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Adherence to intermittent and continuous aerobic exercise prescription in overweight and obese women, a randomized clinical trial

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Objectives: Obesity and a sedentary lifestyle are major public health problems. It is suggested that short sessions of exercise might be considered a more applicable method for attracting sedentary people to physical activity in comparison to long sessions. The objective of this study was to compare the effect of two different aerobic exercise programs (intermittent and continuous brisk walking) on adherence (obedience to the prescribed exercise) and attrition in overweight and obese sedentary females in Iran. Design: Fifteen individuals in the intermittent (INT) group performed 40 minutes of medium intensity exercise in 3 sessions per day, for 5 days per week; the 15 participants of the continuous (CON) group exercised a single 40-minute session per day, 5 days per week. The adherence and attrition of all the participants were assessed in twelve weeks. Results: Regarding adherence to prescribed activity in terms of days and minutes per week, no significant differences were found between the INT and CON groups. However, comparing the sessions of exercise per week, it was found that participants in the CON group significantly adhered more accurately to their prescribed sessions per week (p=0.02). There was no significant difference between the groups regarding adherence to exercise intensity prescription. Conclusion: It seems that the adherence rate for the INT and CON exercise groups can be excellent. However, with an increasing the number of the sessions per day, the INT exercise group had lower adherence to three short sessions per day than one long session in the CON exercise group.

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Key Words: Adherence; intermittent; continuous; exercise; weight

INTRODUCTION

According to the World Health Organization (WHO) estimation in 2008, globally 1.5 billion adults, twenty and older, were overweight, and out of these, over 200 million men and nearly 300 million women were obese (1). The risk of developing overweight and obesity depends on lifestyle factors such as physical activity levels and food intake (2-3). According to Esteghamati et al., the prevalence of obesity and being overweight in Iran is estimated to be 22.3% and

36.3%, respectively (4). The prevalence of obesity among women (30.6%) was more than twice as high as that in men. The prevalence of obesity among Iranian females exceeds the rates in females from neighbouring countries (4).

Inactivity is the other problem related to increasing weight. It has been reported that 15% of men and 20% of women from 51 countries (most of which are developing countries) are at risk of chronic diseases due to physical inactivity (5). Momenan and colleagues reported that the prevalence of inactivity

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was 69.8% in the whole population of Tehran, Iran (6).

Adherence to exercise prescription is important not only for lifestyle change in overweight and obese women, but also in the prevention of returning to sedentary life style. Although commonly a single session of physical activity per day has been recommended for weight reduction, INT physical activity has been suggested as a practical method for changing the lifestyle of obese and overweight individuals (2,7-8). It seems that encouraging overweight and obese individuals to short sessions of brisk walking might be a more applicable method for attracting them to physical activity, in comparison to long sessions exercises (9), particularly in sedentary women in developing countries (7).

Some clinical trials have investigated adherence to INT and CON aerobic exercise protocols in overweight and obese individuals (10-11). However, some of them were supervised exercise programs and some prescribed exercise with equipment that could influence adherence to exercise (9-11). There is the need for a new trial to investigate an exercise protocol measuring real life physical activity like, for example, walking (6,12-13). In the current study, we investigated the differences between adherences to INT and CON unsupervised brisk walking in overweight and obese women.

MATERIAL AND METHODS

Eligible participants were thirty women, from 20 to 45 years of age, who met these inclusion criteria: BMI more than 25, no history of regular physical activity (defined as at least thirty minutes of physical activity per day on most of the week days), no smoking history in the past six months, and no history of weight loss or gain in the past six months (defined as change in body weight for the amount of 10% of current body weight). Subjects were excluded if they had medical conditions that would limit their ability to participate in this study, such as any symptom of cardio-respiratory system, were taking medication that would affect body weight or other metabolic parameters, or were pregnant.

The study took place at the obesity clinic of Sports Medicine Research Center, from 2009 to 2010. Approval of this study was obtained from the Ethical Committee of Tehran University of Medical Sciences.

