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The Effects of Spinning and Body Pump Exercises on C - Reactive Protein and Some Cardiovascular Risk Factors in Middle-aged Women

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Abstract This research is a semi-empirical and applicable one, the goal of which is to determine the effects of spinning and body pump exercises on C - reactive protein and some cardiovascular risk factors in middle-aged women. The population is categorized under three groups; body pump with 12 samples, spinning with 12 samples and witness with 12 samples. The duration of exercises is 8 weeks and 3 sessions in every week. The samples have been checked up in pre-test and post-test. For data analysis and determining the degree of effectiveness a correlated T test has been done and for comparing the groups an ANOVA had been done with a p-value of ≤0/05. The results show that after 8 weeks of doing spinning and body pump exercises, the level of variables of C-reactive protein, Lipoprotein with low density (LDL), Triglycerides (TG), Total **c**holesterol (TC), and the Body Fat Percentage have has been decreased, while the level of High Density Lipoprotein (HDL) has been increased. No effect has been detected in the level of blood pressure. Also data reveal that comparing to the control group, the spinning group has changes in the levels of variables of C-reactive protein, Lipoprotein with low density (LDL), Triglycerides (TG), Total **c**holesterol (TC) and High Density Lipoprotein (HDL), but no tangible difference in the level of Body Fat Percentage. The body pump group, in a comparison with the control group, has changes in the level of variables of C-reactive protein and Triglycerides (TG), but no variation in the level of variables of Lipoprotein with low density (LDL), Total **c**holesterol (TC) and High Density Lipoprotein (HDL). Comparing the spinning and body pump group with each other, there are differences in the variables of High Density Lipoprotein (HDL), while there are no tangible changes in the variables of C-reactive protein, low density Lipoprotein (LDL), Triglycerides (TG) and Total **c**holesterol (TC).

Keywords C-reactive protein, Cardiovascular Risk Factors, Spinning, Body Pump

1. Introduction

Today, overweight is an epidemic and growing problem all over the world which can be interpreted as an indicator of cardiovascular diseases [1]. The cardiovascular organ is one of the vital parts of human body whose diseases are the most dangerous problems. Researches indicate a direct relationship between cardiovascular diseases and the level of blood lipids. Based on epidemiology, doing physical activities have favorable effects on the blood lipoprotein regarding prevention of heart disorders such as coronary heart disease and also help peoples to reach to their potential longevity. So, exercise and physical activities can reform the level of blood lipid. This effect is done by increasing the High Density Lipoprotein which prevents from the arteriosclerosis and by decreasing the low-density Lipoprotein, Triglycerides (TG) and very-low-density lipoprotein which cause arteriosclerosis and fragility of coronary.

Besides, by weight loss, the level of High Density Lipoprotein will be elevated, Triglycerides and blood pressure will be reduced and the process of glucose metabolism to biolysis will be drowsed.

In recent decade, the local-inflammatory and general roots of arteriosclerosis and the related problems have been widely studied. Among inflammatory indexes, C-reactive protein is the most sensitive and powerful one which prognosticates the cardiovascular diseases [2, 3]. The baselines of the C-reactive protein in healthy peoples, can highly antedate the future risk of heart attack and failure, the possible cardiac arrest and the progression of peripheral artery disease. A jump in any of these indexes to 2-5 times, will follow the risk of cardiovascular diseases. Strong evidences indicate that there is a one-to-one correspondence between the level of blood inflammatory indexes and the overall and abdominal

