

Effect of static stretching followed by contrast water therapy recovery on lactate-dehydrogenase concentration after simulated high intensity exercise in youth soccer players

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Abstract

The study aimed to know the effect of static stretching followed by contrast water therapy on Lactate-dehydrogenase LDH after simulated high intensity exercise in youth soccer players, the study included 20 players of ESS team U19 category from first professional Algerian championship, the players were randomly divided on two groups 10 players per group (experimental and control), the experimental group execute static stretching SS followed by contrast water therapy CWT , whether the control group had no activity, the players simulated yoyo test L1 the blood sample was taken, before, after 1h and after 48h to know the concentration of (LDH) in the blood and the rate of recovery. The results of this study showed that static stretching followed by contrast water immersion recovery beneficial to improve the rate of recovery by decreasing LDH concentration and reducing muscle damage after simulated high intensity exercise in youth soccer players.

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Introduction

soccer is characterized by an irregular intensity during the match, the player travels a total distance of 10-13 km (Bangsbo, Mohr, and Krstrup 2006) and makes movements ranging between 825-1632 inside the field, and football is characterized by its intermittent character during physical exertion, the player walks and runs at different speeds and repeats fast running, jumping and changing direction and other movements (Chamari et al. 2008), while physiologically, the level of lactic acid reaches large levels during the match from 8 -16mm, and the average heart rate is 80-90% of the maximum heart rate (Longer 2016), and the maximum oxygen consumption vo_{2max} is between 70-80% (Saeidi and Khodamoradi 2017), all of these physical efforts affect the physical aspect of the player, causing him mental and muscular fatigue greatly, causing him damage to the muscle fibres and depletion of basic energy stores such as glycogen and glucose (Setaouti, Khiat & Kasmi, 2021), and the inability to compatibility between muscles and nerves, and therefore the players after the match or hard exercises needs to recover his physical and physiological abilities and disposal Fatigue (Mohr, Krstrup, and Bangsbo 2005).

Muscle stretching is one of the ways to calm down and recover in soccer, especially static stretching, which is used extensively after high-intensity physical efforts as a protocol for recovering elastic muscles and eliminate the muscle cramps and spasms, also decreasing markers of muscle damage like lactate dehydrogenase LDH (Gremion 2005, Torres, Appell, and Duarte 2007), and muscle extensions contribute to reducing the feeling of muscle pain and reduce the occurrence of chemical reactions resulting from the damage caused by muscle exercises, especially eccentric contractions (LaRoche and Connolly 2006), and the time of muscle extension has a significant role in getting rid of muscle stiffness after exercise, so the athletes needs a longer time in the extensions, this was confirmed by a study of (Nojiri et al. 2021) who confirmed that static muscle extension for a minute helps In reducing the stiffness of the iliac muscle, and five minutes of stretching give greater results.

Also, contrast water therapy CWT is a water immersion recover technique popularly used by athletes to speed up post-exercise recovery. It's done by changing between cold water immersion CWI and hot water immersion HWI on a regular basis (Vaile, Halson, and Graham 2010, Hing et al. 2008). Several studies that looked into CWT found no benefit in terms of performance. Cold water immersion CWI after an exhaustive simulated

team sports exercise provided greater recovery benefits than CWT or control treatments, Nonetheless, many studies have found that CWT beneficial for recovery. CWT has a number of effects on performance recovery,(Versey, Halson, and Dawson 2012) claim that cycling performance can be improved by doing CWT for up to 12 minutes. Since this evidence, there has been a surge in interest in studies that confirm the effect of CWT on recovery of performance, with different protocols. Many physiological responses to CWT have been studied extensively, The best protocols for assisting CWT of exercise performance are, however, unknown. The temperature of the water, the timing of the immersion, the duration of the immersion, the depth of the immersion, and the level of activity can all change. As a result, more research into this recovery method is required(Versey, Halson, and Dawson 2013).

lactate dehydrogenase LDH is an enzyme that the body needs in the process of metabolism, The level of LDH rises after various exercises, and this rise is an indicator of damage to the level of the muscles involved in the physical effort(Brancaccio, Maffulli, and Limongelli 2007,Mokuno et al. 1987), soccer players have high levels of lactate dehydrogenase as a result of daily training and with different training loads, and through the concentration of LDH enzyme, the recovery process of the players can be monitored (Nowakowska et al. 2019).

However, there are few studies that have combined recovery methods, and know their usefulness in accelerating the process of physical recovery, improving physical abilities and eliminating fatigue in athletes, especially in soccer. In our study, we tried to make a combination between recovery methods, and know the effect of static stretching SS followed by contrast water therapy CWT on lactate-dehydrogenase concentration marker of muscle damage after simulated high intensity exercise in youth soccer players.

