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RESEARCH ARTICLE

Effect of a Physical Activity Program on Serum Biochemical Parameters among the Elderly Women

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ARTICLE HISTORY

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Abstract: ***Background*:** The present study examined the efficacy of the walking program on biochemical parameters among the elderly women.

***Methods*:** A total of one hundred elderly women participated in this randomized clinical trial study. The intervention group attended a 24-week walking exercise meeting five times per week. The control group continued with their routine activities. The subjects were assessed in Fasting blood glucose (FBS) and lipid profile before and after 12 and 24 weeks of the program.

***Results*:** The mean age of the elderly participants in the study was 68.33 ± 4.55 years. The results of repeated measures ANOVA showed a significant difference between the intervention and the control group in FBS, total cholesterol, triglyceride, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol after completing the program (for all $p < 0.001$).

***Conclusion*:** The low-cost physical activity intervention could be effective for reducing chronic vascular disease risk factors among community-dwelling elderly women.

Keywords: Community-dwelling elderly women, FBS, lipid profile, physical activity.

1. BACKGROUND

Given the fast growth of the aged people, their health status becomes a concern [1, 2]. The incidence of age-related conditions has largely increased over time [3]. Ageing is accompanied by decline in both physiological and psychological functions [4]. Health problems occur more commonly with ageing which are the main reasons for the functional decline and the inability of older people to maintain simple activities of daily living [5, 6].

Cardiovascular disease (CVD) and metabolic syndrome are major public health problems worldwide [7]. Globally, the number of deaths due to CVD has increased by a third during 20 years, between 1990 and 2010 [8]. High triglyceride (TG), low-density lipoprotein cholesterol (LDL), and total cholesterol (TC) as well as reduced high-density lipoprotein cholesterol (HDL) concentrations are considered as the main factors of CVD [9]. However, the body of literature on the association between lipoprotein-lipid parameters and the risk of CVD has been advanced for the secondary prevention setting than for primary prevention [10].

Regular physical activity (PA) has been considered an effective factor for health improvement, prevention of age-related diseases [11, 12] and enhancement of psychological well-being and physical functioning [13,14]. Regular PA plays an important role in increasing the quantity and quality of life [15]. The World Health Organization (WHO) has recently announced the physical inactivity as the fourth risk factor of [16] global mortality and as an important modifiable risk for CVD [7]. In spite of these PA-related health benefits, the majority of older people are physically inactive [17]. As 38.8% of the Iranian elderly spend their leisure time at home alone and 22.5% of them do not participate in any kind of PA [18]. Various factors are related to the level of PA in the elderly such as social, climate and cultural factors. As Iran is a multicultural country, thus the pattern of physical activity among elderly people is different in different regions of Iran [19]. Furthermore, Iranian elderly men attend the exercise program more than elderly women. Because there are some cultural barriers that limit performing exercise in public places for the Iranian women despite some similarities between the elderly in Iran and in developed countries, the cultural and religious factors should not be neglected [20].

Although many studies have supported the importance of exercise for the older population [23, 24], but there has been a relatively little number of researches examining the role of PA interventions in Iranian community-dwelling elderly population [25]. Therefore, with the increase in the number of elderly population around the globe which comes with an

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increase in the incidence and prevalence of chronic diseases, it is of utmost importance to explore the efficacy of a PA program among Iranian [26, 27]. Therefore, the present study was aimed to assess the effect of PA on lipid profile and fasting blood glucose (FBS) among community-dwelling elderly women.

