

Comparison of different recovery methods after an acute training session on aspartate aminotransferase activity and some hematological indicators of blood in women runners

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Abstract

Introduction: The aim of this study was comparison of different recovery methods after an acute training session on Aspartate Aminotransferase (AST) activity and some hematological indicators of blood in women runners. The present study was applied and quasi-experimental. The statistical population of this study consisted of semi-professional female athletes in athletics (runners) in Tehran. Sampling was done by simple random sampling, so that after informing and inviting interested people and passing the preliminary stages, 30 people were selected from the runners as a research sample and these people were randomly divided into 3 groups of 10 person: group active running recycling, passive recycling group and sports massage were included. They ran 200 meters (short distances) on the track after a 2-hour training session of 25 seconds. In this study, one-way analysis of variance was used. The results of this study showed that there was no significant difference between the three types of recycling methods (inactive, double soft, massage) in changes in the factors of AST, iron. However, there was a significant difference between the three types of recycling methods (inactive, double soft, massage) in hematocrit changes. The recycling method can be used after the athletics competition.

Keywords: Aspartate Aminotransferase (AST), women runners, recovery, intense activity, blood.

Kadın koşucularda aspartat aminotransferaz aktivitesi ve kanın bazı hematolojik göstergeleri üzerine akut bir antrenman seansından sonra farklı iyileşme yöntemlerinin karşılaştırılması

Özet

Bu çalışmanın amacı, kadın koşucuların aspartat aminotransferaz aktivitesi ve bazı hematolojik parametreler üzerine akut bir antrenman seansından sonra farklı toparlanma yöntemlerinin etkisini değerlendirmektir. Bu çalışma uygulamalı ve yarı deneysel olarak yapılmıştır. Bu çalışmanın istatistiksel popülasyonu, Tahran'daki atletizmde (koşucular) yarı profesyonel kadın sporculardan oluşuyordu. Örneklem basit tesadüfi örneklem ile yapılmış olup, ilgili kişileri bilgilendirip davet ettikten ve ön aşamaları geçtikten sonra koşucular arasından araştırma örneklemini olarak 30 kişi seçilmiş ve bu kişiler rastgele 10'arlı 3 gruba ayrılmıştır: grup Aktif koşu geri dönüşümü, pasif geri dönüşüm grubu ve spor masajı dahil edilmiştir. 25 saniye süren 2 saatlik antrenmanın ardından atletizmde 200 metre mesafe kat ettiler. Bu çalışmada tek yönlü varyans analizi kullanılmıştır. Bu çalışmanın sonuçları, aspartat aminotransferaz, demir faktörlerindeki değişikliklerde üç tür geri dönüşüm yöntemi (inaktif, çift yumuşak, masaj) arasında önemli bir fark olmadığını göstermiştir. Ancak hematokrit değişikliklerinde üç tip geri dönüşüm yöntemi (inaktif, çift yumuşak, masaj) arasında önemli bir fark vardı. Geri dönüşüm yöntemi atletizm yarışmasından sonra kullanılabilir.

Anahtar Kelimeler: Aldolaz enzimi, kadın koşucular, iyileşme, yoğun aktivite, kan.

INTRODUCTION

Athletes are exposed to cellular damage by hard practicing and races, causing increasing amount of metabolic waste (1). Some changes occur in muscle tissues by becoming tired and perhaps body can't have the opportunity to come back in exercising periods to initial condition and it will decrease the efficiency (2, 3). Noticing to the recovery periods and faster coming back to the common condition have special importance because small physical damages in physical activities and even in some matches that has too much foot hits are unavoidable (4). Coming back into inadequate condition after one practice session can cause unacceptable action on next session and long-time repeated unsuitable recoveries can cause tiredness and finally make an over training situation (5-7).

In the types of recoveries like active recovery, inactive recovery and massage were always noticed (1). Active recovery and massage mostly had been noticed by coaches and athletes in types of after activity recoveries (8). Active recovery causes increase of blood flow and concludes faster initial condition come back (9-10). Much research has been done on the benefits of active recovery and several reasons have been stated in this regard, including facilitating muscle blood flow, helping to excrete lactic acid, facilitating oxygenation of active tissues, and so on (11). A lot of researchers reported the helpful effects of active recovery on tiredness and athletic actions in comparison with inactive recovery (12-13). On the other hand, massage has vast healing and relaxing usage in matches for physical readiness before match, between two matches and coming back to initial condition after match (14). Some of the best benefits of sports massage are the positive effects on sport action (15, 2), reducing the time of coming back to initial condition after activity (16), reducing the muscle tension (17) and restoring the energy resources by increasing blood flow (18) causing improvement for the next match. So, the type of recovery could affect on the athletes' success by reducing indicators of cellular damage (13).

