Progress in Nutrition 2020; Vol. 22, Supplement 1: 182-188 DOI: 10.23751/pn.v22i1-S.9821

Original article

Comparison of Creatine Kinase Myocardial Band (CK-MB) and high sensitive Troponin I (hsTnI) values between athletes and sedentary people

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Summary. *Study Objectives:* This study was conducted to examine and compare CK-MB and hsTnI values between people who exercise regularly and actively and those who do not, considering that men have a higher muscle mass than women, but also the higher amount of estrogen secreted in women. *Methods:* The test group was composed of 18 men, 17 women, a total of 35 (23.28±4.09 years) persons who engaged in active sports with no problems in terms of blood measurement. The control group was formed from a total of 34 (24.50±5.60 years) persons, including 17 men and 17 women with a sedentary lifestyle that do not engage any sport. Statistical analyses were evaluated in the SPSS program and the Independent Samples t Test was used to determine the difference between the groups. *Results:* The CK-MB values of active athletes were found to be less than 5 U/L (1.95±1.04), which is the mean value, and higher values than the control group. hsTnI values have a significant difference between the test group and the control group and this difference was found to below the middle level. The mean CK-MB and hsTnI values of men participants were found to be statistically significant, with more than the mean value of women participants. The men test group CK-MB values were found to be higher than the control group and there was a significant difference ($p<0.05$). There was no statistically significant difference in hsTnI values between men's test and control groups. *Conclusion:* As a result of CK-MB and hsTnI measurements of the women test and control groups, it was observed that there was no significant difference between them. Herewith, it has been revealed that there are differences in CK-MB and hsTnI values among those who do active sports compared to those who do not, but also among women and men.

Keywords: CK-MB, hsTnI, Sports, Women, Men

Introduction

Troponins are tropomyosin-bound protein complexes found in all skeletal and cardiac muscle cells. Tropomyosin covers the actin-myosin binding sites on the actin filaments and prevents muscle contraction. During the flow of calcium into the muscle cell, calcium binds to the troponin complex. The actin-myosin binding of these binding sites initiates a conformational change, which ultimately leads to muscle contraction exposure. Troponin has three different subunits (troponin T, troponin I, and troponin C) and two of them exist in cardiac-specific forms; cardiac troponin T and cardiac troponin I. Detection of acute increased cardiac troponin concentrations in circulation is a sign of acute myocardial damage. However, it does not provide etiological information about the underlying condition or emission causing disease. According to this, although cardiac troponins are most commonly used to detect acute ischemic injury, various other primary cardiac (e.g. myocarditis, cardiac arrhythmias) and non-cardiac (e.g. sepsis, burns, exercise) conditions may be associated with acutely increased circulation concentrations (1).

Cardiac enzymes are enzymes present in myocardial cells. When the myocardial is damaged for whatever reason, these enzymes are released in the blood, and the level of enzyme increases (2). Creatine kinase myocardial band (CK-MB) is one of three isoforms of creatine kinase (CK) enzyme. CK is not specific for acute myocardial infarction (AMI) for the reason of, it is present in cerebral, myocardial, and skeletal tissues. In some cases, with mild myocardial infarction, CK elevation may not be detected, indicating a lack of satisfactory sensitivity. Therefore, the CK test was gradually abandoned and replaced by CK-MB. Because it's more specific in the heart muscle. CK-MB has been considered the gold marker of acute myocardial infarction for the past two decades. The plasma concentration of CK-MB increases 4-6 hours after the acute myocardial infarction and reaches its highest level within 24 hours. Generally, the CK-MB level returns to a normal range of 48-72 hours after the onset of acute myocardial infarction. As a biomarker, CK-MB is effective, rapid, and economical for the diagnosis of acute myocardial infarction. Therefore, it is widely applied globally in clinical applications. Some studies (3-6) have also proven that CK-MB can be used to estimate infarction size or even left ventricular ejection fraction (6,7). In addition, CK-MB can also be used as a marker for ischemia-reperfusion injury (IRI). Numerous clinical studies have accepted CK-MB as an adjunct examination to assess reperfusion injury after the restoration of the coronary circulation (6-9). In addition, CK-MB is thought to have prognostic significance for post-ischemic mortality and long-term death (6,10,11). However, Domanski et al. showed that troponin T is a better prognostic factor than CK-MB for long-term post-operative mortality after coronary artery bypass grafting (CABG) (6, 12). However, CK-MB has some disadvantages when used as a marker for acute myocardial infarction (AMI). Although the specificity of CK-MB is much better than CK, it is still not suitable. Because skeletal disorders can also cause CK-MB elevation. Because skeletal disorders can also cause CK-MB elevation. In addition, the sensitivity of CK-MB loses its reliability within 6 hours after acute myocardial infarction (AMI), which is not suitable as an early predictor. Some studies have also shown that CK-MB is a less suitable biomarker than cTnI for the diagnosis of small myocardial injury (6, 13, 14). Nevertheless, CK-MB is the most popular acute myocardial infarction (AMI) biomarker, although new biomarkers are continuously reported (6).