2. MATERIALS AND METHODS

2.1. Screening of Subjects

Participants of this study were community-dwelling elderly women aged 60 years and above residing in Urmia city, Iran. Multi-stage cluster random sampling method was employed to recruit the elderly women in this randomized clinical trial (RCT) study. First, four municipality areas of Urmia city were considered as the sampling location. Then, one health centre from each area was randomly selected. From each health centre, 200 elderly women were randomly included in the screening process. The contact information of all elderly woman was extracted from their health care folders. They were called for initial screening. Eligible criteria were age 60 years old and above, not using medications affecting lipid levels, no serious medical conditions including hypertension, diabetes, history of CVD, and not participating in regular PA program. Then, the subjects were assessed by a physician for medical clearance prior to taking part in the study. After the screening process, 100 elderly women were selected and randomly assigned to two equal groups (intervention and control). The written consent was signed by the elderly women after informing them about the aim, benefits and drawbacks of the study. The study procedure was according to the principles of Helsinki Declaration on medical research involving human subjects. The study procedure was approved by the ethical committee of Urmia University of Medical Sciences.

2.2. Intervention

All elderly women in the intervention group were invited to the respective primary health care centres. They were informed about the purpose and procedure of the study as well as potential benefits, probable risks and discomforts. The right for the withdrawal from this clinical research at any time without any penalty and consequence was mentioned in the consent form. The subjects were assured about the privacy and confidentially of the provided information. They were instructed that there would be three free biochemical tests during data collection. All the participants of this study signed the written consent form before starting the study program. The intervention group underwent a walking exercise program in 2 days per week as a group centred at the gym and 3 days per week as an individualized method at home through 12 weeks, After the first stage of the intervention, the experimental group continued their program at home individually until the 12 weeks follow-up. Walking exercise is effective and simple, with a low possibility of injury, can be performed without special skills, and has the appropriate exercise intensity [33]. Therefore, walking exercise is recommended for everyone. The exercise group was familiarized with the program during two instruction sessions. The intervention was a moderate intensity walking exercise (warm up, walking, cool down). For warming up, the subjects were instructed to perform marching in place, brisk walking and standing and sitting with light dumbbells for five minutes before starting the walking program. For cooling down, the exercise participants were recommended to walk slowly and perform some stretching exercises based on shoulder and upper back stretch, triceps stretch, seated calf stretching, and standing quadriceps stretching for the lower body for five minutes after completing the workout. The duration of walking was increased gradually from 10 to 50 minutes and intensity levels began at 40-50% peak heart rate (HR) reserve increasing to 60-70% HR reserve over the intervention. Intensity levels were monitored by instructors with supervision of the researcher [34].

The elderly women continued their walking program 5 days per week for 50 minutes during weeks 12-24. The participants in the control group continued their routine activities. However, after collection of the data, they were instructed about the exercise protocol during two weeks (one hour for two sessions a week) and an educational booklet was provided for them as well.

2.3. Management of the Intervention

During the exercise program, the intervention group was trained by two qualified instructors with supervision of the researcher. There was a mandatory attendance sheet that each participant must sign at the beginning of each exercise session to identify the number of sessions that they attended. The subjects who attended the program more than six sessions each month were rewarded by the researcher.

During follow up, the researcher called each participant once per week to encourage them to continue with the PA program.

2.4. Instruments

The outcome variables for the current study were lipid profile and FBS. First, the subjects were interviewed to collect their demographic characteristics, medical history, and cognitive situation. The medical folders of the subjects were used to determine the diagnosed health conditions. The cognitive situation was assessed by Abbreviated Mental Test Score (AMTS). The subjects who obtained score 6 or over were entered into the study.

2.5. Blood Collection

The participants were tested on overnight fasting blood samples (in the early morning, 12 hours after the last meal). They were asked to sit comfortably in a chair with their arm on the armrest to form a straight line from the shoulder to the wrist and not bent at the elbow. Two trained laboratory technicians took the blood specimens. All the process of blood taking was conducted in the respective health centres under the supervision of the researcher and instantly transferred to a laboratory (Nematii, Urmia, Iran) in an icebox. All biochemical tests were performed in one laboratory in Urmia, Iran. The standard methods were used for the detection of

Table 1. Socio-demographic characteristics of respondents in the intervention and control groups.