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obesity which possibly the reason is the higher level of cytokine secretion from adipose tissue in overweight people [4]. Usually, the overall adipose tissue is greater in women compared with men which put the women more at the risk of chronic inflammation [5]. Often, the C-reactive protein (CRP) is produced by the liver and the adipose tissue in reaction to the accumulation of inflammatory cytokine. CRP itself has an inflammatory characteristic and is interpreted as a strong risk factor for cardiovascular diseases, high blood pressure and heart failure.[6, 7] Exercise and physical activities are other effective factors in determining these indexes [5]; more Physical activities, less coronary diseases signs [8]. In this regard, the effects of exercise-based protocols on CRP have been studied specifically [9]. So there is a great attempt to decrease the level of the inflammatory indexes which causes a reduction of cardiovascular diseases [5]. Possibly, physical activities decrease the inflammatory, coagulation, fatness indexes and as a result the mortality rate. The results in this regard are contradictory; Nassis and Hammett's [10] researches show no change in CRP after aerobic exercises in fat people, while Kakhak et al. studies reveal a reduction of CRP after activities. Lots of researches have been done for figuring out the relationship between exercise and the level of CRP. Because of CRP's wide range of performance, like stimulate phagocytosis and the release of complement components in reaction to inflammatory and tissue hurts, a bigger range of exercises and their relative effects have been studied [1]. Pil-Byung et al. in 2011 [11] have done a research in which tumor necrosis factor alpha or TNFα, CRP and IL-6 have a tendency to increase in the control group and these were vice versa for the exercising group. In this condition TG and LDL-C have increased significantly in control group which was again vice versa for the exercising group, in which the level of HDL-C has elevated a lot. Birhandi et al. [12] in 2011 have done a research in which the samples run on treadmill in a duration of 8 weeks, 3 sessions in each week with an intensity of 65-80% of maximum heartbeat. After the performance, their level of ICAM-1, CRP, TG, and IL6 show no tangible difference while the level of CHOL, HDL, and LDL had decreased [13, 14]. Some of the researches indicate that aerobic exercises are more effective rather that strength training regarding the blood lipoprotein. The researcher of the present paper has tried to study the effects of aerobic exercises and strategies to adjust the level of lipoproteins, **c**holesterol, Triglycerides, and CRP to decrease the cardiovascular risk factors [15, 16, 17, 18]. Actually the goal of this article is to determine the effects of spinning and body pump exercises on C - reactive protein and some cardiovascular risk factors in middle-aged women.

2. Methodology

This research is a semi-empirical and applicable one. Before any action a meeting was held with Physical Education department and the sport clubs. After distribution of the handouts, the non-qualified samples; such as very overweight ones ore those who use special medicine, were excluded. The final population was 36 which randomly categorized in 3 groups of 12 people (spinning, body pump and aerobic). The conditions were explained them and they consented to participate in all parts of the test. They were told not to use any anti-inflammatory, hormone or cold medicine at least 24 hours before the blood sampling. Also the intense physical activities were forbidden in the mentioned time. The blood sampling was done at 8 A.M before having breakfast. Anthropometric measurements (Height and weight) and physiologic measurements (Systolic and Diastolic Blood Pressure) were done after blood sampling and a brief breakfast. After five-minute sitting, the blood was taken from the sample's right-hand vein (5 milliliters). After transferring the blood samples to the laboratory, they were centrifuged in the room temperature. In the pre-test the temperature and time were recorded to create the same condition for the next test. After 8 weeks, the exercisers participated in the Test with the same condition of the pre-test.

Exercising protocol: The three groups did the common aerobic exercises with an intensity of 70-80% of maximum heartbeat, but each group had different overload to reach the determined intensity. The duration of each session was 60 minutes and the exercises were divided to 10 parts with 2-minute active interval between them. It was tried to match the exercises with each other, so randomly, 3 exercisers were chosen and required to do the spinning exercises and according to the resistance bike, they reached to the wanted intensity. The condition was the same for the body pump group but with weights instead of bike. At the same time, the third group was doing the rhythmic aerobic exercises. Music was combined with the exercises as synchronizing, relaxing and pace controlling factor for the groups. The music works as a guide and encourager for the exercisers. The class was included of 10 tracks of 4-6 minutes of music. Depending on the type of the exercises, the tracks were played for an aerobic block in 32 bytes, with different paces. After each track it was a 2-minute interval. For spinning there were 10 parts; the first for warming up, and the last for cooling down. So, 8 parts were designed for the basic spinning exercises and between each they did stretching. The spinning exerciser could adjust the intensity of pedaling between 8 to12. These activities were synchronized with the body pump group. In body pump group, the overload was compensated with adding more weights, intensifying the exercises and using music with faster rhythm which caused more pressure on body. The class was included of 10 tracks, in each of them the focus was on specific muscles. Between each track, stretching exercises were done, the weights were changed for the next track and coaches gave brief recommendations. Track 1: warming up, track 2: working on hip and thigh muscles, track 3: chest, track 4: back muscles, track 5: triceps, track 6: biceps, track 7: feet, track 8: shoulders, track 9: abdominal, track 10: cooling down and stretching. Control group did the rhythmic aerobic exercises which were designed in 10 parts; the first for warming up, and the last for

cooling down. After each track it was a 2-minute interval for relaxing and stretching. The intensity could be changed by varying the type of the exercises and the distances (80-140 meters per minutes) or by replacing the music with different rhythm.