The randomization procedure was balanced block randomization in random blocks of 4, 6, and 8, into 2 groups (CON group and INT group).

Prescribing exercise in the CON group was as follows: the subjects were prescribed to do brisk walking twenty minutes per day within the first week, thirty minutes in the second week, and forty minutes from the third to the twelfth week, for five days each week throughout the study. (For more adaptation to the exercise protocol, the duration of the exercise was increased during the first two weeks, then forty minutes exercise was allowed in the third week.) Every individual's "maximal heart rate" was calculated using the 220-age formula and 64-76% of the maximal heart rate was considered to be everyone's exercise intensity. The aim was for individuals to exercise in the moderate intensity range (14).

In the INT group, the participants were asked to walk with the same exercise prescription mentioned above, but in three short sessions per day, with each session lasting more than 10 minutes and the sum of all three sessions was forty minutes. To eliminate any physiological effects, the time gap between the walking sessions in each day was requested to be more than four hours. Similar to the other group, to adapt participants with the protocol of the study, the participants in the INT group walked two and three sessions per day (each session lasting ten minutes) during the first and the second week of the study, while the sum of their exercise was twenty and thirty minutes per day. Therefore, we had a twelve-week exercise protocol with a two-week adaptation protocol with the same exercise intensity and type, but different in daily duration in both groups.

An instructive class for all participants was performed with the following objectives: provide moderateintensity aerobic exercise instruction by measuring the radial pulsation, the Borg Rating of Perceived Exertion (RPE) and Talk test (14-16). With these criteria, the participants should be walked in moderate intensity. This means that heart rate should be maintained within the range of 64-76% of maximal heart rate (as calculated for each of them and recorded in their logbooks), RPE should be maintained on 13-14 numbers or ability to talk should be maintained in the range that they could not comfortably speak. Participants received a personal logbook for recording the time, duration and intensity of their own exercise per session. Two sessions of exercises for all participants were performed under the supervision of the sports medicine specialist to set the standards of exercise according to prescribed protocol for the participants. These sessions were performed in the vard of the sports medicine research centers clinic, which had an open environment for free walking. Heart rate and RPE was measured during these bouts. Dietitians taught participants about self-monitoring

healthy nutrition according to the United States Department of Agriculture-My Pyramid. They recommended, for example, 6-11 portions of bread and cereals, 3-5 portions of vegetables or 2-4 portions of fruit per day.

All of the participants were visited every three weeks

Variables	Intermittent Group (n=15)	Continuous Group (n=15)	P value*
Age (year)	33.10 (7.70)	32.44 (9.54)	0.81
Height (m)	1.57 (0.04)	1.56 (0.07)	0.09
Weight (Kg)	69.00 (5.40)	77.83 (17.37)	0.06
BMI (Kg/m2)	27.87 (2.33)	31.57 (4.78)	0.06
Data is presented as Mean (SD); *	significant differences between g	roups $(p < 0.05)$	

 Table 1. The Baseline Characteristics of Participants in the Study.

for twelve weeks; after three weeks, six weeks, nine weeks and finally twelve weeks from the start of the study; all of the subjects were invited to the Obesity Clinic for evaluation. In these visits, the logbooks of the participants were assessed to determine a correct recording of the training, including frequency, duration and intensity of their brisk walking each day. They were encouraged to comply with the study protocol.

Adherence was calculated during participation in the study based on these items: the average minutes of exercise completed divided by the minutes of exercise prescribed per day and per week (CON and INT: 200 minutes/week); the average frequency of exercise completed divided by the frequency of exercise prescribed per week (CON and INT: five days/week); and the number of sessions completed divided by the number of sessions prescribed per week (CON: five sessions/week; INT: fifteen sessions/week). Attrition was calculated by dividing the number of people who left the intervention by the total number of subjects who were initially recruited.

All participants signed the informed consent form.