	PA Group		Con Group		x^2	P-value
	N	%	N	%		
Marital status						
Married	22	51.2	21	46.7	1.375	0.711
Widowed	21	48.8	24	53.3		
Occupation						
Housewife	42	97.7	44	97.8	7.284	0.058
Retired	1	2.3	1	2.2		
Education						
literate	6	14.0	3	6.7	4.083	0.256
Illiterate	37	86.0	42	93.3		
Housing Status						
Private	40	93.0	40	88.9		
Rented	3	7.0	5	11.1	9.822	0.119
Living arrangement						
Alone	10	23.3	13	28.9		
With spouse	12	27.9	16	35.6		
With family	11	25.6	4	8.9	14.241	0.281
With Children	8	18.6	12	26.7		
With relatives	2	4.7	0	0.0		
Age (Mean ±SD)	(68.56±4.40)		(68.09±5.06)		t=2.239	0.086

Note: PA: physical activity; Con: Control; N: Number

blood lipids and glucose. The laboratory technicians were blind to the group allocation and also about the previous measurement results in post-test evaluations.

2.6. Biochemical Measurement

Serum levels of TC, TG, HDL, and FBS were measured by using a kit and enzymatic methods (Parsazmon, Tehran, Iran). LDL was calculated by using the Friedewald formula [27-31]. Biochemical markers were assessed thrice at baseline, 12^{th} week and 24^{th} week of the program.

2.7. Ethical Approval

The study protocol was approved by the ethics committee of Urmia University of Medical Sciences (P6/92/4/47647).

2.8. Informed Consent

The written informed consent was obtained from all participants. Before signing an informed consent form, the potential participants were informed of the study procedure and possible benefits along with potential risks of the study.

2.9. Data Analysis

SPSS version 20 (SPSS® IBM, New York, U.S. A) was used to analyse the data. For reporting the means (m) ± standard deviations (SD) of the variables scores, descriptive statistics were used. Two way repeated measure ANOVA was used to detect mean differences between and within groups at three times of measurement. The independent t-test was used to compare mean scores for the FBS, TG, TC, HDL, and LDL level between the intervention and the control groups before the intervention.

3. RESULTS

Compliance or attendance rate for all subjects was calculated by the following formula: (sessions attended/ total number of sessions) x 100. All participants in PA group completed at least 18 of the 24 exercise sessions and had 88% compliance rate during the first 12 weeks.

The parametric statistical tests were used for data analysis as the Shapiro-Wilk test, Skewness, kurtosis, and histogram [35] indicated that all the data were normally distributed.

Table **1** shows the socio-demographic characteristics of the study subjects. A total of 88 out of the 100 elderly women (43 in the PA and 45 in the control group) with a mean age 68.33 ± 4.55 successfully completed the study program. At baseline, the PA and control groups did not statistically

Table 2. Baseline comparison of PA and control groups on the outcome variables.

	PA	Control	t	P Value
	(n=43)	(n=45)		
FBS	97.34±8.76	94.68±10.01	2.499	p=0.061
TC	226.02±45.57	218.86±34.69	2.250	p=0.084
TG	163.97±74.47	151.55±52.09	1.643	p=0.160
HDL	50.92±10.35	47.75±10.89	1.693	p= 0.170
LDL	149.69±29.16	140.89±37.21	2.172	p=0.500

Note, PA: Physical Activity; FBS: Fasting Blood Sugar, TC: Total Cholesterol, TG: Triglycerides, HDL: High-density lipoprotein, LDL: Low-density lipoprotein

Table 3. Between group differences for biochemical parameters.