Considering to that the liver is one of the main body organs that has special importance in adjusting hormone functions and metabolism during the rest, exercising and coming back to initial condition using

different enzymes, one of the most used diagnostic enzymes is "Aspartate Aminotransferase" (AST) that increases after exercising and muscular damage (21, 22). Various factors, including exercise, affect the secretion of liver enzymes (AST) in the body, and the response to each depends on the intensity and duration of exercise (25). This enzyme exists in most body cells especially in heart and liver cells and in less amounts in kidneys and muscles. This enzyme is in group of Transaminase enzymes. AST catalyzes the interconversion of aspartate and α -ketoglutarate to oxaloacetate and glutamate. Inasmuch as the cellular pathogenesis indicators begin to producing and secreting abnormally, if this problem (increasing cellular damaging indicators) stays at high amount after exercising or match, it affects the athlete's efficiency. One of the symptoms of fatigue is the presence of AST enzyme in liver enzymes. These information's mean that choosing and using the correct recovery form probably can have positive effects in this case. Fatigue is due to changes that occur first in the muscle and then in the chemical factors in the blood serum of athletes. These changes are due to the production of waste products that are the end product of energy production machines. Performance is better, especially during short periods of high-intensity fatigue training, which usually limits the athlete's performance and delays the desired result..

According to the theoretical foundations, the effects of active recovery on inactive recovery are proved but there are some questions: How to do active/inactive recovery? In which indexes should we check the effects? And on which athletes should we apply the exercise protocols? In Saensirisuwan et al., research in 1998 (28) on young male boxers with an increasing activity time until they get exhausted, results meaningful increasing amount of AST enzyme comparing to the controlled group. Ajami Nezhad et al., in 2014 (21) have found that the amount of Hemoglobin rises after doing aerobic exercises for a while but other liver indexes including AST doesn't change meaningfully comparing to the controlled team. Shojaaldin et al., in 2017 (29) have found that there's no meaningfully statistic differences between active recovery and walking under water on muscular damages like AST and creatine kinase of football players after a set of matches. Inasmuch as

there's no information about comparing different ways of recovery after on session of hard exercise on the activity of the female runners' AST enzyme, in this research the indexes of cellular and tissue pathogenesis like hematological indexes (Iron, serum, Hematocrit, WBC, RBC and Hemoglobin) and AST will be examined.

Materials and Methods

Study Participants

This is an applied and semi empirical research which has been done in steps. The statistical community of research includes female runners of Tehran. 30 semi-professional women were chosen on their own will. The reason for using semi-professional runners can be pointed to the relative fitness of the body, lower body resistance to fatigue and inflammatory indicators of the liver compared to professional runners.

Demographic character forms (physical activity and sport history, health assessment and medical history) and standard valid laboratory equipment like fridge, centrifuge, and Elisa (to measure biochemical blood indexes) are used to collect the information's. The research is semi-empirical that has been done in field-experimental way via pre-test-post-test plan. Before doing the plan, the anthropometric and demographic data have been measured and recorded using assessment tools.

Study Intervention

Due to limited access to professional runners (having a contract with professional clubs), among the semi-professional female runners, 30 people in the range of 18-24 (average: 21.34 ± 2.32) years old and 161-175 (average: 169.126 ± 4.112) centimeters and 54-68 (average: 62.113 ± 4.217) kilograms have been chosen. They randomly put into 3 teams (running active recovery, massage inactive recovery and sitting inactive recovery) depend on age range, diet controlling (not being in any special diet), health history (not having any special disease) and physical activity history. First of all, it has been explained that they must have fast around 10-12 hours. All of the runners were doing their special exercises for 2-3 hours 3 days a week. The people participated in a 120 min special track and field session with 85% of maximum capacity heart rate before the official match. The exercise schedule has been done; includes 15 min warm up, 45 min special running exercise, 5 min hard 200 meters (short distances) running exercise with 80-85% of maximum capacity heart rate

(30). The active recovery group ran slowly on the treadmill for 20 minutes at 55% of maximum heart rate. AST enzyme is used to evaluate the indicators of muscle damage that indicate fatigue (31). In the following, the pre-test measuring and blood sampling has been done and the samples has been sent to laboratory to test the intended indexes. then, on the match day, all 3 teams have joined and immediately after the match, sampling has been done and the teams begin to do their special recoveries that had been chosen before and immediately, the third sampling has been done right after the recoveries.

Statistical Analysis

using the Kalmogroph-Smirnoff test for checking normality of data, one-way analyze of variance for checking differences between averages to check the changes between groups in meaningful ($P=0.05$) level using the SPSS22 software package the informations have been analyzed.