Statistical analysis

CON variables were presented as mean and standard deviation, and categorical variables were summarized as frequencies and percentages. An independent t-test was used for CON data, whereas the Fisher exact or chi-square test was used for the analysis of categorical

data. To compare the linear trend of the variables over time between exercise groups, a repeated measures ANOVA was used, with group as the between variable and time as the within variable. Statistical analysis was performed using SPSS 17.0 (SPSS, Inc., Chicago, Illinois) software. The level of significance was set at p<0.05.

RESULTS

Of the thirty participants initially enrolled, nineteen completed the 12-week course of the study and their data were included in final analysis. There were no differences between significant the basic characteristics of participants in each group (Table 1). However, the number of overweight women in the INT and CON groups was twelve and seven, respectively, and the number of obese women was three and eight, respectively (p=0.06). There were not any significant differences regarding marital status, educational level or ethnicity. The description of the means of days and minutes of exercise per day and per week for both the INT and CON groups were shown in Table 2.

Regarding adherence to prescribed activity in terms of days and minutes per week, no significant differences were found between the INT and CON groups, as shown in Table 3. However, comparing the sessions of exercise per week, it was found that participants in the CON group significantly adhered more accurately to their prescribed exercise (p=0.02). As shown in

	Tab	le 2.	Exercise	D	escrip	otion	in	the	Intervention	Groups
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Variable	Intermittent group (n=10)	Continuous group (n=9)
Days of exercise per week	4.08 (1.66)	4.71(0.80)
Minutes of exercise per week	152.95(60.71)	173.50(45.70)
Minutes of exercise per day	28.51 (11.42)	34.15 (3.73)
Sessions of exercise per week	9.96 (4.87)	4.79 (0.73)

Data is presented as Mean (SD).

Variables	Intermittent Group (n=10)	Continuous Group (n=9)	P value
Ratio DW ^a	0.82 (0.33)	0.94(0.16)	0.32
Ratio MW ^b	0.76 (0.30)	0.87 (0.14)	0.17
Ratio SW ^c	0.66 (0.32)	0.96 (0.15)	0.02*
Ratio HR ^d	0.87 (0.08)	0.93 (0.09)	0.19

Table 3. Comparison of Adherance Values Between the Intervention Groups.

Data is presented as Mean (SD). * significant differences between groups (p < 0.05).

^a: DW, days per week: (average days per week)/5

^b: MW, minutes per week: (average minutes per week)/200

^c: SW, sessions per week: (average session per week)/(5 in CON group,15 in INT group)

^d: HR, heart rate: average HR/recommended HR

Table 3, there was no significant difference between the groups regarding adherence to exercise intensity prescription (0.19).

As shown in Figure 1, there were linear positive changes in the INT and CON groups regarding minutes of exercise per week (p < 0.001). This linear increase would be seen not only in the first two weeks when we prescribed lower time of exercise per day, but also from the third to the twelfth week of the study, when our exercise prescription was fixed.

In terms of attrition, six individuals from the CON group and five participants from the INT group withdrew the study during the follow-up. No significant differences were found between the INT and CON groups (p=0.71); the average attrition was 33.3% in the INT group and 40% in the CON group.



Figure 1: Linear Positive Changes in the INT and CON Groups Regarding Minutes of Exercise Per Week (p <0.001).

DISCUSSION

Regarding adherence to prescribed activity in the present study in terms of days per week and minutes per week, no significant differences were found between the INT and CON groups. For example, both the CON and the INT groups walked the majority of the prescribed days. This is excellent adherence similar to some other trials (11, 17). Based on available evidence, it seems that adherence to INT short sessions of exercise is better than CON long sessions (9, 18-19). However, other factors can influence this adherence, including being free to choose the place and time of exercise (9, 18-19). Whenever the exercise prescription is free and without limitations of time, place, supervision or equipment, participants tend to exercise more, relative to any restriction of the conditions (9). For example, to eliminate any physiological effects in the present study, the time gap between the walking sessions in each day was requested to be more than four hours and the participants who were unsuccessful in completing three sessions explained that they did not have enough time in the day for this wide range of time between their sessions. It seems that place of exercise protocol is an important factor for adherence to exercise. Jacobson and colleagues (11) showed that INT exercise had higher adherence in comparison with CON exercise, but the CON group in their study had to exercise in the laboratory; whereas, the INT group was free to select their exercise place. It seems that difference in adherence was due to this reason. In our study, both groups were free to select the time and place of brisk walking.