	Intervention Time		PA Group	p Value	Con Group	
			M Diff		M Diff	p value
	0 week	12week	17.84	0.001*	2.24	1.00
TC	0 week	24week	37.16	0.001*	0.35	1.00
	12week	24week	19.33	0.001*	2.6	1.00
TG	0 week	12 week	20.84	0.001*	9.42	0.23
	0 week	24week	41	0.001*	1.51	1.00
	12week	24week	20.16	0.001*	7.91	0.12
	0 week	12 week	2.95	0.001*	1.23	0.22
HDL	0 week	24 week	6.13	0.001*	0.31	1.00
	12 week	24week	3.18	0.001*	1.54	0.04*
LDL	0 week	12week	13.96	0.001*	4.93	0.36
	0 week	24week	25.04	0.001*	5.21	0.56
	12 week	24week	11.08	0.001*	0.3	1.00
	0 week	12week	5.49	0.001*	0.47	1.00
FBS	0 week	24week	11.16	0.001*	0.07	1.00
	12 week	24week	5.67	0.001*	0.53	1.00

Abbreviation: PA: Physical Activity; Con: Control; FBS: Fasting Blood Sugar; TC: Total Cholesterol; TG: Triglycerides; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; M Diff: Mean Difference; *: P<0.05

differ with respect to demographic data (marital status, occupation, education level, housing status and living arrangement) (Table **1**; P>.05 for each).

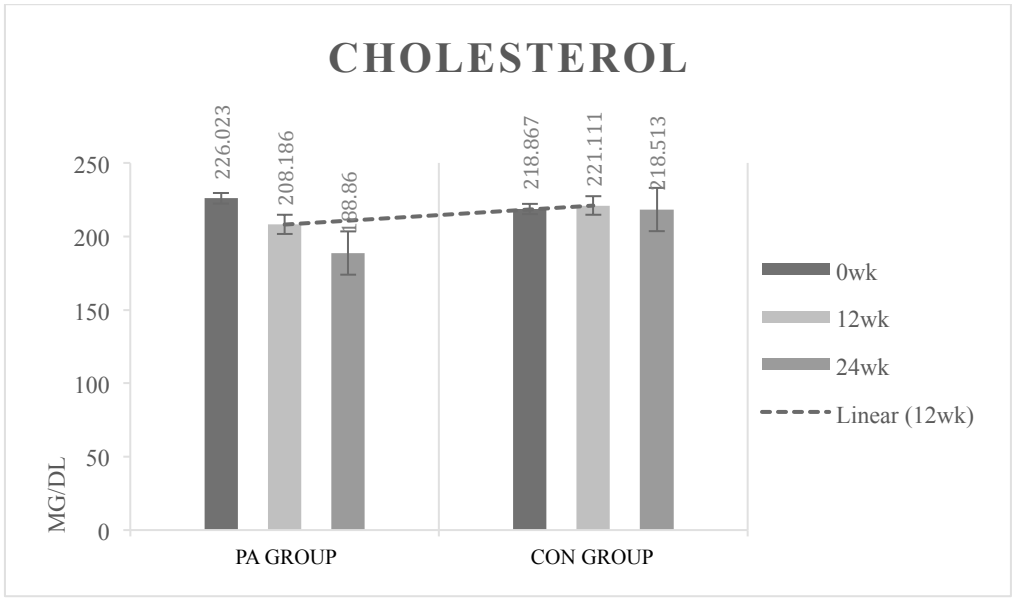
According to the results of the statistical analysis, there were no significant differences in the distributions of all scores for the dependent variables between the exercise and control groups prior to the intervention ($p < 0.05$, Table **2**).