Method and Materials

Participants

Thirty (20) young soccer players of E.S.Setif team under 19 years (U19) of the algerian first professional championship(mean +SD: age = 18,16 ± 0,55 years, height = 180,65 ± 5,82 cm, weight = 67,72 ± 6,70 kg, BMI = 20,58 ± 1,44 kg/m) the players were randomly divided into two groups of 10 players per group(experimental and control) the experimental group use static stretching followed by contrast water therapy, and the control group in inactive recovery this mean the subjects had no activity.

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Table 1. Demographic characteristic of the sample.

Variables	Mean ± SD
Age (years)	18,16 ± 0,55
Height (cm)	180,65 ± 5,82
Weight (kg)	67,72 ± 6,70
Body mass index (kg/m ²)	20,58 ± 1,44

SD- standard deviation

Table 1 showed characteristic of the sample, Mean ± SD; age(18,16 ± 0,55), height(180,65 ± 5,82), weight(67,72 ± 6,70), Body mass index(20,58 ± 1,44).

Table 2. Comparison between groups in pre-tests.

Variables	Groups	Pre-tests	P-value
LDH	EG	189.30 ± 9.50	0.089
	CG	190.5 ± 13.64	

EG - experimental group, CG - control group, P- probability

The table 2 shows that there are no statistically differences between the experimental group and control group in pre-tests. (p>0.05), this means that the sample is equivalent in the pre-tests.

Study variables

The study used two groups of teen participants each group, the sample tested pre-post test to determine the effect of the independent variable on the dependent variable, the independent variable was static stretching SS followed by contrast water therapy CWT, while the dependent variable was lactate-dehydrogenase LDH.

Study Protocol

In the week preceding the study, anthropometric tests was taken(height, weight, BMI).The 5-10 ml blood sample was taken from the right arm vein(Moradi and Monazzami 2020), of each participant, before, after 1h, after 24h. The yoyo intermittent recovery test L1 used us an exercise induced muscle damage, when the blood sample was taking, the participant simulated yoyo intermittent recovery test L1, 1h after the test the blood sample was taking again for the second time, than immediately the players performed the recovery protocol; static stretching SS followed by contrast water therapy CWT, in SS method the subjects performed the SS protocol consisting of two 15s stretches to the gastrocnemius,hamstrings quadriceps, glutes, hip flexors, adductors and abductors (Pooley et al. 2017), than immediately the players alternated between immersion in cold water (9.7 ± 1.4°C) to the level of the iliac crest for 1 minute and then a warm shower

($39.1 \pm 2.0^{\circ}\text{C}$) for 2 minutes, this procedure repeated another 4 times until a total of 5 exposures were completed and each intervention was employed for a total duration of 15 minutes, after 24h the same protocol of recovery was performed, the blood sample was taking again for the third time.

Statistical Analyses

The study used mean and standard deviation (SD) with all the value. Statistical analyses used SPSS program version 28, paired T-test used within group and independent T-test used between groups comparison.

Results

Table 3. Comparison of creatine kinase post-test 1h and post-test 24h.

Variables	Groups	Test	Mean \pm SD	P-value
LDH	EG	Post-test 1h	212.10 \pm 19.30	0.001
		Post- test 24	198.10 \pm 12.72	
	CG	Post-test 1h	213.60 \pm 17.80	0.363
		Post- test 24	208.8 \pm 13.64	

According to the results of LDH post-test 1h and post-test 24h, the table 2 shows statistically significant decrease in muscle damage in EG after the recovery protocol SS followed by CWT. While CG shows no significant decrease in muscle damage. $p > 0.05$

Figure 1. The change of LDH in different stages.

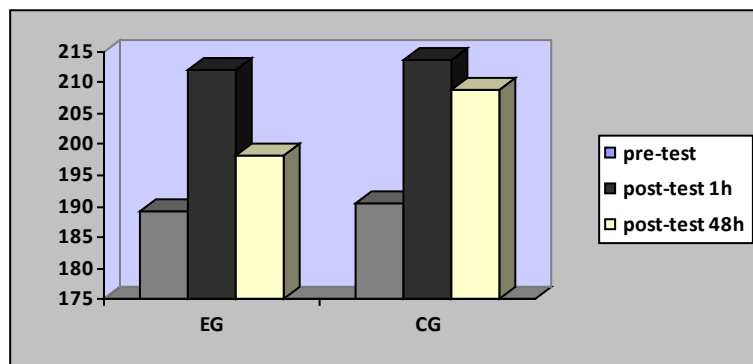


Table 4. Comparison between study tests in post-test 24h for LDH.

