Combined Exercise Program Reduces C- reactive protein on Obese Women

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ABSTRACT

Objective: *the present study examined Anthropometry, C-reactive protein (CRP) and physical function in obese women after combined exercise program.* ***Materials and Methods:*** *Obese women (n= 40; aged from 20-30 years; BMI; 35.0-39.9 kg/m^2) were recruited for a 3 month trial. Participants were divided into group I (n=12; aged from 20 to less than 25 years) and group II (n=28; aged from 25 to 30 years). Participants in both groups had been received a combined aerobic and anaerobic exercise program 3 times/week. Anthropometry, CRP and physical function (4 meter walking velocity, chair rising test time, 6 min walking distance and hand grip strength) were assessed at baseline and after 3 month.* ***Result:*** *In both groups, the results revealed significant increase in all measurements (P<0.05) except CRP level, chair rising test time, and BMI which exhibited significant reduction (P<0.05). The effect of age showed that there was no significant difference between the two groups (P>0.05).* ***Conclusion:*** *results provide evidence that combination of aerobic and anaerobic exercises experienced by obese adults can reduce CRP level and improve physical function. This can be translated into enhanced quality of life.*

Key words: *Exercise, CRP, physical function, obesity.*

INTRODUCTION

A recent explosion in the cardiovascular risk has swept across the globe. Primary prevention is the preferred method to lower cardiovascular risk. Lowering the prevalence of obesity is the most urgent matter[13].

Adipose tissue serves as an endocrine organ, secreting a host of inflammatory cytokines including IL-6, which stimulates hepatic production of C-reactive protein (CRP)[14]. CRP is an acute phase protein in the pentraxin family[2]. It is elevated in obesity and its concentration correlates with cardiovascular risk[4]. The elevation of CRP may contribute to poorer physical performance and physical disability via decreases in skeletal muscle protein content and loss of muscle mass and strength[14].

Various studies have shown the benefits of weight reduction[1]. Therefore, there must be attractive and persuasive evidence of weight-loss benefits in everyday function to motivate obese women to lose weight. Thus, the goal-setting should focus on positive weight-loss effects, not only the number of kilos lost[15]. So the aim of this study was to investigate the effects of combined exercise program on CRP level and physical function in obese women.

MATERIALS AND METHODS

Participants

Participants (n = 40) were recruited for the trial. Eligibility criteria included: being woman, class II obesity[16] unmarried, from 20 to 30 years of age, did not participate in regular physical activities three months before the study, stable weight maintenance (i.e., no weight loss or diet). Individuals were excluded if they had musculoskeletal disorder, cardiopulmonary diseases, metabolic disorders or any systemic problems affecting the results. Eligible contacts were invited to a clinic visit and gave written informed consent to participate in the study.

Design and Intervention

Participants were divided into one of two groups: Group I (n = 12) where age ranged between 20 to < 25 years and Group II (n = 28) where age ranged between 25 to 30 years. Both groups received the same structured exercise training program 3 times/week for 60 min/session during the 3 months of the trial. The exercise program consisted of a warm-up phase (5 minutes), an aerobic phase (15 minutes),a resisted phase (20 minutes), a second aerobic phase (15minutes), and a cool-down phase (5 minutes)[8] The mode of aerobic training was walking. The intensity for the

aerobic exercise portion was 60% to 75% of target heart rate. Participants were regularly monitored throughout the exercise program, and their heart rates were recorded during the exercise sessions. Strength training included multigym mild resisted exercises for lower and upper limbs. Two sets of 12 repetitions were performed at each exercise, with resistance being progressively increased during the intervention as strength improved. Rest interval separated each exercise from 1 to1.5-minute. Warm-up and cooling down phases were in the form of respiratory and flexibility exercises for upper and lower limbs.

Measurements

All variables except the graded exercise test (baseline only) were collected on all participants at baseline and after the 3-month intervention.

Graded Exercise Test

A graded exercise test using a symptom-limited Naughton protocol was performed during initial testing and was used as an exclusion criterion and to establish an individually tailored exercise prescription for participants[10].

Anthropometry measures

Body Weight, Height, and BMI were obtained using standard techniques.

C-reactive protein

Venus blood samples were drawn in the morning after an overnight fast. The samples were immediately centrifuged and stored at –80°C until final analysis[3].

