Original Article

The effect of a selected home-based exercise program by consuming coffee on blood lipid profile of inactive middle-aged men in COVID-19 pandemic condition

NAHID TALEBI[1] ✉, ALI REZA TAHERI[1], ASIEH GOODARZI[2]

[1]*Department of Physical Education and Sport Sciences, Faculty of Humanities, Shahed University, Tehran, Iran*
[2]*M. Sc. in Sport Physiology, Faculty of Sports Sciences, University of Isfahan, Isfahan, Iran*

ABSTRACT

The purpose of this study was to examine the effect of 8 week a selected home based exercise program by consuming coffee on blood lipid profile of inactive middle-aged men in pandemic COVID-19 condition. The present study is a semi-experimental methodology and 44 middle-aged men with fatty liver were randomly divided into four groups of 11 cases: home-based exercise, coffee, home-based exercise + coffee, control. Blood test was used to measure blood lipid profile. The combined home-based exercise intervention was performed for 8 weeks, three sessions and 60 minutes per session. Coffee intervention consumed 10 grams of coffee per every other day. The results showed that weight, body mass index, LDL cholesterol, total cholesterol and triglyceride decreased significantly after eight weeks of training in all three experimental groups and HDL cholesterol increased significantly ($p < .05$). It seems that performed combined home- based exercise and in combination with coffee consumption can be effective in improving the blood lipid profile of inactive middle-aged men in quarantine and paired COVID-19 conditions and prevent liver damage.
Keywords: Sport medicine, Health, Inactive, Home-based exercise, Coffee consumption.

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✉ **Corresponding author.** *Department of Physical Education and Sport Sciences, Faculty of Humanities, Shahed University, Tehran, Iran.* *https://orcid.org/0000-0002-3861-1005*
E-mail: rizkaawidayanti13@gmail.com
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INTRODUCTION

One of the most common infectious diseases in the world is acute respiratory infections. Acute respiratory infections (ARIs) are caused by viruses and respiratory bacteria (Cardoso, 2010; Cintra & Arruda, 1999). The COVID-19 virus, which has now become a pandemic and has become the most important public health challenge in the world, has become one of the most effective types of viruses in acute respiratory infections (Park, 2020). In addition to being contagious, the virus has mutated rapidly and has taken on different types (Scartoni et al.,2020; Huang et al., 2020). People at risk for COVID-19 problems include the elderly and people with chronic illnesses or poor immune function (Bartlett et al., 2018). According to the World Health Organization (WHO), the risk of developing COVID-19 in middle-aged people, followed by the elderly, is higher than in young people due to vulnerability and increased injuries and physiological diseases caused by aging. In these conditions, it has become a tool to maintain and improve the function of the immune system in old age and middle age (Schroeder et al., 2019; Babaei Khorzoghi, 2020; Rector et al., 2008).

Among the measures used by governments and their health systems to prevent and decrease the rapid spread of this disease are, staying at home, reducing social relationships, and using a mask. Such decisions can cause fundamental changes in people's lifestyles, including changes in physical activity, followed by increased inactivity and lack of mobility, and this can be the beginning of various other diseases such as obesity, metabolic syndrome and Inactive disease in different age groups, especially the middle-aged (Siavoshy, 2015) and cause many disorders in the functioning of various body systems (Ji et al., 2020).

Some studies show a decrease in total cholesterol, LDL-C and HDL-C in patients with acute respiratory infections, especially in patients with COVID-19. Also, in patients with different types of infections, there are similar changes in plasma fat levels. In particular, levels of total cholesterol, LDL-C, and HDL-C decrease, while plasma triglyceride levels may increase (Feingold, 2020). Changes in fat levels are associated with the severity of the underlying infection, meaning that the more severe the infection, the more severe the changes in lipid and lipoprotein levels (Marin-Palma et al., 2019). It should also be noted that during the recovery of infectious diseases, lipid and lipoprotein problems in plasma return to pre-infection levels (Trinder et al., 2019).

Despite the fact that pneumonia is one of the main symptoms of COVID-19, liver disorders have also been observed in patients (Zhang et al.,2020). One study reported that patients with COVID-19 had elevated liver enzymes (alanine aminotransferase (ALT) and aspartate aminotransferase (AST) at the time of admission, respectively (Chen et al., 2020). Another study reported that liver damage in patients COVID-19 is common (Guan et al., 2020).