Variables	Mean \pm SD	P-value
LDH	198.10 \pm 12.72	0.030
	208.8 \pm 13.64	

Table 5 shows that there are statistically significant differences between experimental group and control group in post-tests 24h for in favor of the experimental group.

Discussion

The main findings from this study were that static stretching SS followed by contrast water therapy CWT recovery, is a beneficial method to decrease the level of lactate-dehydrogenase LDH after simulated high intensity exercise, that's mean reducing of muscle damage and improving recovery rate of soccer players. This study suggested that in static stretching exercises the protocol consisting of two 15s stretches to the gastrocnemius, hamstrings quadriceps, glutes, hip flexors, adductors and abductors (Pooley et al. 2017), however, in contrast water therapy CWT, the players alternated between immersion in cold water ($9.7 \pm 1.4^{\circ}\text{C}$) to the level of the iliac crest for 1 minute and then a warm shower ($39.1 \pm 2.0^{\circ}\text{C}$) for 2 minutes, this procedure repeated another 4 times until a total of 5 exposures were completed and each intervention was employed for a total duration of 15 minutes.

The results within-group comparison showed that the concentration of lactate-dehydrogenase decreased when we applied static stretching followed by contrast water therapy in experimental group post- test only, also the comparison between groups, the results showed an decrease in LDH concentration in favour of experimental group. Therefore, from these results it can be said that the recovery protocol can be a good way to reducing muscle damage and improving recovery rate of soccer players.

Our findings are similar to previous research, (Muanjai and Namsawang 2015) study revealed that static stretching SS have an effect on reducing muscle damage and improving physical recovery, as(Pooley et al. 2020) study indicated that Static stretching SS has long been recommended as a way to reduce muscle damage after exercise by decreasing muscle oedema, markers of muscle damage and inflammatory as lactate dehydrogenase LDH However, Muscles are elongated, often to the point of slight discomfort, and held for a prescribed period of time when performing SS.

It has been suggested that SS may support mostly in dispersion of post-exercise muscle oedema, potentially reducing the damaging effects (Delextrat et al. 2014). It is essential to use soccer players as participants in research studies in order to assess the effects of SS on post-competition recovery of soccer players. When assessing semi-professional male soccer players(Dawson et al. 2005) found a significant improvement in peak power 15 hours after exercise; however, no differences in subjective assessments or range of motion were found. These findings may appear to be more relevant to elite youth soccer, but the athlete training status and participant

age 24 years may not accurately reflect the elite young population. It's possible that the muscle damage elicited by a competitive semi-professional soccer match differs significantly from that elicited by a competitive elite soccer match, affecting the effectiveness of SS as a recovery technique.

Contrast bath is a form of hydrotherapy that involves repeatedly dipping a limb in hot and cold water. This gets done at a specific rate, temperature, and time. The repeated alternating between the two temperatures may cause constricting and dilating of blood vessels, leading to a pump effect. This is believed by some to increase circulation into tissues throughout the body. Even though this therapy is widely used (Sayers, Calder, and Sanders 2011), Different professionals may use different timing and temperature to produce the best result. In addition, the increase in blood flow may lead to oxygenation of blood (improving the healing process). It may also improve the transport of waste products (solving edema) and decreasing muscle damage (Bieuzen, Bleakley, and Costello 2013). More oxygenation occurs due to the hot water. Hot water is thought by some researchers to cause your haemoglobin (a protein in the blood involved in transporting oxygen) to get oxygen more efficiently into your tissues.

Nevertheless, there are a few studies that dealt with the combination of physical recovery methods to know their usefulness in accelerating the recovery process, and our current study combined static stretching exercises and followed them with a contrast water therapy after a high-intensity physical effort to see the effect of this new method on reducing muscle damage by controlling the decrease in concentration of LDH, which is one of the indicators of damage and muscle tissue, and we reached the possibility to say that the current recovery method, according to the established protocol, achieved positive results, accelerating and elimination of muscle damage resulting from high intensity physical exertion, and we believe that studies should be carried out similar to the search for the best appropriate ways to help football players to recover the optimal physical, especially with the closeness and intensity of matches.

Conclusion

This investigation reveals that static stretching followed by contrast water immersion can be a useful method, to decrease the concentration of biochemical marker (lactate dehydrogenase), reducing muscle damage and accelerating rate of recovery, after simulated high intensity exercise in youth soccer players.

In addition, the combination between recovery methods may help soccer players to improve their physical performance after each training session or match, that is why we suggest conducting studies about this method.

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