Physical Function

This variable was assessed through physical performance tasks. Physical performance tasks included:- (1) 6-minute walk distance in which participants were instructed to walk as far as possible in a 6-minute time on an established course. They were not allowed to carry a watch and were not provided with feedback during the trial. Performance was measured in the total distance covered. This test was significantly correlated to treadmill time and symptom limited maximal oxygen consumption and has a 3-month test–retest reliability of 0.86[12]. (2) Repeated chair rising test in which participants sat in a straight-backed chair with arms fold across the chest and stood five times consecutively as quickly as possible. The time of 5 completed chair rises was measured[6]. (3) 4- Four-meter walking velocity in which participants walked at their usual pace over a 4-meter course in indoor. The time was taken and used to compute walking speed[14]. (4) Hand grip strength was measured in both hands using an adjustable grip strength dynamometer. Three trials were made with a pause of about 10-20 seconds between each trial to avoid the effects of muscle fatigue. The maximum overall value was used in the analyses[14].

Data Analyses

SPSS version 16.0 (SPSS, Inc., Chicago, IL) were performed to analyses all results, data was tested for normality using Kolmogorov-Smirnov test. The quantitative variables were expressed as mean ± standard deviation (SD). Comparison of variables before and after intervention was done using paired t-test. Comparison between 2 different groups was done using unpaired T-test. Pearson's correlation co-efficient "r" used to assess the correlation between each quantitative variable in all subjects. All P-values in the analysis were considered statistically significant when $P \leq 0.05$.

RESULTS

In this study, 40 obese women were enrolled. The study consisted of two age groups namely group I (n = 12) where age ranged from 20 to less than 25 years and this group constituted 30% from the whole sample. Group II (n = 28) where age ranged between 25 to 30 years and this group constituted 70% from the whole sample.

The demographic profile of the patients is shown in Table 1. At baseline, there were no statistically significant differences in between the two groups.

Table (1): Demographic Characteristics of the study sample.

Characteristics	Groups	Mean ±SD	P-Value
Weight (Kg)	Group I	95.3 ± 6.1	>0.05[a]
	Group II	92.9+ 8.2	
Height (Cm)	Group I	160 ± 2.2	>0.05[a]
	Group II	159 ± 6.4	
BMI (Kg/m^2)	Group I	37.03 ± 1.3	>0.05[a]
	Group II	36.6 ± 1.5	

SD: Standard deviation [a] Non-significant

Anthropometry results:

Means for baseline and after 3 month measures are shown in table (2). In both groups, anthropometrics has been decreased significantly following the exercise program (P=0.000), see table 2. There were no group differences in anthropometrics at baseline and after 3 month, see figure 1.

Table (2): Anthropometrics of the groups pre- and post-treatment.

Variables	Groups	Pre M ±SD	Post M ±SD	P-Value
Weight	Group I	95.3 ± 3.4	84.3 ± 8.2	0.000[b]
	Group II	92.9 ± 8.2	82.1 ± 8.6	0.000[b]
BMI	Group I	37.03 ± 1.3	32.7 ± 2.3	0.000[b]
	Group II	36.6 ± 1.5	32.3 ± 1.9	0.000[b]

M ±SD: mean ±standard deviation; [b]: significant; BMI: body mass index.

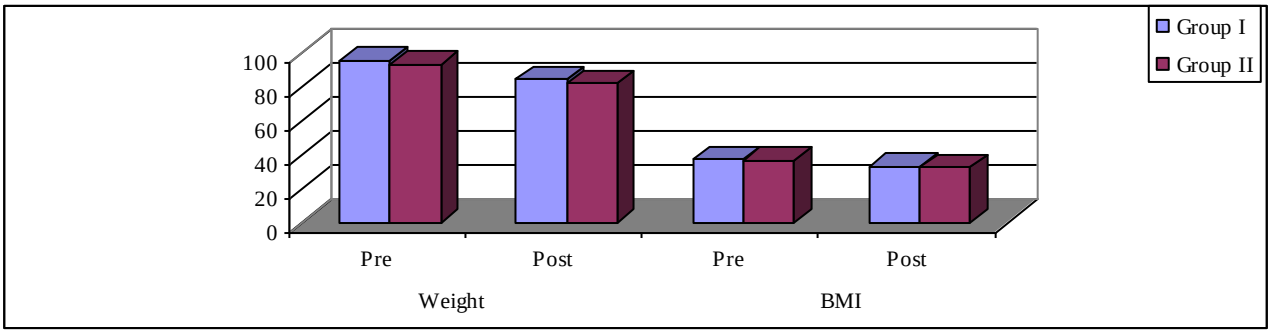

Fig. (1): Effect of age on anthropometry before and after intervention.