3. Statistical Methods

The samples have been checked up in pre-test and post-test. For data analysis and determining the degree of effectiveness a correlated T test has been done and for comparing the groups an ANOVA had been done with a p-value of ≤0/05.

4. Materials for Measurement

- Health Questionnaire
- The measuring device for CRP, CHOL, TG, HDL, LDL, made by Hitachi Company, model: 911
- The measuring kit for CRP, made by Pars Azmoon Company and measuring kit for CHOL, TG, HDL, LDL made by Biosystem Company
- 24-branch Centrifuge device, made by Iran Khod Saz Company
- Caliper 01127A, made by Lafayette, for measuring the body fat of the exercisers
- Laboratory Stadiometer
- Medical scales
- Blood pressure device
- Sport top Spinner bike made in Taiwan
- Technogym Dumbbell and barbell
- Polar Pulse time stethoscope
- Aerobic step

5. Results

The Kolmogorov–Smirnov test (K–S test) indicated that the samples of the three groups had natural distributions.

The obtained results from the Table 1 indicate that the spinning's C - reactive protein is in this state: t= 9/753 and a p-value of 0/000 which t=8/864 and a p-value of 0/000 is obtained for the body pump. We specify p≤0/05, which shows that a course of spinning and body pump exercises has tangible effects on the C - reactive protein.

As it is shown in Table 2, HDL has t= -8/560, p=0/000 in spinning group, and t= -5/345, p=0/000 in body pump group.

Table 1. Statistical data of the effects of spinning and body pump exercises on C-reactive protein

result	p-value	df	t	Standard deviation	Average	number	Type of the test	variables	Group
Tangible change	0/000	11	9/753	0/86	3/25	12	Pre-test	CRP (pg/ml)	**Spinning**
				0/67	1/50	12	Pre-test		
Tangible change	0/000	11	8/864	1/07	3/33	12	Pre-test	CRP (pg/ml)	**Body pump**
				0/65	1/66	12	Pre-test		

Table 2. Statistical data of the effects of spinning and body pump exercises on some cardiovascular risk factors

result	p-value	df	t	Standard deviation	average	number	Type of the test	variable	group
Tangible change	0/000	11	-8/560	7/03	49/33	12	Pre-test	HDL (mg/dl)	**Spinning**
				5/87	57/25	12	Post-test		
Tangible change	0/000	11	7/845	10/62	81/91	12	Pre-test	LDL (mg/dl)	**Spinning**
				8/36	67/58	12	Post-test		
Tangible change	0/000	11	6/698	26/30	89/66	12	Pre-test	TG (mg/dl)	**Spinning**
				20/37	73/25	12	Post-test		
Tangible change	0/000	11	7/138	16/55	157/83	12	Pre-test	TC (mg/dl)	**Spinning**
				15/34	133/00	12	Post-test		
Tangible change	0/000	11	7/175	3/60	28/40	12	Pre-test	Fat percentage (%)	**Spinning**
				2/72	25/78	12	Post-test		
Tangible change	0/000	11	-5/345	7/14	50/83	12	Pre-test	HDL (mg/dl)	**Body pump**
				5/35	55/58	12	Post-test		
Tangible change	0/000	11	7/140	10/71	80/33	12	Pre-test	LDL (mg/dl)	**Body pump**
				7/12	69/91	12	Post-test		
Tangible change	0/000	11	6/980	28/07	94/16	12	Pre-test	TG (mg/dl)	**Body pump**
				22/04	79/25	12	Post-test		
Tangible change	0/000	11	7/049	18/08	154/50	12	Pre-test	TC (mg/dl)	**Body pump**
				14/08	138/16	12	Post-test		
Tangible change	0/002	11	4/099	2/18	23/72	12	Pre-test	Fat percentage (%)	**Body pump**
				1/51	22/43	12	Post-test		

Table 3. Statistical data of the effects of spinning and body pump Exercises on the blood pressure

