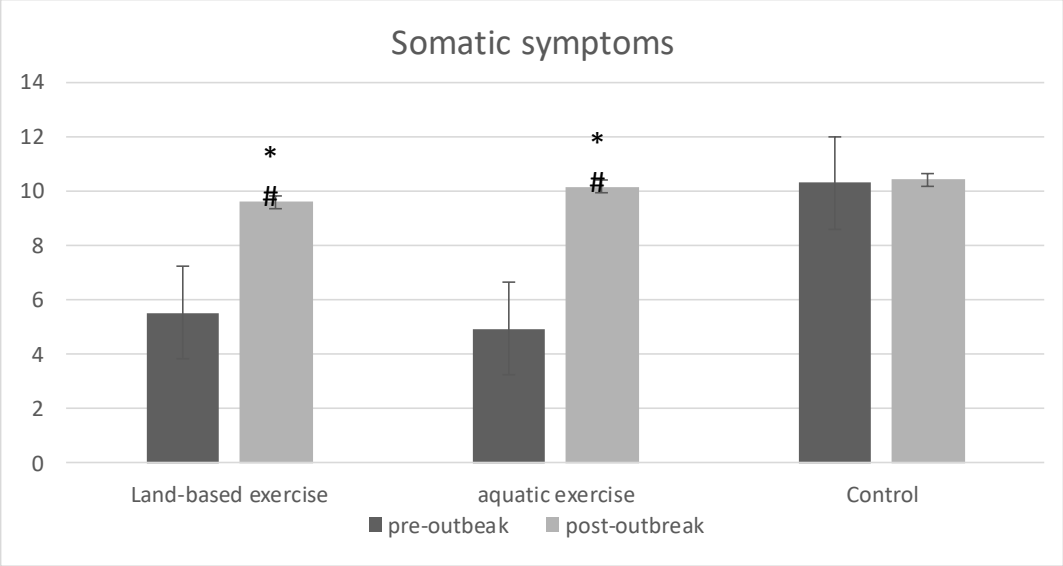

Figure 1. comparison of somatic symptoms of menopause pre- and post-outbreak among land-based, aquatic and control groups, *p<0.05: significantly different with pre-outbreak conditions, #p<0.05: significantly different with control group

Psychological symptoms increased significantly following the outbreak compared to pre outbreak in land-based (P <0.001) and aquatic (P <0.001) groups. While, it did not change significantly in post compared to pre outbreak in the control group (P =0.219) (Figure 2) (Table 2).

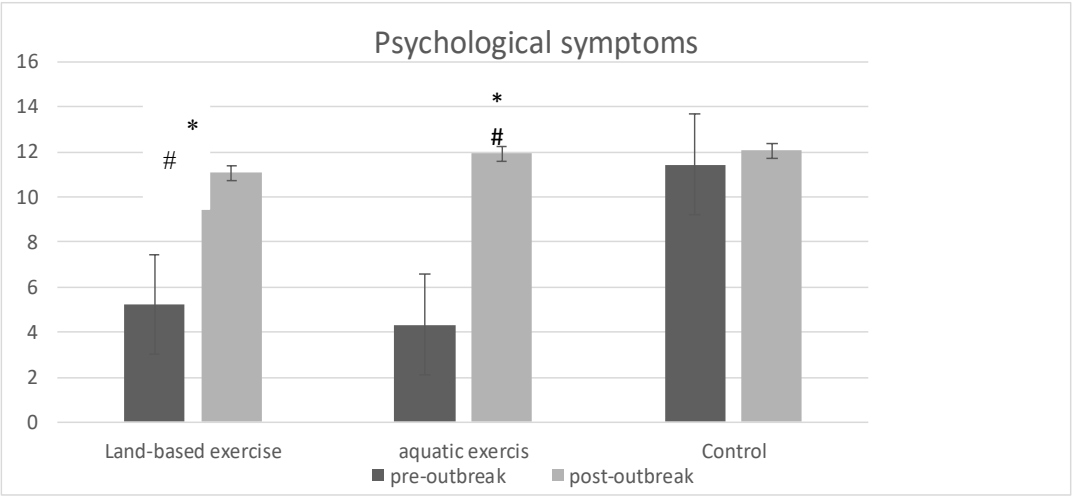

Figure 2. comparison of psychological symptoms of menopause pre- and post-outbreak among land-based and aquatic exercise and control groups, *p<0.05: significantly different with pre- outbreak conditions, #p<0.05 significantly different with control group

Sexual symptoms increased significantly following the outbreak compared to before the outbreak in land-based (P <0.001) and aquatic (P <0.001) groups. While it did not change significantly in the control group (P =0.071) (figure 3) (Table 2).