C-reactive protein result:

In both groups, CRP has been decreased significantly following the exercise program (P=0.000), see table 3. No significant difference was found between the groups at either pre or post treatment measurements (P>0.05), see figure 2.

Table (3): CPR values of the groups pre- and post-treatment.

Variables	Groups	Pre M ±SD	Post M ±SD	% of change	P-Value
C-reactive protein	Group I	9.1 ± 3.4	3.1 ± 2.1	66.3 ±14.7	0.000[b]
	Group II	10.5 ± 5.6	5.1 ± 4.4	57.5 ± 23.3	0.000[b]

M ±SD: mean ±standard deviation; [b]: significant

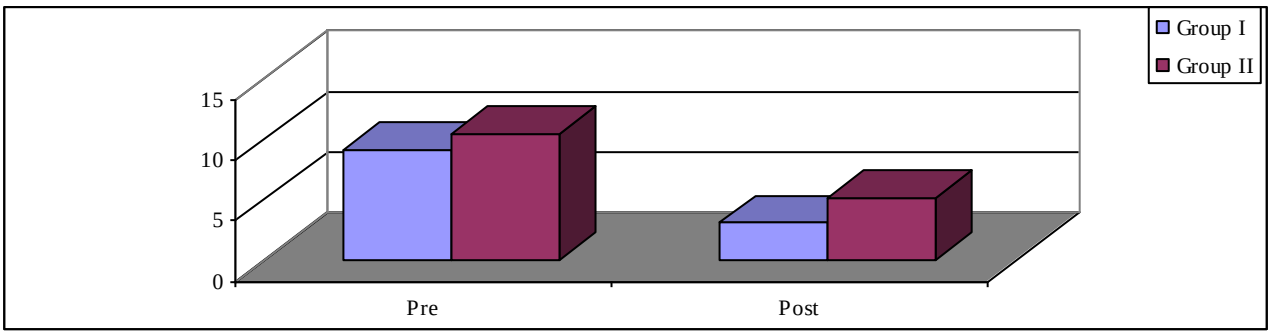

Fig. (2): Effect of age on C-reactive protein before and after intervention.

Physical function results

Regarding physical function, all the parameters have been increased significantly following the exercise program except chair rising test time which has been decreased significantly after intervention in both groups (P=0.000), see table 4. Pre and post treatment measurement comparison between the groups found non significant difference (P>0.05), see figure 3 and 4.

Table (4): Physical function values of the groups pre- and post-treatment.

Variables	Groups	Pre M ±SD	Post M ±SD	% of change	P-Value
6 min distance	Group I	356.4 ± 49.4	402.0 ± 39.8	13.4 ± 7.5	0.000[b]
	Group II	354.5 ± 46.1	401.1 ± 38.5	13.8± 8.1	0.000[b]
4 meter velocity	Group I	0.81 ± 0.16	1.2 ± 0.29	41.6 ± 21.1	0.000[b]
	Group II	0.79 ± 0.16	1.06 ± 0.29	35± 25.1	0.000[b]
RT HG	Group I	23.3 ± 3.3	26.7 ± 3.5	14.9 ± 5.8	0.002[b]
	Group II	24.9 ± 4.7	27.5 ± 4.8	11.7 ± 9.2	0.000[b]
LT HG	Group I	20.6 ± 3.2	23.5 ± 4.5	13.5 ± 10.1	0.000[b]
	Group II	22.2 ± 4.3	24.3 ± 3.9	9.8 ± 8.4	0.000[b]
Chair rising test time	Group I	12.1 ± 1.7	9.7 ± 1.2	19.5 ± 8.1	0.000[b]
	Group II	12.7 ± 3.9	10.2 ± 1.9	18.1 ± 12.6	0.000[b]