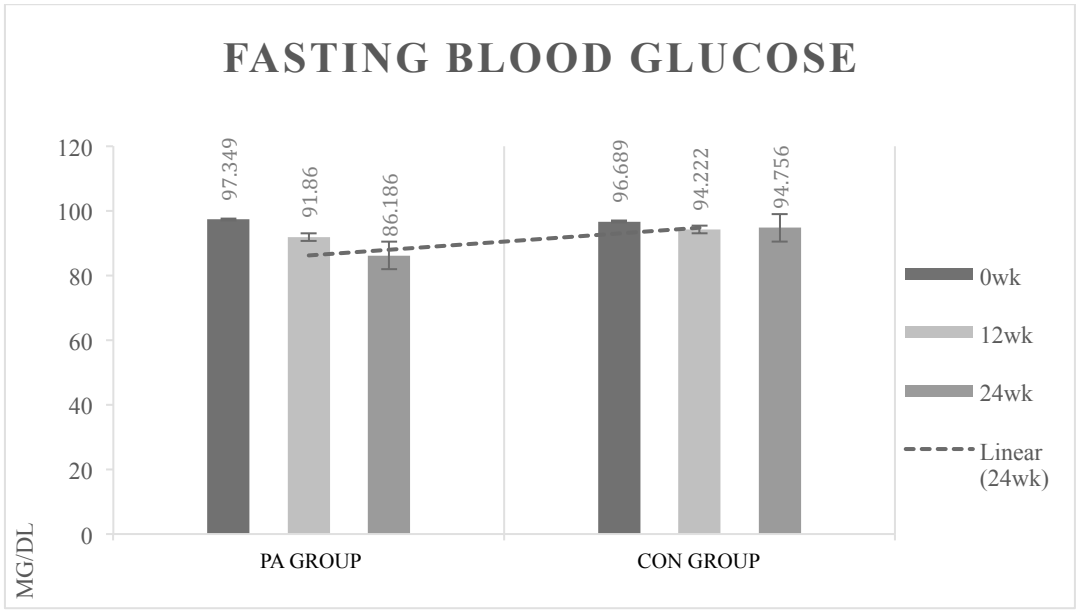
The results of statistical analysis showed significant differences between groups after completing the program for FBS ($F = 156.61$, $p<0.001$, $\eta2=0.482$), TC ($F = 108.00$, $p<0.001$, $\eta2=0.391$), TG ($F = 10.78$, $p<0.001$, $\eta2=0.332$), HDL ([$F = 68.57$, $p< 0.001$, $\eta2=0.290$), and LDL ($F=83.622$, $p< 0.001$, $\eta2=0.290$) (Table **3**). Furthermore, all the outcome variables improved significantly from 0 to 12 week-test, 0 - to 24 week-test and 12 - to 24 week -test only in the intervention group ($p < 0.001$, Fig. **1**).

4. DISCUSSION

The results of this study support the supposition that a 24-week walking exercise can be an effective program for improving serum biochemical parameters among a sample of elderly women.

Walking programs as used in the current study appear to effectively decrease FBS. This result is in accordance with


CHOLESTEROL
226.023
208.186
188.86
218.867
221.111
218.513
250
200
150
100
50
0
MG/DL
PA GROUP
CON GROUP
0wk
12wk
24wk
Linear (12wk)


FASTING BLOOD GLUCOSE
97.349
91.86
86.186
96.689
94.222
94.756
120
100
80
60
40
20
0
MG/DL
PA GROUP
CON GROUP
0wk
12wk
24wk
Linear (24wk)