Research has shown that light to moderate physical activity can be one of the ways to deal with acute respiratory infections for COVID-19 and increase the level of immunity (Garber et al., 2011).

This drink strengthens the central nervous system and due to its chlorogenic acid, can increase fat metabolism with its antioxidant and anti-inflammatory properties and is effective in improving body composition (Hashida et al., 2017). In addition, due to the policies adopted during the COVID-19, middle-aged and elderly people, especially those with chronic diseases, should avoid going to the gym and exercise club and exercise at home or in private spaces. Therefore, new training methods such as distance sports and the use of teas such as coffee can be used. Therefore, the present study aimed to investigate the effect of eight weeks of combined training with the ultimate distance preparation approach independently and with coffee consumption on blood lipid profile (cholesterol, HDL cholesterol and LDL and triglycerides) of inactive middle-aged men with in COVID-19 conditions.

MATERIALS AND METHODS

This study was a semi-experimental methodology based on a four-group design with pre- and post-test. Statistical population includes all middle-aged men (30-60 years) with inactive living or working in Borkhar city of Isfahan.

$$n = \frac{2\sigma^2\left(Z_{1-\frac{\alpha}{2}}+Z_{1-\beta}\right)^2}{d^2} \quad (1)$$

The FELIS formula was used to determine the sample size Based on the results of Taniguchi et al. (Chen et al., 2020), σ = 78.1 (standard deviation), d = 2.43 (confidence level), with test power of 0.8 and α = .05, sample size for each group is 76 / 10 sample were obtained and considering the probability of falling 11 men were considered for each group (n = 44). As a result, 44 were purposefully selected and homogenized to study participants (age, weight, body mass index) by simple random sampling in three experimental groups combined home-based exercise (n = 11), coffee consumption (n = 11), home based exercise + coffee consumption (n = 11) and control group (n = 11) were divided.

Inclusion criteria, no cardiovascular disease, no physical disability to perform activities, sufficient time to attend training, having one of the degrees of fatty liver 2, 1 and 3 or high serum levels of AST and ALT enzymes and having medical certificate of Exercise activity.

At first, in a session, the subjects were introduced to the type of plan, objectives and method of its implementation and were assured that their information would remain confidential and only the general results of all participants would be used. Then, written consent was obtained from them to participate in the research. In the next step, the subjects were replaced in three experimental groups and one control group. The pre-test included: measuring height (cm) and weight (kg) using a standard scale with a digital height meter, BMI (kg/m^2) and blood tests were performed.

Blood sampling was performed in two stages, 24 hours before the start of the first training session and 24 hours after the end of the research project. Blood samples were taken for all subjects (12 hours of fasting) in Vali-e-Asr laboratory in Dolatabad, Isfahan, under the same conditions. After 10 minutes, blood samples were separated from the serum with BT3000 auto analyser and were tested using PARS AZMOON Kit made in Iran**.**

After that, the subjects of the training group participated in a home-based exercise program for 8 weeks, 3 sessions per week and each session for 60 minutes in the evening in the virtual space. The home-based exercise protocol consisted of several interconnected training sections or sections that were performed at multiple times and repetitions in a row. Each part or part of the training consisted of a combination of movements (coordination, strength, balance, speed, flexibility and aerobic endurance) that was designed by the researcher based on the physical status and age of the subjects and on the basis of the principle of overload. At the beginning of each session, warm up for 10 to 15 minutes, including walking, jogging, and stretching.

Hence, the primary element of the home-based exercise, including three parts of balance, aerobic, strength with elasticity, muscular endurance, coordination and flexibility, was performed with an intensity of 60 to 70% of the maximum heart rate, and finally the cooling operation with stretching movements and light exercises. It was performed for 10 minutes. Coffee consumption group on a daily basis (in coordination with the training and coffee consumption group) in the morning between 9.30 and 11 am and in the afternoon between 3.30 and 5 am, a 180 cc cup of Indonesian, Chery and Java coffee of Robusta type. And medium roast with a degree of softness of / 5 was consumed as a brew. Consumption was two cups per serving and the weight of each cup of coffee was 4 to 5 grams. The amount of caffeine in the sample consumed was between 215 to 235 mg per cup of 180 cc, which was measured by the standard knowledge laboratory located in Khorasgan Azad University of Isfahan by ISIRI method. The control group did not participate in any sports activities during this period. Finally, post-test was performed on experimental and control groups in completely similar conditions to pre-test.