M ±SD: mean ±standard deviation; [b]: significant; HG: hand grip

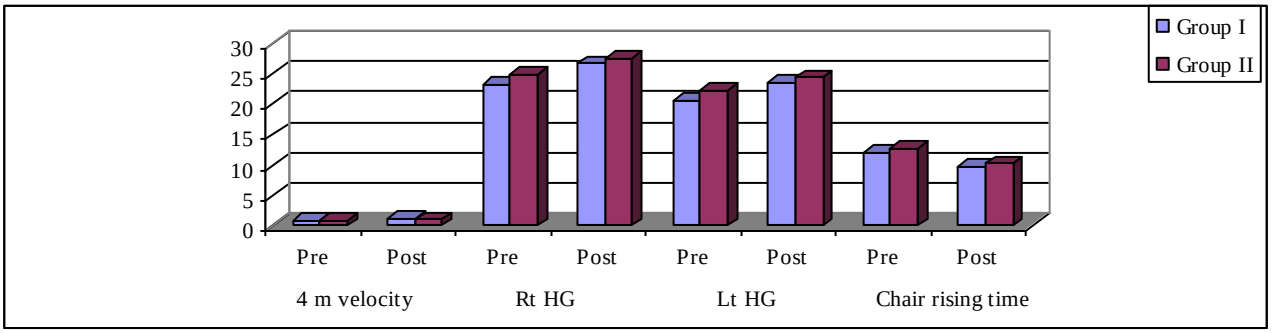

Fig. (3): Effect of age on physical function measures before and after intervention. m: meters; HG: hand grip.

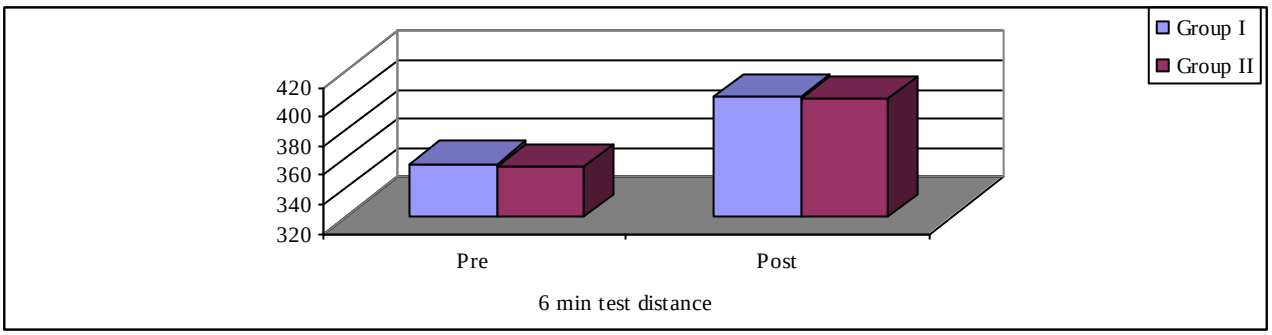

Fig. (4): Effect of age on 6min test distance before and after intervention.

Correlations between age, BMI and physical function

Table 5 shows correlations between age, BMI, physical function and CRP in the first group. Both age and BMI (before and after intervention) had no significant (P >0.05) correlation with any of the studied parameters.

Table (5): Correlations between age, BMI, physical function and CRP in first group.

Parameters after intervention		Age	BMI before	BMI after
6 min test	r	0.49	-0.37	-0.31
	p	0.102	0.235	0.320
4 meter velocity	r	0.13	-.57	-.342
	p	0.668	0.045	0.173
RT hand grip	r	0.20	-0.34	-0.03
	p	0.526	0.274	0.932
LT hand grip	r	0.20	-0.14	-0.04
	p	0.537	0.663	0.882
Chair rising test	r	-0.48	-0.14	-0.05
	p	0.113	0.665	0.867
CRP	r	-0.40	0.24	0.17
	p	0.203	0.420	0.588

r = Pearson correlation coefficient

Table 6 and figures 5-8 show correlations between age, BMI, physical function and CRP in the second group. Age had no significant (P >0.05) correlation with any of the studied parameters. BMI before intervention had a significant inverse intermediate correlation with 6 min test (r = -0.46, P = 0.013) also, BMI before intervention had a significant direct intermediate correlation with CRP (r = 0.51, P = 0.006). Regarding BMI after intervention, it showed a significant inverse intermediate correlation with 6 min test (r = -0.43, P = 0.021) and had a significant direct intermediate correlation with CRP (r = 0.53, P = 0.004).

Table (6): Correlations between age, BMI, physical function and CRP in the second group.