Despite the numerous benefits of sports on health, one of our daily needs for life is; more efforts are required to become one of the mandatory tasks such as nutrition and sleep much researches have been done on increasing interest and participation in sports for a healthy life, especially in order to be protected from cardiovascular diseases and to protect the body completely against many diseases. The cardiovascular system is one of the systems that benefit most from aerobic exercises such as running, swimming, cycling. Regular exercise, which is one of the important factors in preventing or slowing the atherosclerotic process that can develop in all arteries in the body, has an important place in preventing diseases such as heart attack and stroke with this feature. During sports, the heart muscle contracts stronger and faster in order to meet the increased oxygen demand in the muscles. Thus, sports can help strengthen the heart muscle in the long term (15). Despite the strong effects of physical activity and exercise on cardiovascular health, frequent physical activity is known to promote cardiorespiratory crispness. However, the processes and mechanisms that reduce the risk of cardiovascular disease remain unclear. Over the past few years, research has been carried out aimed at detecting the significant physiological and biochemical effects of exercise on the benefits of the cardiovascular system. As a result, significant progress has been made from observational and interventional studies in which the participants were people (16). Hematological and biochemical levels can play an important role in adapting exercise in humans, adaptation of cardiovascular activity, and organizing physiological responses such as physical, physiological balance. Depending on the type, severity, and duration of exercise, there may be changes in hematological and biochemical parameters. Variations in biochemical values during and after intense exercise may vary due to differences such as a person's training status, gender, age, environmental conditions, and nutrition (17). However, this study has been planned since the specific sudden deaths in athletes, the scope and duration of the exercise, and the risk of cardiovascular disease remain uncertain. Thus, it was considered to examine and compare CK-MB, known as the gold standard in the biochemical diagnosis of myocardial damage (18), and high sensitivity troponin I (hsTnl), the most specific marker of increased myocyte damage as a result of myocardial ischemia (19), values between those who do regular and active sports and those who do not.

Method

Participants

The test group was composed of 18 men, 17 women, a total of 35 (23.28±4.09 years) persons who engaged in active sports with no problems in terms of blood measurement. The control group was formed from a total of 34 (24.50±5.60 years) persons, including 17 men and 17 women with a sedentary lifestyle that do not engage any sport. Participants who do not have any acute or chronic health problems and who do not consume alcohol and similar substances are included in the research. Subjects participating in the study were warned not to use drugs that could affect their performance such as steroids, anti-inflammatory drugs, and vitamin supplements during the 2 weeks before the test.

Biochemical Analysis

They were asked to avoid caffeine or heavy-handwork exercise for 24 hours before the test. Blood samples taken from both study groups were analyzed in the biochemistry laboratory and CK-MB and hsTnI values were examined. Peripheral venous blood (approximately 5 ml) was collected, stood for 15 min, and centrifuged for 5 min at 5000 rpm. The serum was separated, and then CK-MB, and hsTnI levels were detected using an immunoassay analyzer (Beckman Access II, United States) (20).