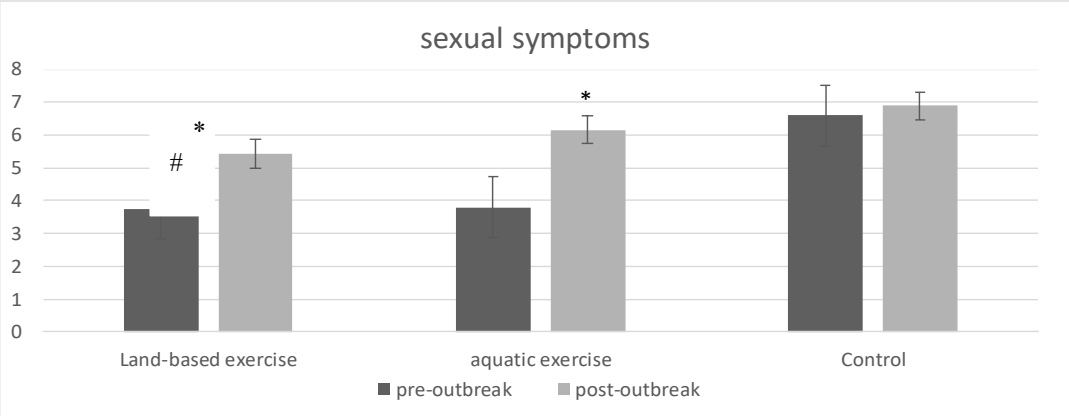

Figure 3. comparison of sexual symptoms of menopause pre- and post-outbreak among land-based and aquatic exercise and control groups, *P<0.05: significantly different with pre-outbreak conditions, #P<0.05: significantly different with control group

Sitting time did not change significantly in land-based exercise (P =0.562) and aquatic exercise (P =0.412), and control (P =0.957) groups. Following the outbreak, there was no significant change in sleeping time of land-based exercise group (P =0.295). Sleeping time increased significantly in the control (P =0.043) and aquatic exercise (P =0.026) groups. Between group comparisons following the outbreak indicated that there were no significant differences between the study groups considering somatic (F=0.371, P =0.691), psychological (F=0.338, P =0.714), and sexual (F=1.522, P =0.224) symptoms of menopause as well as sitting (F= 0.197, P = 0.821) and sleeping time (F=1.765, P =0.177).

Table 2. Menopausal symptoms, sitting and sleeping time before and after COVID-19 induced quarantine

		Land-based exercise	%change	Aquatic exercise	%change	control	%change
Somatic symptoms (score)	BQ	5.53(3.19)	73.59*	4.93(1.38796)	121.62*	10.30(4.21)	1.26
	AQ	9.60(3.93)		10.16(3.60)		10.43(3.92)	
Psychological symptoms (score)	BQ	5.23(3.08)	111.47*	4.33(1.47)	175.51*	11.43(5.69)	5.51
	AQ	11.06(5.03)		11.93(4.77)		12.06(5.51)	
Sexual symptoms(score)	BQ	3.76(1.71)	42.17*	3.80(1.42)	62.10*	6.60(3.71)	4.54
	AQ	5.43(2.56)		6.16(3.35)		6.90(3.73)	
Sitting time (min/day)	BQ	569.50(301.71)	-4.03	454.00(261.14)	8.36	522.00(364.84)	0.38
	AQ	546.50(313.05)		491.97(326.23)		524.00(372.01)	
Sleeping time (hour/day)	BQ	8.00(1.64)	-4.62	7.13(1.77)	9.39*	8.06(1.83)	6.69*
	AQ	7.63(1.92)		7.80(2.12)		8.60(2.32)	

BQ: before quarantine, AQ: after quarantine

Considering changing household physical activity during COVID-19 as shown in Table 3, 22, 19, 38, 5, 6 women (Total number=90) reported highly increased, increased, no change, reduced and highly reduced daily physical activity respectively. However, Chi-square findings indicated that, there was no significant difference between the study groups (P =0.819). Participants (n=60) reported the Changes of transportation during COVI-19 as increased (n==2), no change (n=12), reduced (n=23) highly reduced (n=48), and Chi-square test indicated no significant difference between the study groups (P =0.715).

Considering job activities, out of 30 participants in each study groups, 28 women in the land-based group, 26 women in the aquatic group, and 27 women in the control group were housewives (not having other job) and there was no significant difference in the job activities between the study groups (P =0.122). Also, 7,9, and 7 participants of land-based exercise, aquatic exercise and control groups reported increasing

suffering from disease during COVID-19 respectively, while others reported no change, and there was not significantly different between the study groups (P =0.792). None of the participants in the three groups participated in any type of exercise activities during the COVID-19 outbreak.