Items after intervention		Age	BMI before	BMI after
6 min test	r	-0.03	-0.46	-0.43
	p	0.988	0.013*	0.021 b
4 meter velocity	r	-0.04	-.31	-.23
	p	0.986	0.104	0.248
RT hand grip	r	0.02	-0.12	-0.06
	p	0.914	0.532	0.759
LT hand grip	r	0.09	-0.15	-0.15
	p	0.646	0.434	0.449
Chair rising test	r	-0.07	0.16	-0.07
	p	0.717	0.403	0.738
CRP	r	0.24	0.51	0.53
	p	0.215	0.006*	0.004 b

b :Significant

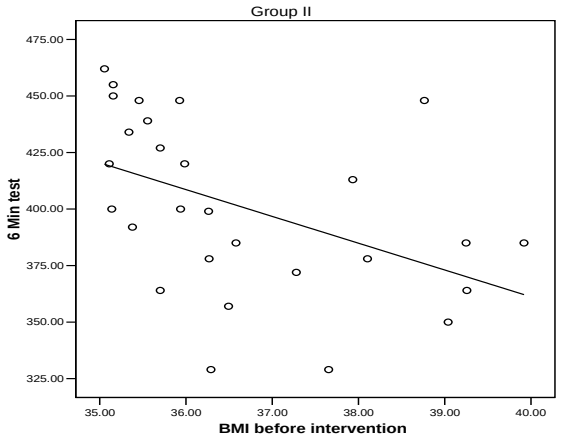

Fig. (5): Scatter plot of the correlation between BMI before intervention and 6MWT in the first group.

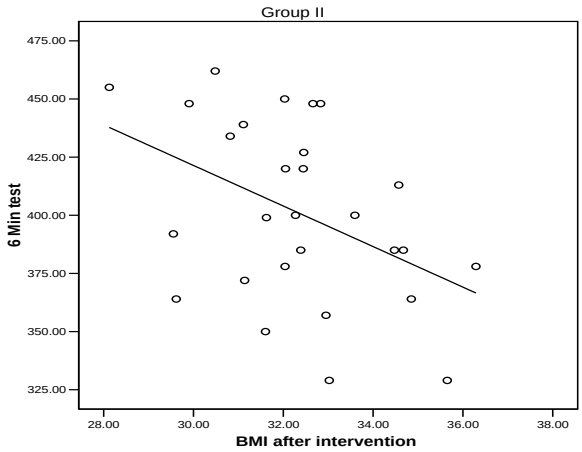

Fig. (6): Scatter plot of the correlation between BMI after intervention and 6MWT in the second group.

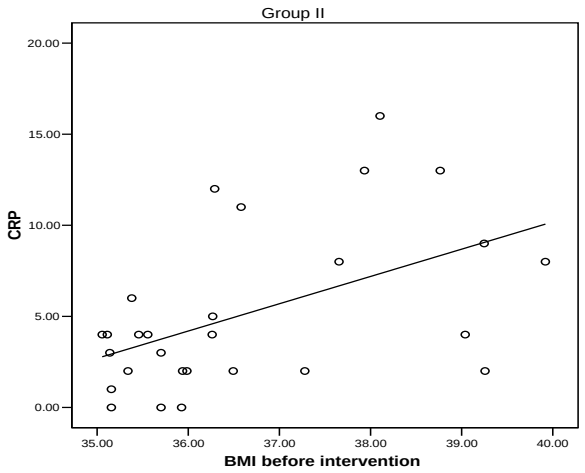

Fig. (7): Scatter plot of the correlation between BMI before intervention and CRP in the first group.

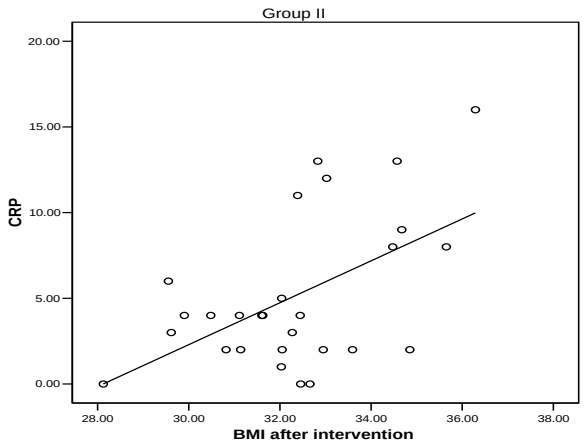

Fig. (8): Scatter plot of the correlation between BMI after intervention and CRP in the second group.

Table (7): % of change for both groups post- treatment as a summary.