The statistical software program (SPSS version 24) was used for data analysis. Standard statistical methods were used for the calculation of means and standard deviation(SD). Analysis of covariance (ANCOVA) was run on each of the dependent variables. criterion for significance was set at an alpha level of $p < .05$.

RESULTS

Table 1 provides information related to the demographic characteristics of the four groups participating in the study.

Table 1. Demographic characteristics of four research groups.

Variable	Exercise and Coffee group	Exercise group	Coffee group	Control group
	M ± SD	M ± SD	M ± SD	M ± SD
Height (cm)	1/752±0/53	1/69±0/71	1/71±0/82	1/71±0/32
Weight (kg)	99/98±21/23	88/95±16/61	87/30±7/04	91/17±7/57
Age (year)	42/31±9/31	41/63±6/97	38/63±13/90	44/90±7/43
BMI (kg/m^2)	32/45±6/05	31/17±5/51	30/05±2/98	30/92±2/37

Table 2 shows the mean and standard deviation of the values related to the lipid profile of the study groups in the pre-test and post-test stages.

Table 2. Mean and Standard Deviation of Pre and Post-test of research variable.

Variable		Exercise and Coffee group (n = 11)	Exercise group (n = 11)	Coffee group (n = 11)	Control group (n = 11)
LDL (mg/dl)	Pre-test	42/63±121/48	46/42±98/94	23/65±105/31	34/82±119/61
	Post-test	29/03±101/81	36/13±86/24	29/83±98/12	23/95±135/69
HDL (mg/dl)	Pre-test	8/77±36/64	8/36±31/27	8/81±40/27	10/57±38/7
	Pre-test	8/58±41/12	7/76±36/9	5/83±43/01	8/81±35/81
TG (mg/dl)	Pre-test	81/17±150/81	56/31±121/01	104/77±191/72	65/21±139/63
	Pre-test	44/68±116/01	45/94±103/63	67/57±141/91	74/23±159/09
TC (mg/dl)	Pre-test	46/81±185/91	53/68±149/09	43/42±183/54	48/21±184/18
	Pre-test	43/01±172/18	51/15±155/72	37/29±176/09	29/35±201/82

As the results of Table 2 show, the mean weight, body mass index and also the values of LDL cholesterol, TG triglyceride, total TC cholesterol, in all three groups of post-test training, significantly decreased compared to the control group (P = 5%) and HDL cholesterol levels increased significantly (P = 5%).

Table 3. Results of MANCOVA Analysis on the mean scores of blood lipid profile.

Test	Value	F	Hypothesis df	Error df	(*p*)	Eta	Power statistical
Wilks Lambda	0/300	4/209	12/000	87/601	**0/001	0/331	0/996

Note. p < .05.

The results of Table 3 show that the performed interventions decrease the minimum mean of components (LDL cholesterol, triglyceride, total cholesterol) in the experimental group compared to the control group (p = .001, F = 4.209) and between There are differences in the means of the four study groups in the post-test. The effect or difference was equal to 0.331 percent. That is, 0.331% of individual differences in serum levels of liver enzymes are related to the effect of combined exercise.

The results of Table 4 show that after removing the effect of synchronous variables on the dependent variable and according to the calculated F coefficient, between the adjusted means of LDL cholesterol of the subjects with (510% effect and 99% statistical power), HDL cholesterol with (Effectiveness of 233% and statistical power of 737%), triglyceride level with (effect of 226% and statistical power of 719%) and total cholesterol with (effect of 244% and statistical power of 767%), a substantial difference was seen in the post-test (p < .05).

Table 4. ANCOVA results of the post-test corrected from the pre-test for the experimental and control groups.

Variable		Sum of Square	df	Mean of Square	F	Sig	Effect Size	Statistical power
LDL (mg/dl)	Effect of experiment	8158/543	3	2719/514	12/160	**0/001	0/510	0/99
	Error	7827/851	35	223/653	-	-	-	-
HDL (mg/dl)	Effect of experiment	310/868	3	103/623	3/542	*0/024	0/233	0/737
	Error	1023/970	35	29/256	-	-	-	-
TG (mg/dl)	Effect of experiment	15679/023	3	5226/341	3/413	*0/028	0/226	0/719
	Effect of experiment	53600/665	35	1531/448	-	-	-	-
TC (mg/dl)	Group	5969/507	3	1989/836	3/773	*0/019	0/244	0/767
	Error	18460/637	35	527/447	-	-	-	-

Note. p < .05.

