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Research Article

The effect of whey supplementation on some indicators of muscle damage in elite soccer players

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Abstract

Background: Aerobic exercise causes muscle damage and inflammation. The aim of this study was to examine the effect of whey supplementation on some indicators of muscle damage in elite soccer players.

Materials and Methods: A semiexperimental study was conducted on 18 male football players from the national youth football team (16-18 years old) who took part in the training camp and were divided into two experimental and placebo groups. The experimental group consumed 25 grams of whey protein supplement with purity of over 90% daily for four weeks, and the control group received 25 grams of starch placebo (8). All subjects participated in the football competition camp's routine exercises. Correlated and independent t-tests were used to determine intra-group and inter-group differences. The collected data were analyzed at a significance level of $p \leq 0.05$.

Results: The results showed that concurrent training and buttermilk consumption has a significant effect on reducing waist circumference, systolic and diastolic blood pressure, low-density protein, triglycerides and a significant increase in high-density protein in overweight girls, $p \leq 0.05$.

Conclusion: Young athletes can use the whey supplement to speed up the recovery process to prevent muscle pain and damage after sports activities, especially eccentric activities.

Keywords:
whey, muscle damage, soccer players

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1. Introduction

Carrying out heavy sports activities without optimal food consumption and providing the basic elements needed by the body has adverse consequences for people's health. Heavy physical training results in an increase in muscle damage, catabolism, and as a result, an increase in the daily need for protein, which can cause oxidative stress (1). Football players, especially elite football players, are exposed to heavy physical and mental pressure. Elite teenage soccer players' bodies are in the final stages of physical development, so they require more nutritional care and attention than adults (2). Nutrition after exercise is important to restore carbohydrate reserves, compensate for lost electrolytes, and repair damaged tissue caused by sports activity. Sports associated with intense muscle contractions, with increased muscle damage, membrane dysfunction, fluid leakage outside the cell, and increased production and release of enzymes indicative of muscle damage, such as creatine phosphokinase (CPK), lactate dehydrogenase (LDH), and finally, they are accompanied by delayed bruising (3). Various strategies have been investigated to reduce the rate of muscle destruction and contusion, the most effective being stretching, massage, cold therapy, anti-inflammatory drugs, and nutritional supplements (4). Different studies have shown that the use of a whey protein supplement is a suitable option for providing nutrients to maximize catabolism compensation in those who have intense physical activity (5). Whey protein is part of milk protein. This protein contains large amounts of branched chain amino acids (essential amino acids). Hydrolysis of whey protein can increase plasma amino acids concentration after a meal and stimulate muscle protein synthesis faster and more intensively.

Whey protein can be considered a strategy to accelerate recovery (6). Spaulder et al. (2023) studied the effects of vegetable protein supplementation compared to whey protein on exercise-induced muscle damage in active elderly people. The results showed that the consumption group had a significant reduction in muscle damage caused by exercise (7). Athletics after intense activities are concerned about pain and possibly factors that weaken performance, especially the increased risk of injury in athletes due to the decrease in strength related to delayed muscle contusion. Based on this, people are looking for solutions to these problems. Considering Whey protein's complementary role in maintaining muscle mass and the outstanding role of the national youth team in the future of the country's football sport and the little information that exists about the muscle injuries of the athletes of the national youth team therefore, this research is followed by investigation of the effect of whey supplementation on some indicators of muscle damage in elite soccer players.

2. Materials and Methods

In this semi-experimental research, 18 players (according to calculation with G-Power program) were selected from among the male football players of the national youth football team (16-18 years old) who participated in the training camp of the competition and were divided into two experimental and placebo groups by a simple random method. The subjects filled in the written consent form and it was approved by their general practitioner. The age requirements for participating in the research were 16-18 years. In addition, they had at least six months' experience as a national team member in this discipline.

In addition, the absence of any type of disease, and the absence of supplements, drugs, tobacco and alcohol. Before starting the research and at the end of the research protocol, height, weight and BMI parameters were evaluated. The experimental group consumed 25 grams of a whey protein supplement with purity of over 90% daily for four weeks. The control group received 25 grams of a starch placebo (8). Since the athletes were in the camp, they were not allowed to consume any food other than the food prepared by the camp officials. As part of the research protocol, all subjects performed the routine exercises of a football competition camp. To measure creatine phosphokinase and lactate dehydrogenase, a blood sample of 5 cc was taken from the brachial vein. This was done 24 hours before and 48 hours after the research protocol. This was done utilizing a colorimetric method and a commercial diagnostic kit (Pars Azmoun Company, Iran) was evaluated. The measurement unit for CK and LDH was the international unit per liter (IU/L). Kolmogorov Smirnov test was used to determine variance homogeneity and Shapiro-Wilk statistical test was applied to assess the normality of data distribution. Correlated and independent t-tests were used to determine intra-group and inter-group differences. The collected data were analyzed at a significance level of $p \leq 0.05$.