Data Statistic

Statistical analysis was evaluated in the SPSS 22.0 program. Descriptive statistics including arithmetic mean, standard deviations, frequency, and percentage values. Independent Samples t Test was used to determine the difference between the groups. According to the central limit theorem, t-test results can give healthy results even when normal distribution acceptance is not achieved. Since the sample size in each group is over 30, normal distribution acceptance was tested based on the central limit theorem.

Results

As can be seen from Table 1, 50.7% of the participants in the study consisted of the test group and 49.3% of them were the control group. When the sports branches were analyzed, it was seen that parallel to the non-sports control group consists of 34 people, do not have any branch 20 (basketball, football, volleyball, handball) and 15 people playing individual sports (sports, swimming, tennis, fighting).

According to the results shown in Table 2, the mean CK-MB values of the test group participants are 0.50 more than the mean CK-MB values of the control group participants ($p<0.05$). The calculated 95% confidence interval for this difference was found to be

Table 1. Demographic information of the participants

	Women		Men		Total	
	n	%	n	%	n	%
Group						
Test	18	51.4	17	48.6	35	50.7
Control	17	50.0	17	50.0	34	49.3
Sports Branch						
None-	17	50.0	17	50.0	34	49.3
Team Sports	11	55.0	9	45.0	20	29.0
Individual Sports	7	46.7	8	53.3	15	21.7

Table 2. CK-MB and hsTnI values of test and control groups

	Test (n=35)		Control (n=34)			
Group		**Sd**		**Sd**	**t**	**p**
CK-MB	1.95	1.04	1.45	0.49	2.535	0.014
hsTnI	1.95	1.61	1.33	0.78	2.062	0.045

Not: represents the group mean, sd standard deviation. According to the Levene test results, Welch's t test results for independent groups were reported, since variance equality was not accepted in both analyzes.

(0.102-0.889). Cohen's D = 0.608, which is the calculated effect size statistics regarding the mentioned difference, indicates that there is an effect above the middle. When the hsTnI values were examined, the mean difference between the test group and the control group is 0.62, and 95% confidence interval (0.015-1.238) for the difference. The effect size statistics regarding the difference is Cohen's D = 0.494 and it indicates that there is an effect below the middle level.

The CK-MB value of the men test group was investigated 2.69 ± 0.88 and the control group was investigated 1.76 ±0.46. The CK-MB value of the women test group was investigated 1.25 ±0.60 and the control group was investigated 1.14 ±0.30. The hsTnI value of the men test group was investigated 2.86 ± 1.88 and the control group was investigated 1.68 ±0.91. The hsTnI value of the women test group was investigated 1.10 ±0.49 and the control group was investigated 0.97 ±0.41. There was a statistically significant difference between men and women in terms of CK-MB and hsTnI values ($p<0.001$).

Discussion

CK-MB is an enzyme with high sensitivity and specificity. While CK-MB activity is normally lower than 5 U / L, activities such as resistance exercise, long-term running, and marathon in healthy people doubt the accuracy of the practice of CK-MB in the diagnosis of acute myocardial infarction. CK-MB activity is similar in percentage among marathons and patients with acute myocardial infarction. In addition, there are differences in the removal of this enzyme. Enzyme removal is slower in athletes (20). In this study, it was revealed that the active athletes had a CK-MB value in the normal reference range of less than 5 U / L (1.95 ± 1.04) and higher than the control group (Table 2).

Many researchers have noted that exercise increases plasma CK and CK-MB activities, which are the most commonly used marker of skeletal muscle damage caused by exercise (22). A study to examine the effects of acute exercise on CK, CK-MB level in sedentary men individuals, thus determining the level of muscle damage caused by exercise, showed a greater increase in CK-MB levels during acute exercise and the result of exercise may cause more heart muscle damage (23). The type, duration, and intensity of muscle-related activity depend on the effect of exercises on CK and CK-MB. It is stated that the status of CK-MB and serum CK does not show a clear difference in athletes and varies according to the severity of the exercise and age (24). Kayhan stated that in the study of the effect of different strength training on creatine kinase enzyme activity and blood parameters, there was a difference between pre- and posttest in terms of CK-MB values (25). In another study, it was aimed to evaluate the cardiac effects of athletes exercise with biochemical parameters and there was a statistically significant increase in serum BNP, IMA, Copeptin, and CK-MB values after exercise in wrestling and football branch athletes compared to pre-exercise and control groups. Besides that, there was no statistically significant difference in cTnI values (26). With this study, we have done on athletes interested in different sports branches, the CK-MB values of the active sports test group were higher than those who did not and it supports the literature (Table 2). To evaluate the cause of CK-MB differences in terms of gender, it is also seen in Table 3 that CK-MB values in men (Control Group 1.76±0.46, Test Group 2.69 ±0.88) is higher than women. The main reason for this is the fact that men have larger heart muscle mass (27-30).