Adherence to the number of sessions of exercise per week in the CON group was significantly greater than in the INT group (p=0.02). This means that the CON group was more successful in exercising for five long sessions per week, compared to the INT group who exercised for fifteen short sessions. The mean number of walking sessions in the INT group was two sessions per day, instead of three sessions (9.96 sessions per week). The participants mentioned that shorter bouts of walking were easier than longer bouts, but they did

not have enough time to leave home or work for walking three times per day. The other studies have prescribed intermittent exercise with different bouts per day, for example, two, three or more sessions per day (11, 19-21). As an example, in their 18-month study, Jakicic and colleagues found that intermittentexercise had greater adherence, especially in trials with duration less than twelve weeks (19). Nevertheless, they prescribed two sessions per day or ten sessions per week. This is near the ten sessions of the study mentioned. It seems that participants tend to prefer two sessions of exercise per day rather than three (11). Perhaps increasing the regime to more than two sessions of short sessions of exercise per day, or more than ten sessions per week, can reduce adherence rate. However, both groups had similar minutes per week, so the INT group walked two sessions longer than 10 minutes. Therefore, adherence to INT exercise is similar to the CON type regarding the total volume of exercise per week.

As an important point, there was an increasing trend in the subjects' adherence to the details of our prescription during the twelve-week study (P<0.001). However, Schmidt and colleagues found that in the second six weeks of their trial, the time of exercise of the participants decreased (20). Perhaps it was due to their supervised exercise. It seems that for starting and maintaining any changes in overweight and obese sedentary lifestyles, we should apply fewer restrictions during the exercise prescription and the exercise protocol should be practical for them (9).

Regarding demographic characteristics such as menopause, marital status, educational level and ethnicity, there is some evidence that shows these items can influence the adherence to prescribed exercise (22). Arikawa and colleagues reported that adherence to twice-weekly weight training exercise prescription was significantly lower among women with a higher level of education and among unmarried women with children aged six to twelve, compared with married women without children. In the present study, however, there were not significant differences in marital status, educational level and ethnicity between the groups.

In our study, the average attrition was 33.3% in the INT group and 40% in the CON group, but the number of individuals who left the study was not significantly different between the two groups. The rate of loss of follow-up in our study can be compared well with other studies (10-11, 20). The remarkable loss of follow-up of the studies might be due to the application of extraordinary changes in lifestyle of the participants by the study protocols such as supervised exercise. Schmidt and colleagues showed that attrition in CON group with supervised exercise was significantly greater than that in INT unsupervised group during the first 24 weeks of the 72 week trial,

but this difference disappeared until 72 weeks (20). Due to an unsupervised exercise protocol and the short duration of the trial, both groups had similar attrition rates in the present study.

Reasons for attrition included: lack of time for exercise or visits (n=8), moving to another city or country (n=2), medical reasons (n=1) (this subject sustained a hand fracture during her own work). Similar to other studies "having no time for exercise or follow-up visits" has been found to be the most common reason for a participant to discontinue the study (17, 23).

Limitations and strength points: The primary limitations of our study were the small number of participants and the subjective methods of evaluation. The strength of our study was the unsupervised practical educational exercise protocol, which can be used in obesity clinics for changes in the lifestyle of sedentary overweight and obese women.

In conclusion, the adherence rates for the INT and CON exercise groups were excellent during the twelve-week aerobic exercise regimes, but by increasing the sessions per day, the INT group had lower adherence to three short sessions per day than one long session in the CON group. However, the INT group had good adherence to total time of exercise prescription.

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