3. Results

The characteristics of the subjects are presented in Table 1.

Table 1: Statistical description of subjects' characteristics according to centrality and dispersion indices

Index / group*		height (cm)	age (years)	weight (kg)	Body mass index (kg.m^2)
placebo	pre-test post-test	175±1.82	45.6±17.1	74 ± 2.64 69±1.69	21.25 ± 0.14 21.14±0.18
whey	pre-test post-test	174±1.35	45.18±16.8	65.1 ± 7.17 68.16±1.65	21.4 ± 0.75 21.9±0.7

Table2: Research variables in two groups

Index / group*		**LDH** IU.L	**CK** IU.L
placebo	pre-test post-test	331.4±9.44 347±51.٣	112.2±19.3 228.89±8.16
whey	pre-test post-test	336.7±41.٥ 340.4±35.٧	108.3±18.1 174.±٢٢5.36

The results of the correlated t test showed that the level of creatine kinase enzyme in the blood of the two groups increased significantly compared to the pre-test, p≤0.05. The results of the independent t-test showed a significant difference between the two groups, so that in the supplement group, this increase was less, p≤0.05. The results of the correlated t test showed that the level of lactate dehydrogenase enzyme in the blood of the two groups increased compared to the pre-test, and this increase was significant in the placebo group, p≤0.05. The results of the independent t test showed a significant difference in the comparison between the two groups, so that in the supplement group, the value of this increase was less p≤0.05 .whey protein supplement moderates the increase of these enzymes.

4. Discussion

The results showed that creatine kinase and lactate dehydrogenase enzymes increased in both groups of the present study. However, the consumption of whey protein along with physical activity moderated the increase of these enzymes. The above results are consistent with Spoelder et al (2023), Rouhani et al (2016) and Huang et al (2017) (7,9,10).

The increase in free radical production after intense activities can cause increased oxidative damage to muscles and muscle pain (8). Protein supplements are a suitable option for providing nutrients to maximize catabolism compensation in physically active people. Taking a whey supplement at the same time and performing resistance exercises increases protein synthesis, decreases protein breakdown, and creates a positive protein balance after exercise; these things can lead to muscle growth. Consuming whey protein results in an increase in amino acid intake by the skeletal muscle. This causes an increase in protein synthesis and a decrease in protein breakdown in skeletal muscle.

This feature accelerates recovery and reduces muscle damage after extroverted activities (11). Myofibril reconstruction is an important part of preventing aging and muscle diseases. In addition to this, muscle damage caused by extroverted activities disrupts satellite cells and damages the muscle cell membrane. During muscle damage, satellite cells are necessary for the reconstruction of myofibrils. In the absence of satellite cells, myofibril reconstruction does not take place properly (12). Therefore, satellite cells can prevent muscle damage during outdoor activities. Consuming whey protein along with exercise increases satellite cells (11, 12). Many researchers have emphasized the effect of long-term supplement use on reducing muscle injuries. In the study of Lala et al (2014), a twelve-week intervention with hydrolyzed protein caused a decrease in creatine kinase and lactate dehydrogenase indices (13). In the study of Samadi et al (1400), whey protein supplement consumption caused a decrease in inflammation and muscle damage in athletes along with a decrease in LDH and CK levels (8). It should be noted that none of the above researches stated that consumption of whey protein led to a decrease in muscle damage index enzymes in athletes. Instead, they showed that the amount of these enzymes after sports training in the group Experimental interventions were significantly less than the control group. Because heavy sports training leads to an increase in the level of the above enzymes, and protein supplements can reduce its intensity (3). However, Moore and Ipkoglu (2018) showed that lactate dehydrogenase and creatine kinase did not change after taking a whey supplement, which contradicts the present research results (14). It is possible that this discrepancy is the result of different subjects, different training protocols and the number of supplements consumed.

Conclusion

The consumption of whey protein along with exercise causes an increased impact on protein synthesis, improving strength, and also increasing satellite cells. This causes an adjustment in delayed muscle damage indices such as LDH and CK. It is therefore recommended that young athletes use the supplement in order to speed up the recovery process after sports activities, especially eccentric ones.

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Compliance with ethical standards

Conflict of interest None declared.

Ethical approval the research was conducted with regard to the ethical principles.

Informed consent Informed consent was obtained from all participants.

Author contributions

Conceptualization: F.B, M.H, M.H, M.SH.G, F.GH ; Methodology: F.B, M.H, M.H, M.SH.G, F.GH; Software: F.B, M.H, M.H, M.SH.G, F.GH; Validation: F.B, M.H, M.H, M.SH.G, F.GH; Formal analysis: F.B, M.H, M.H, M.SH.G, F.GH ;Investigation: F.B, M.H, M.H, M.SH.G, F.GH; Resources: F.B, M.H, M.H, M.SH.G, F.GH;Data curation: F.B, M.H, M.H, M.SH.G, F.GH; Writing - original draft: F.B, M.H, M.H, M.SH.G, F.GH; Writing - review & editing: F.B, M.H, M.H, M.SH.G, F.GH; Visualization: F.B, M.H, M.H, M.SH.G, F.GH; Supervision: F.B, M.H, M.H, M.SH.G, F.GH ;Project administration: F.B, M.H, M.H, M.SH.G, F.GH; Funding acquisition: F.B, M.H, M.H, M.SH.G, F.GH.