Table 3. Comparing changes of household and transportation activities using Chi-square test

activities	group	Highly increased	increased	No change	reduced	Highly reduced	p
Household	Land-based exercise	7	9	9	2	3	0.710
	Aquatic exercise	8	6	13	1	2	
	Control	7	4	16	2	1	
transportation	Land-based exercise	0	1	5	9	15	0.815
	Aquatic exercise	0	0	5	6	19	
	Control	0	1	7	8	14	

Discussion

The results showed that before the cessation of exercise, the somatic, psychological and sexual symptoms of menopause were lower in both aquatic and land-based exercise groups compared to the control (non-exercise) group and there was no significant difference between aquatic and land-based exercise groups. After cessation of exercise, menopausal symptoms in the two groups who previously participated in exercise activities increased significantly compared to the control group, so that there was no significant difference in menopausal symptoms between exercise and control groups. In other words, the beneficial effects of exercise on menopausal symptoms disappeared after cessation of exercise for three months. Possible effective factors on menopausal symptoms including sitting time **(5)**, exercise volume **(5, 7)** and daily physical activity **(7)** were measured and no significant difference was found between the study groups.

Some other studies indicated no significant effect of physical activity on menopausal symptoms **(8)**. A meta-analysis study indicated that exercise-based interventions and mind-body therapies are effective on quality of life, menopausal symptoms, and depression among Asian premenopausal women **(24)**. During menopause, reduction of estradiol levels increases the sympathetic activity **(25)** and possibly changes FSH and inhibin B, which affect endorphin concentrations in the hypothalamus. In this condition vasomotor symptoms increase which induce somatic symptoms through reduction of the thermo-neutral zone **(26)**. Physical activity increases the secretion of some neurotransmitters related to alertness (norepinephrine), satisfaction (dopamine), and anxiety and sleep quality (serotonin) **(27)**. Evidence supports the increasing effects of exercise on serotonin secretion which can improve sleep **(28)**. These effects of exercise may improve menopausal related symptoms including somatic and psychological problems which can be a justification of findings of the present study.

The present study also indicated that there was no significant difference considering menopausal symptoms between aquatic and land-based exercise groups. No study was found comparing the effect of aquatic and land-based exercise on menopausal symptoms. However, similar to our findings, aquatic exercise was as effective as land-based exercise in improving physical functioning, muscular strength and endurance, balance, flexibility, and aerobic capacity **(15)**, range of motion and physical disability in patients with chronic low-back pain **(29)**, pain level, health-related quality of life and static endurance and functional status in lumbar disc herniation patients **(30)**, and physical and psychological health aspects in women with fibromyalgia **(31)**. It seems that aquatic and land-based exercised induce similar physiological effects with probably common mechanism for improving health and physical function.

Other findings of the study indicated increasing of menopausal symptoms after three months cessation of exercise. Our findings was similar by another study

indicating that sedentary behavior was associated with more severe menopausal symptoms **(6)**. Previous findings have indicated the higher levels of sedentary behavior were associated with higher levels of inflammatory markers **(32)** such as interlukine-6(IL-6) as an indicator of inflammation **(33)**. Besides, menopausal transition is an inflammatory event, with inflammation of systemic and central nervous system **(34)** and menopausal symptoms are associated with inflammatory factors **(20)**. So, increasing inflammation as a result of sedentary behavior could be a cause of increasing menopausal symptoms in the present study groups. Even a short period of detraining has been harmful for elderly women who regularly participated in a program of strength training previously, because it impaired physical performance, and increased inflammatory factors **(35)**. The mediating role of COVID-19 on increasing psychological stress and inflammation **(36)** can also be considered as an effective factor which enhances the effect of detraining or inactivity on menopausal symptoms.

One of the limitations of the present study was that due to the COVID-19 conditions, it was not possible to control the hormonal status and weight change of the participants longitudinally and other possible factors, including psychological and nutritional factors associated with menopausal symptoms, due to interview conditions. Other limitations of this study were the small number of participants and not finding women who continued their exercise program due to lock down of all sport clubs and swimming pools during the initial phase of COVID-19 pandemic.

Conclusion

In summary, the present study found that aerobic exercise on land and in water was effective in reducing menopausal symptoms. But cessation of exercise can increase these symptoms, so that menopausal symptoms are similar to those of inactive people, which may be due to the return of hormonal and physiological changes caused by exercise to pre-activity. Therefore, it is recommended to maintain participating in these activities in possible situations in order to keep its positive effects on the menopausal symptoms.

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Author's Contributions

NA, MKJ MH and YA contributed in the study design. NA performed the study and collected the data. MK supervised the study and MH was consultant of the study. MKJ and YA provided the first draft of the manuscript. All authors read and approved the final version of the manuscript.

Conflict of Interest

There was no conflict of interest to be declared.

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