Variables	Group 1	Group 2
BMI	8	5
CRP	22	19
6 min. walk test	19.4	18.7
4 meter walking velocity	23	24
Chair rising test time	17.6	16.8
Right HG.	10	9
Left HG	7.3	6.6

DISCUSSION

Inflammation has been hypothesised as a potential mediator of the association between obesity, physical inactivity and the development of chronic diseases, such as cardiovascular disease and type 2 diabetes. Systemic CRP is a sensitive marker of low-grade systemic inflammation and is an independent risk factor for CVD[9].

The present study examined the effect of combined exercise program on CRP level and physical function and also, studied the effect of age. The results of this study revealed significant reduction in anthropometrics and CRP level and significant improvement in physical function with no significance difference between the groups.

There is sufficient evidence to suggest that physical activity lowers inflammatory biomarkers in a variety of settings and populations which came in agree with these results. Studies that have demonstrated reductions in CRP concentrations range from 16% to 41%. The average change in CRP associated with physical activity appears to be at least as good, if not better, than currently prescribed pharmacological interventions in similar populations[11].

The reduction of CRP could be explained as follows; adipose tissue produces approximately 25% of the systemic IL-6, which is responsible for signaling the liver to secrete CRP. Therefore, higher levels of body fat are likely to be associated with higher CRP levels; conversely, reductions in body fat are expected to lower CRP. Regular physical activity has ant-inflammatory properties[5,9,11].

In addition to reduction in CRP, we found improvement in physical function. Obese adults prefer to walk more slowly depending on the degree of obesity to reduce their acute metabolic rate, thus making walking more comfortable. These observations could be the reflection of the overall impairment of physical fitness as a consequence of obesity and its metabolic complications.

This intervention may have improved muscle power and physical fitness which helped to increase physical performance.

A moderate weight loss intervention that incorporates calorie restriction +/- exercise training has previously been shown to improve physical function in obese adults which support our trial results[7,8].

Conclusion

The results of this study provide evidence that the combination of aerobic and anaerobic exercises can reduce CRP and anthropometry measures and increase physical performance. This can be translated into enhanced quality of life.

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Conflict of interest: The authors have declared that no competing interests exist.

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الملخص العربي

تأثير التمارين الهوائية واللاهوائية على انخفاض مستوى بروتين سي التفاعلي في النساء البدينات

الهدف من البحث : وقد صمم هذا العمل لدراسة تأثير برنامج التمارين ال هوائية واللاهوائية على انخفاض مستوى بروتين س ي التفاعلي والأداء الوظيفي لدى النساء البدينات الدرجة الثانية . **خطة البحث :** وقد أجريت هذه الدراسة على أربعين امرأة بدينة من الدرجة الثانية ومؤشر كتلة الجسم يتراوح من 35 إلى 39.9كجم/م2 لمدة 3 اشهر وقد تم تقسيم المرضى عشوائياً إلى مجموعتين حسب السن والمجموعة الأولى (عدد =12) حيث تراوحت أعمارهم ما بين 20 إلى اقل من 25 عاماً والمجوعة الثانية (عدد =28) حيث تراوحت أعمارهم ما بين 25 إلى 30 عام كلا الفريقين تلقى نفس البرنامج من التمارين ال هوائية واللاهوائية 3 مرات أسبوعيا . وقدتم عمل تقييم قبل بدأ البرنامج العلاجي وبعد انتهائه لكل مريض من كلا المجموعتين وقد شمل : مؤشر كتلة الجسم و ومستوى بروتين سي التفاعلي وسرعة المشي خلال الأربعة أمتار ووقت الارتفاع من على الكرسي واختبار الستة دقائق سيراً على الأقدام وقبضه اليد . **النتائج :** أظهر التحليل الإحصائي للنتائج انخفاض ملحوظ في بروتين سي التفاعلي ومؤشر كتلة الجسم واختبار الارتفاع من على الكرسي في كل من المجموعتين مع زيادة ملحوظة في اختبار ستة دقائق والسرعة خلال الأربع أمتار وقوة قبضة اليد اليمنى واليسرى في نهاية الدراسة . كما أظهرت الدراسة تأثير السن على الأداء الوظيفي قبل وبعد البرنامج انه لا توجد فروق كبيرة بين الفئات العمرية . **الملخص :** من نتائج هذا البحث أن التمارين الهوائية واللاهوائية أداة علاجية فعالة تساعد على انخفاض في بروتين سي التفاعلي وتحسين الأداء الوظيفي لدى السيدات البدينات .

الكلمات الدالة : التمارينات- بروتين سي التفاعلي- الأداء الوظيفي- السمنة .