References

1. Ghoochani, S., Riyahi Malayeri, S., Daneshjo, A. Short-term effect of Citrulline Malate supplement on LDH and Lactate levels and Resistance Exercise Performance. *Journal of Military Medicine*, 2022; 22(4): 154-162.

2. Shirvani, H., Riyahi malayeri, S., Akbarpour Bani, M., Kazemzadeh, Y. The Effects of Taurine Supplementation with High Intensity Intermittent Exercise on Serum IL-6 and TNF-α in Well-Trained Soccer Players. Journal of Sport Biosciences, 2013; 5(2): 59-79. doi: 10.22059/jsb.2013.35040.

3. Goodarzi, A., Bambaei chi, E., Rahnama, N. The Effect of a Futsal Match on Some Biochemical Markers of Muscle Damage (Cr & AST). *Journal of Sport Biosciences*, 2015; 7(1): 1-10. doi: 10.22059/jsb.2015.54272

4. Riyahi Malayeri, S., Mirakhorli, M. The Effect of 8 Weeks of Moderate Intensity Interval Training on Omentin Levels and Insulin Resistance Index in Obese Adolescent Girls. Sport Physiology & Management Investigations, 2018; 10(2): 59-68.

5. Vasconcelos QDJS, Bachur TPR, Aragão GF. Whey protein supplementation and its potentially adverse effects on health: a systematic review. Appl Physiol Nutr Metab. 2021 Jan;46(1):27-33. doi: 10.1139/apnm-2020-0370. Epub 2020 Jul 23. PMID: 32702243.

6. Mor, A., and Ipekoglu, G. The Effect of Whey Protein Supplementation on Exercise-Induced Muscle Damage, International Journal of Medical Research & Health Sciences, 2018, 7(7): 132-137.

7. Spoelder M, Koopmans L, Hartman YAW, Bongers CCWG, Schoofs MCA, Eijsvogels TMH, Hopman MTE. Supplementation with Whey Protein, but Not Pea Protein, Reduces Muscle Damage Following Long-Distance Walking in Older Adults. Nutrients. 2023 Jan 10;15(2):342. doi: 10.3390/nu15020342. PMID: 36678213; PMCID: PMC9867418.

8. Samadi, M., Soleimani, D., Moradi, M., Kamari, N., Rezaei, M., Hozoori, M. The Effect of Whey Protein Supplementation on Inflammatory Markers and Muscle Damage in Basketball Athletes: A Double-Blinded Clinical Trial. *Journal of Isfahan Medical School*, 2021; 39(640): 659-664. doi: 10.22122/jims.v39i640.14166.

9. Rohani H, Asjodi F, Safarimosavi S, Bahmanzadeh M. The Role of Resistance Training and Whey Protein Intake on Delayed Onset Muscle Soreness Indices after Eccentric Resistance Exercise in Untrained Men. Iranian J Nutr Sci Food Technol 2017; 12 (1) :11-20

10. Huang WC, Chang YC, Chen YM, Hsu YJ, Huang CC, Kan NW, Chen SS. Whey Protein Improves Marathon-Induced Injury and Exercise Performance in Elite Track Runners. Int J Med Sci. 2017 Jun 22;14(7):648-654. doi: 10.7150/ijms.19584. PMID: 28824296; PMCID: PMC5562115.

11. Ha E, Zemel MB. Functional properties of whey, whey components, and essential amino acids: mechanisms underlying health benefits for active people (review). J Nutr Biochem. 2003 May;14(5):251-8. doi: 10.1016/s0955-2863(03)00030-5. PMID: 12832028.

12. 12- Foegeding EA, Davis JP, Doucet D, et al. Advances in modifying and understanding whey protein functionality. *Trends in Food Science & Technology*. 2002; 13(5):151–159.

13. 13- Lollo PCB, Amaya-Farfan J, Faria IC, SalgadoJVV, Chacon-Mikahil MPT, Cruz AG, Oliveira CAF, Montagner, PC, Arruda M. Hydrolysed whey protein reduces muscle damage markers in Brazilian elite soccer players compared with whey protein and maltodextrin. A twelve-week in-championship intervention, International Dairy Journal. 2014; 34, 19-24.

14. Mor A, and Ipekoglu G. The Effect of Whey Protein Supplementation on Exercise-Induced Muscle Damage, International Journal of Medical Research & Health Sciences, 2018, 7(7): 132-137.