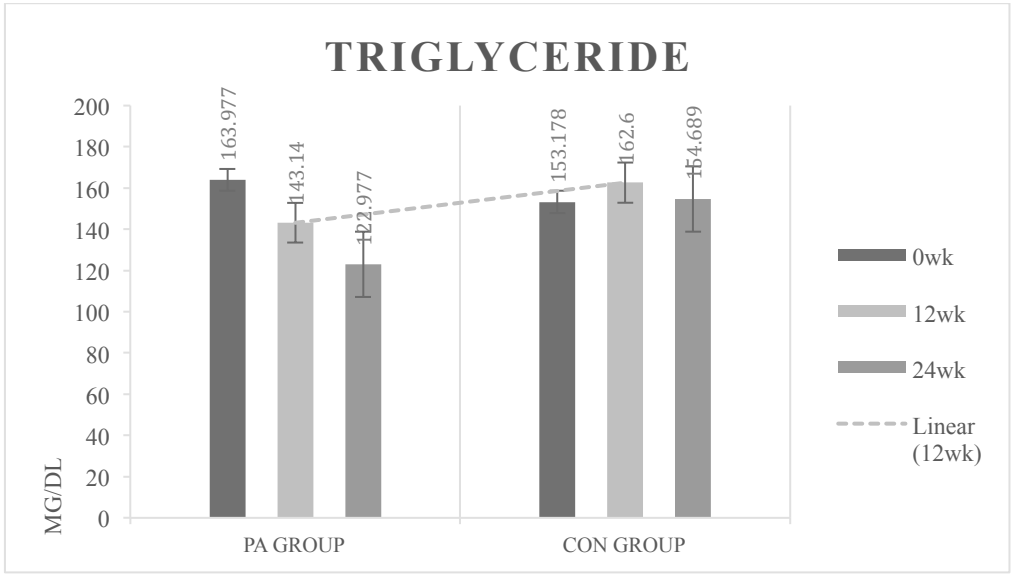
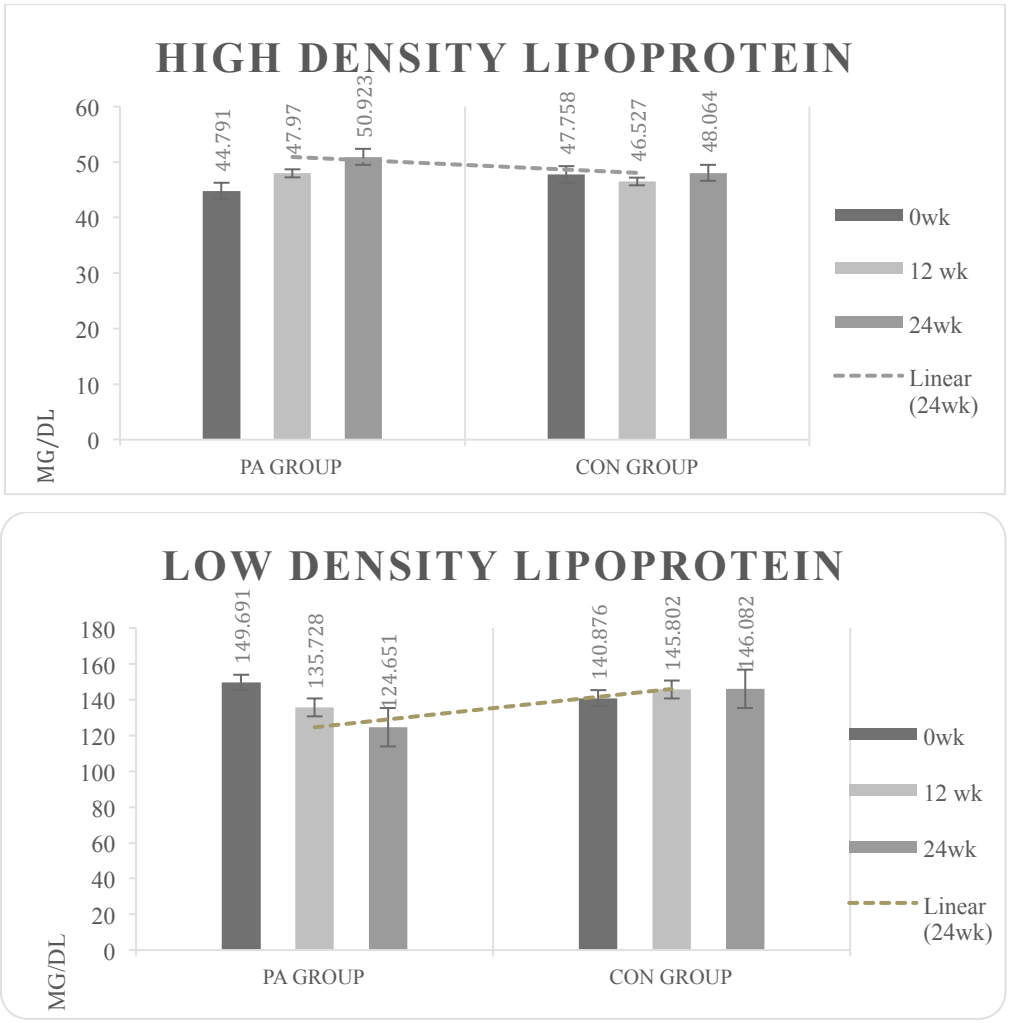

TRIGLYCERIDE
163.977
143.14
122.977
153.178
162.6
154.689
200
180
160
140
120
100
80
60
40
20
0
MG/DL
PA GROUP
CON GROUP
0wk
12wk
24wk
Linear (12wk)

Fig. (1) contd….