Result	p-value	df	t	Standard deviation	Average	number	Type of the test	Variable	Group
No tangible change	0/159	11	1/511	0/54	12/58	12	Pre-test	Systolic mm/g	**Spinning**
				0/27	12/42	12	Post-test		
No tangible change	0/139	11	1/595	0/43	8/46	12	Pre-test	Diastolic mm/g	**Spinning**
				0/24	8/35	12	Post-test		
No tangible change	0/419	11	0/840	0/83	12/58	12	Pre-test	Systolic mm/g	**Body pump**
				0/34	12/45	12	Post-test		
No tangible change	0/591	11	0/553	0/52	8/40	12	Pre-test	Diastolic mm/g	**Body pump**
				0/34	8/35	12	Post-test		

Table 4. The results of analysis of one-way variance for determining differences between a course of spinning and body pump exercises and control on the C-reactive protein, HDL, LDL, TG, TC, and fat percentage

Result	p-value	F	Changing sources
Tangible change	0/001	9/235	**CRP**
Tangible change	0/002	7/649	**HDL**
Tangible change	0/004	6/738	**LDL**
Tangible change	0/001	8/822	**TG**
Tangible change	0/001	8/924	**TC**
No tangible change	0/155	1/976	**Fat percentage**

LDL has t=7/845, p=0/000 in spinning, and t= 7/140, p= 0/000 in body pump. TG has t= 6/698, p= 0/000 in spinning, and t= 6.980, p= 0/000 in body pump. TC has t= 7/138, p= 0/000 in spinning, and t= 7/049, p= 0/000 in body pump. The body fat percentage is t= 7/175, p= 0/000 in spinning, and t= 4/099, p= 0/002 in body pump. According to p≤0/05, the table shows that a course of spinning and body pump exercises has tangible effects on HDL, LDL, TG, TC, and fat percentage.

As it is obvious in the Table 3, the systolic blood pressure has t= 1/511, p= 0/159 in spinning, and t= 0/840, p= 0/419 in body pump. The diastolic blood pressure has t= 1/595, p= 0/000 in spinning, and t= 0/553, p= 0/000 in body pump. It can be concluded that a course of spinning and body pump exercises has tangible effects on the blood pressure.

The results of the Table 4 indicate that the C-reactive protein has F = 9/235, p = 0/001—HDL: F = 7/649, p = 0/002—LDL: F = 6/738, p = 0/004—TG: F = 8/822, p = 0/001—TC: F = 8/924, p= 0/001.

According to p≤0/05, in CRP, HDL, LDL, TG, and TC there are tangible changes between spinning, body pump and the control group. But based on the results, there is no tangible change in fat percentage between these 3 groups.

6. Discussion

The obtained result of the present research is an indicator of the effects of spinning and body pump exercises on C - reactive protein and some cardiovascular risk factors in middle-aged women. Actually, the spinning and body pump exercises decreased the level of variables CRP, LDL, TG, and TC and body fat, increased HDL and no change were detected regarding the blood pressure. Compared with the control group, the spinning group has tangible changes in CRP, LDL, TG, TC, HDL, but there was no change in the body fat level. The body pump showed changes in CRP and TG, but no change in the level of LDL, TC, and HDL was detected. In a comparison between spinning and body pump group, changes were obvious in the level of the HDL, but no shift in the CRP, LDL, TG, and TC. Some researches show strong evidences about the effects of the physical activities on the level of the CRP and cardiovascular factors. Daray et al. and some others claimed that physical activities have no effect on the levels of CRP and cardiovascular risk factors. Other effective factors can be age, sex, race, initial fitness level, type and intensity of the exercise and the duration of them. Back-ground cardiovascular problems, using cigarettes or diabetes could lead to different results. Also, researches shows that people with high CRP and high blood lipids are more in danger of arteriosclerosis. By aging and intensifying the effects of the inflammatory CRP factor, artery elasticity will decrease and the risk of the cardiovascular diseases will increase. Besides doing exercises, some factors should be controlled to prevent the various cardiovascular diseases; such as controlling false appetite, increasing the level of dopamine and insulin secretion, improving the function of parasympathetic and increasing of the anti-inflammatory factors. Involvement of CRP and blood lipids in the screening cardiovascular tests could significantly be helpful in preventing the related diseases, especially in young population. The effects of life style, healthy eating habits and physical activities cannot be neglected. As a conclusion, the present research indicates that regular Spinning and Body Pump exercises decrease

CRP, the risk of cardiovascular diseases and the danger of arteriosclerosis, especially in older people which increase the longevity.

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