Results

In table 1, the pre-test and post-test and after recovery data are reported.

Table 1. pre-test post-test and recovery periods of components.

Variable	Measuring time	Groups		
		Rest group	Slow Running Group	Massage group
White blood cell	Before practice	6530±1137	5930± 771	6890± 1312
	After practice	8660± 982	8310±662	9490± 1236
	After recovery	6190±1525	6490/± 593	7400±1401
Red blood cell	Before practice	5.73±0.61	5.73±0.67	5.19±0.82
	After practice	6.34±0.75	5.89±0.69	5.96±1.05
	After recovery	6.19±0.63	5.70±0.63	5.67±0.90
Hemoglobin	Before practice	15.21±2.00	15.54±2.07	13.85±2.22
	After practice	17.45±2.46	18.88±2.18	16.41±2.95
	After recovery	16.70±2.49	15.69±2.11	15.25±2.47
blood Iron	Before practice	98.70±44.97	122.30±48.75	118.90±52.43
	After practice	117430±31.75	137.60±34.84	146.20±45.73
	After recovery	115.10±34.50	124.20±34.62	142.30±45.67
Hematocrit	Before practice	46.23±5.49	46.68±5.94	41.63±6.68
	After practice	53.22±6.25	47.97±6.10	49.31±8.86
	After recovery	50.80±6.61	47.36±5.90	45.91±7.45
ASD	Before practice	26.80±7.25	26.61±7.03	26.17±7.22
	After practice	31.87±6.68	32.17±6.46	31.93±6.91
	After recovery	27.81±6.89	29.32±6.02	29.22±6.29

Table 2. one-way analysis of variance results in post-test

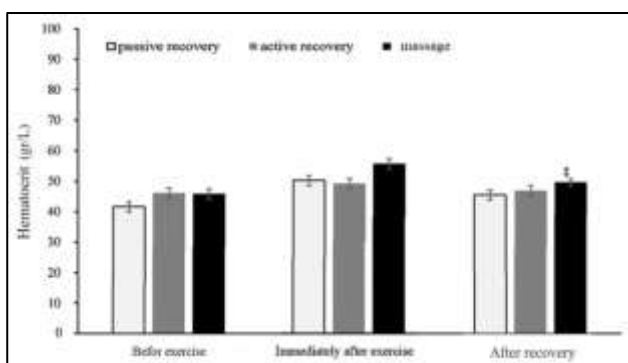
Variable	Statistical index	SS	DF	MS	F	P
White blood cell	Between groups	7646000	2	3673000	3.75	0.03
	Within groups	26400000	27	977851		
	Total	33750000	29			
Red blood cell	Between groups	1.17	2	0.58	0.92	0.41
	Within groups	17.22	27	0.63		
	Total	18.39	29			
Hemoglobin	Between groups	12.75	2	74.41	1.44	0.25
	Within groups	176.67	27	51.66		
	Total	189.42	29			
Hematocrit	Between groups	148.82	2	73.47	1.41	0.27
	Within groups	1394.98	27	52.68		
	Total	1543.80	29			
Blood Iron	Between groups	4371.46	2	2185.73	1.52	0.23
	Within groups	38830.40	27	1438.16		
	Total	43201.86	29			
ASD	Between groups	70.20	2	35.10	0.21	0.80
	Within groups	4418.60	27	163.65		
	Total	4488.80	29			

Considering to that there was no meaningful changes in amount of Hematocrit (F=1.44, P=0.25), Iron (F=1.52, P=0.23), WBC (F=0.92, P=0.41), Hemoglobin (F=0.97, P=0.39) and AST (F=0.21, P=0.80) of all 3 teams but there was meaningful changes in WBC (F=3.75, P=0.03) in post-test.

Table 3. one-way analysis of variance results to check 3 types of recovery effects on components