When CK-MB differences were examined as exercise and non-exercise, it was revealed that the CK-MB value of the test group (1.95 ±1.04) was higher

Table 3. Comparison of CK-MB and hsTnI values between test and control groups by gender

		Group				
		Test		Control		
	Gender	X	Sd	X	Sd	p
CK-MB	Men	2.69	0.88	1.76	0.46	0.000
	Women	1.25	0.60	1.14	0.30	
hsTnI	Men	2.86	1.88	1.68	0.91	0.000
	Women	1.10	0.49	0.97	0.41	

than the control group (1.45 ±0.49) (Table 2). The most important reason that there is an increase in cardiac output during exercise as well as the combination of different mechanisms (27, 30-32). To evaluate both of the different gender and exercise conditions, it was determined that exercise increases serum CK level in both men and women, but the serum CK level is lower in women than men. This is because the less secreted estrogen hormone transfers less enzyme from the muscle to the serum. After all, it reduces membrane permeability after exercise (23, 33).

In this study, it should be noted that hsTnI values cannot be compared with clear expressions such as CK-MB values. Because almost all of the studies, reported for hsTnI in the literature, were made for cardiovascular events, acute myocardial infarction (AMI), acute chest pain, etc. (34-39). In other words, the majority of the studies are about the subject of sick individuals. However, since the individuals in this study, both the control group and the test group, are people who do not have any acute or chronic health problems, they are considered to be healthy. Therefore, this study is considered to be very important in terms of both originality and scientific value. On the other hand, in the literature research, there are a few important studies that are related to exercise size. However, this study differs especially with gender discrimination (40-42).

To evaluate the reason of hsTnI differences in this study in terms of gender, it is seen in Table 3 that hsTnI value is higher in men (Control group: 1.68 ±0.91, Test group: 2.86 ±1.88) than women (Control group: 0.97 ±0.41, Test group: 1.10±0.49). To examine the reason for hsTnI differences as those who exercise and do not, it can be seen in Table 2 that the hsTnI value of the test group (1.95 ±1.61) is higher than the control group (1.33 ±0.78). To evaluate both different gender and exercise conditions, it has been determined that exercise increases the hsTnI level in both men and women, but the hsTnI level is lower in women than men.

The reasons for all these differences about CK-MB and hsTnI, if not clearly stated that women tend to have heart function that gradually disappears after entering menopause, gender differences in myocardial recovery after arrhythmogenic activity and infarction, the women sex hormone estrogen has a cardio-protective mechanism responsible for gender-specific differences in normal heart function and disease outcome (30), men myocytes were exposed to a higher degree of hypertrophy than women (28), the women heart is smaller than the men heart, but beats more per minute (27), maybe possible to rank like. However, although its clinical significance is not fully understood, high troponin I concentrations are common after exercise (41), physical activity may be more important in less active individuals in protecting against subclinical cardiac ischemia or myocardial stress and injury (43), these facts are also seen in other studies. Although the knowledge that exercise increases the hsTnI value and the hsTnI value is higher in men, many prospective studies are needed on the subject, as Parsons et al. (43).

Acknowledgement

The study was carried out with the approval of The Siirt University Non-Interventional Clinical Research Ethics Committee , which was given in date 26/12/2019 and numbered E.18045-2019/09.06.

Conflict of Interest

Deniz Çakaroğlu and Mustafa Oğuzhan Kaya declare that they have no conflict of interest.

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