The outcomes of LST post hoc test demonstrated a drastic decrease in blood lipid components between the combined training group and the control group, coffee group - combined training group with coffee and the control group (p = .001) (Table 5). In general, the results demonstrated that there was a substantial difference between the three intervention groups and the control group in reducing blood lipid biomarkers (p = .001) and among the interventions, the combined exercise method with coffee consumption was more effective in reducing LDL cholesterol.

Table 5. The Results of Post Hoc Tests LSD for compare groups.

Variable	Group(1)	Group(2)	Mean difference	Standard. error	Sig.
LDL (mg/dl)	Exercise	Coffee	-5/546	7/175	0/445
		Exercise and coffee	0/865	6/869	0/900
		Control	-33/612	6/692	**0/001
	Coffee	Exercise and coffee	6/411	6/871	0/357
		Control	-28/067	6/732	**0/001
	Exercise and coffee	Control	-34/478	6/489	**0/001
HDL (mg/dl)	Exercise	Coffee	0/843	2/595	0/747
		Exercise and coffee	-0/543	2/484	0/828
		Control	6/329	2/518	*0/017
	Coffee	Exercise and coffee	-1/386	2/485	0/581
		Control	5/486	2/435	*0/031
	Exercise and coffee	Control	6/872	2/347	**0/006
TG (mg/dl)	Exercise	Coffee	5/805	18/776	0/759
		Exercise and coffee	9/891	17/975	0/586
		Control	-38/630	18/218	*0/041
	Coffee	Exercise and coffee	4/085	17/979	0/822
		Control	-44/436	17/616	*0/016
	Exercise and coffee	Control	-48/521	16/979	**0/007
TC (mg/dl)	Exercise	Coffee	2/293	11/019	0/836
		Exercise and coffee	7/736	10/549	0/468
		Control	-23/343	10/692	*0/036
	Coffee	Exercise and coffee	5/442	10/551	0/609
		Control	-25/637	10/338	*0/018
	Exercise and coffee	Control	-31/079	9/965	**0/004

Note. p < .05.

DISCUSSION

The aim of this study was to evaluate the effectiveness of home-based exercise and coffee consumption on lipid profile (cholesterol-total TC, HDL high-density lipoprotein cholesterol, LDL low-density lipoprotein cholesterol and TG triglyceride) in middle-aged non-hepatic men. The results showed that the intervention of home-based exercise with coffee consumption had a significant effect on improving the blood lipid profile of the experimental groups compared to the control group. Examination of lipid profile components also showed that exercise has a significant effect on lowering low-density LDL cholesterol, TC triglyceride and total TG cholesterol compared to the control group.

It also had a significant effect on increasing HDL high cholesterol in the three study groups. This effect was greater in the exercise group with coffee consumption than in the combined exercise group and coffee group. Coffee consumption and exercise alone were able to have the greatest effect on LDL cholesterol. The results of the present study on the change of blood biomarkers in response to sports activities are in line with some of the findings of researchers that can be found in the research of Khandaghahi et al. (2019), Nejad Salim et al. (2017); Jafari et al. (2015); Hosseini Kakhki et al. (2015); Wang (2017); And Benn (2007) pointed out Tondpa Khaneghahi et al. (2017) showed that a period of intense intermittent aerobic exercise (HIIT) and continuous lipid profile and health status of patients with inactive were effective. In the HIIT exercise group, the increase in HDL and the decrease in LDL were higher than in the continuous exercise group (Hayat et al., 2021). Also, the results of the present study are consistent with the results of IQUAL et al. (2020) which showed that during the COVID-19 pandemic, it is better to maintain and continue your diet and physical activity and there is no reason to stop. There is no such thing and they should use their medical measures to improve their condition as well as before (Iqbal et al., 2020), but in carrying out such programs it is better to take in case of infectious diseases such as COVID-19, the considerations of the National Headquarters. He also considered COVID-19 in sports exercises, and performed sports exercises with new methods, such as doing physical activities with new approaches, for example, distance sports using new technologies and in bed. Cyberspace, like the tools used in the present study. Babaei Khorozoghi (2020), in his study that examined the role of physical activity in maintaining and improving the immune system in COVID-19 conditions, showed that light to moderate exercise in COVID-19 conditions can increase the body's immunity and To maintain and improve the body's immunity (Babaei Khorzoghi, 2020), Khaneghahi et al. (2017) showed that a period of intense intermittent aerobic exercise (HIIT) and continuous lipid profile and health status of overweight inactive patients Has been effective. In the HIIT exercise group, the increase in HDL, and the decrease in LDL, total cholesterol was higher than in the continuous exercise group (Tondpa Khaghani et al., 2019).