Note: 0wk= before intervention; 12wk=12 week after intervention; 24wk=24 week after intervention; Con group= control group; PA group= Physical Activity group

Fig. (1). Mean scores of biomedical parameters within and between groups.

the previous studies which found a significant FBS improvement after an aerobic exercise program [36-38]. For instance, Kadoglou *et al*. [37], showed a considerable improvement on FBS result of the administration of rosiglitazone (8 mg/d) plus exercise training. In another study, the positive impact of aerobic exercise on the level of glucose and insulin became evident after 8 weeks ([40, 41]. Likewise, Goldhaber-Fiebert *et al*. [39] found that glycaemic control of type 2 diabetic subjects can be improved through a group-centred intervention focusing on the nutrition and walking exercise. The result of this study is also in accord with the study among T2DM patients which showed that aerobic training exercise resulted in a significant improvement in HbA1c and FBS [37]. The mechanism for the improvement of FBS value in glucose homeostasis in the current study could be due to an increase in muscle glucose uptake, since skeletal muscle is known to play an important role in the removal of glucose from circulation [42].

The present study showed that a 24-week walking exercise alone improved the lipid profile, which is exhibited by a reduction in TC, TG, and LD levels and an increase in HDL level. Similarly, Lian *et al*. [43] found a significant effect of a walking exercise on reducing TC, TG, and LDL-C and increasing HDL-C. [37] also reported that a 12-month gym-based aerobic training 4 times a week improved the lipid profile. Furthermore, results of a cohort study in Taipei with three classified groups (as inactive, low or high level of PA) indicated an association between LDL/non-HDL and reduction of mortality in the elderly people who joined in the regular PA program [44]. However, a randomized, controlled trial study could not provide definitive evidence for the effect of a 24-week PA on TC, LDL-C, and HDL-C levels in elderly people with type II diabetes [38]. Ferrer-Garcia *et al*. [45] also reported that there were no significant reductions in lipid profile parameters except for TC level in the exercise group who was subjected to resistance training combined with aerobic training for a period of 24 weeks.

The different modes of the exercise, the duration of the study, the intensity of the exercise and the volume of the exercise protocol could be the reasons for the discrepancies between their results and those of the current study. Training supervision also plays a vital role in achieving desirable

changes in the lipid profile of the subjects. Continuous supervision makes the subjects be able to perform exercise in a proper procedure. The compliance rate is also higher in the supervised training. Furthermore, the subjects are controlled to perform the prescribed exercise accordingly. In our study, the PA group conducted the exercise in group-centered, two days per week and they were supervised for correct performance and proper technique.

CONCLUSION

In conclusion, the present study provides evidence for the beneficial effects of walking exercise on lipid profiles and FBS in elderly women. Therefore, it can be concluded that using PA intervention is more effective for reducing CVD risk factors among community dwelling elderly women. These positive effects have important roles in improving the quality of life and independency among this group of people. Therefore, it could be more effective to encourage community or institutionalized elderly for attaining PA program by health care providers, physiotherapists, and geriatrics.

LIMITATION OF THE STUDY

This study has some limitations which have to be pointed out. The participants of this study were elderly women residing in Urmia, Iran, which could limit the generalization of the results to senior centres or other community-living seniors. Moreover, due to financial issue, we could not measure all biomarkers such as the A1C. In addition, due to accuracy issue, attendance rate during follow up was not measured. However, biomedical parameter changes between trials 2 and 3 were important indicators of PA performance of the elderly women. This research was single blind study and it is suggested that future studies use a double-blind or triple blind design for preventing possible bias.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No Animals/Humans were used for studies that are the basis of this research.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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