Nejad Salim et al. (2015) reported that resistance training significantly increases HDL and also significantly reduces LDL, triglyceride and total cholesterol in the training group compared to the control group (Nejadsalim et al., 2018). Jafari et al. (2016) showed that intermittent interval training significantly reduces leptin and low-density LDL lipoprotein and significantly increases HDL high-density lipoprotein (Jafari et al., 2016). Benn (2006) showed that aerobic exercise increases the oxidation of fatty acids (Wagenmakers et al., 2006). Wang (2017) showed that exercise increases lipolysis and decreases fatty acids in muscles (Wang & Xu, 2017). Hosseini Kakhk et al. (2015) stated that eight weeks of combined aerobic and resistance training improves the lipid profile of patients with inactive (Hosseini Kakhk et al., 2017).

On the other hand, the results of some studies are inconsistent with the findings of this study, such as the study of Khajeh Salehi Sahlabadi et al. (2019), which showed that combined exercise does not significantly reduce the lipid profile of overweight boys (Salehisahlabadi et al., 2018). Perkins et al. (2009) also stated that moderate-intensity exercise program has no significant effect on men's lipid profile (Perkins et al.,2009). The causes of this discrepancy may be related to the age difference of the subjects, the type of exercises, the frequency and intensity of the exercises.

Combined home-based exercise is a combination of new and up-to-date training methods and includes movements (balance, speed, coordination, strength, aerobic endurance and flexibility) that increase the consumption of free fatty acids and daily energy consumption. Develops physical and motor fitness factors and increases metabolism. It also increases muscle tissue and reduces body fat, resulting in reduced release of free fatty acids into the liver, reduced fat deposition in the liver, and increased fat oxidation in the liver. In addition, the combination of different exercises in this system allows a person to challenge and promote several physical factors in a simultaneous training cycle. Also, in relation to the results of a combination of exercise and coffee interventions, it can be said that the effectiveness of this type of intervention was greater in improving the lipid profile of middle-aged men with fatty liver. Coffee as an energetic and useful plant food has protective effects for the liver. The chlorogenic acid in coffee helps reduce the absorption of fat in the intestine, and the rate of glucose absorption in the small intestine and increases fat metabolism in the liver. Caffeine can increase resting energy expenditure.

Findings of Colitis (2007) showed that coffee consumption reduces fat absorption, energy consumption, lipogenesis, breakdown of fat cells and their proliferation to increase energy consumption (Perkins et al., 2009). In this regard, Hayat et al. (2021) investigated the effect of coffee consumption on inactive disease and liver fibrosis in a meta-analysis and concluded that regular coffee consumption is significantly associated with a reduced risk of inactive disease. Which is in line with the results of the present study (Hayat et al., 2021).

CONCLUSION

In general, the results show that the intervention of home-based exercise and coffee consumption is effective in improving the lipid profile. Also, eight weeks of home-based exercise produced a positive effect on the blood lipid profile. Therefore, it was suggested to perform exercise and at home according to the program presented in this study along with coffee consumption per day to prevent, maintain and improve blood lipid biomarkers in middle-aged people with inactive.

AUTHORS CONTRIBUTIONS

All authors have contributed equally to this work. Nahid Talebi, Ali Reza Taheri, and Asieh Goodarzi conceived and designed the study, collected the data and carried out the study. Conceptualization, methodology and final draft preparation by Nahid Talebi; data analysis, editing, by Ali Reza Taheri and Asieh Goodarzi.

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DISCLOSURE STATEMENT

This study has obtained its ethical approval from the Research Ethics Committee of Shahed University, Tehran, Iran (Code: IR.SHAHED.REC.1399.116).

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