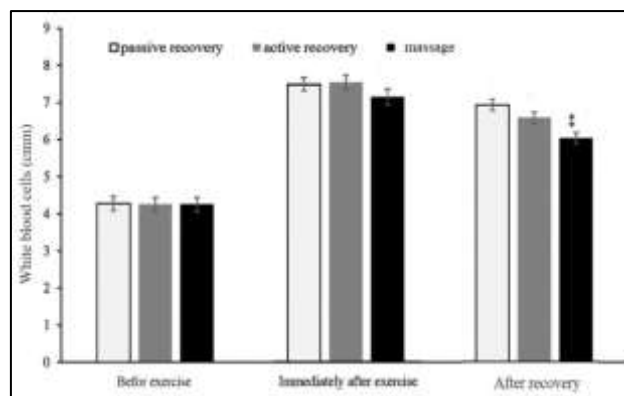
Variable	Statistical index	SS	DF	MS	F	P
White blood cell	Between groups	7348382	2	3674191	3.75	0.04
	Within groups	26390000	27	977358		
	Total	33740000	29			
Red blood cell	Between groups	0.12	2	0.06	0.77	0.47
	Within groups	2.21	27	0.08		
	Total	2.33	29			
Hemoglobin	Between groups	4.74	2	2.37	4.52	0.02
	Within groups	14.15	27	0.52		
	Total	18.90	29			
Hematocrit	Between groups	40.06	2	20.03	4.10	0.02
	Within groups	131.72	27	4.87		
	Total	171.79	29			
Blood Iron	Between groups	720.06	2	360.03	1.54	0.23
	Within groups	6281.40	27	232.64		
	Total	7001.46	29			
ASD	Between groups	27.46	2	13.73	1.24	0.30
	Within groups	297.50	27	11.01		
	Total	324.96	29			

As you can see in table 3 that the differences of all 3 teams between post-test and recovery have been calculated and then the averages have been checked by one-way ANOVA. Some meaningful differences have been seen between the effects of 3 groups on Hematocrit (F=4.10, P=0.02), WBC (F=3.70, P=0.04) and Hemoglobin (F=4.52, P=0.02) of the semi-professional female runners.



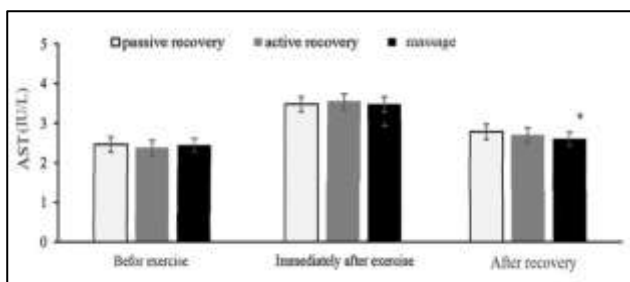
‡ There's meaningful difference between massage and other types of recovery.

Chart 1. the changes of Hematocrit comparison between 3 different types of recovery



‡ There's meaningful difference between massage and other types of recovery.

Chart 2. the changes of WBC comparison between 3 different types of recovery



Meaningful difference with pre-test ($P > 0.05$)

Chart 3. the changes of AST comparison between 3 different types of recovery

The LSD test results have shown that there are meaningful differences between the massage recovery team with soft running and passive rest in amount of Hematocrit ($P=0.009$), WBC ($P=0.01$) and Hemoglobin ($P=0.01$). No difference has been seen in changes of Iron ($F=1.54$, $P=0.25$), RBC ($F=0.77$, $P=0.47$) and AST ($F=0.10$ and $P=0.54$) of semi-professional female runners.

Discussion

The research has been done to compare the effects of different types of recovery on AST and some other hematological indexes. The results have shown that the amount of AST reduces after implementing the protocols which is not a meaningful change and it is congruent to Kinoshita and Fealy (29, 32, 33); They have reported that there's no meaningful increase of liver enzymes after the exercise and on the other hand, there are meaningful differences in Hematocrit, WBC, Hemoglobin but it wasn't congruent to Saengsirisuwan et al., (28) results. Perhaps it could be attributed to athletes' readiness and gender differences and the sports (Boxing, Track and Field). The capability of athlete to do the daily exercises depends on how fast he/she can comeback to initial condition by replacing the body liquids, storing energy and healing damaged muscle tissues (34). Recovery after a long-time activity has a complicated process but it can be in 3 levels. First level called fast level happens in first 30 min after exercising. Next one is the mid-term level that lasts about 2 hours after exercise, and in the end, it is the long-term level that happens in last 20 hours before next session (35). Many body organs are under the pressure during a match or a session of exercise like the liver, muscular system, active muscles, nervous system, hormone system, muscular glycogen and triglyceride and energy system. It is obvious that the recovery during or after exercising has great effects on restoring the lost amount of energy, blood pH, muscles, body temperature and etc (36). By the way,

Baraghmedi and Abdollahpour Darvishani (37) have reported that optimizing the initial condition comeback after exercise and match is helpful for exercise or next performance of elite athletes or competitive athletes for a period of time, according to their research in 2020.

There are some differences between 3 types of massage, passive rest and soft running recovery after running exercises of semi-professional female runners in some hematological indexes. The result of LSD test has shown there are meaningful differences between the soft running team and passive rest in blood hemoglobin ($P=0.009$) that is congruent to Ajaminejad et al., 2014 results (21). Also, there is no meaningful difference between 3 types of recovery in changes of AST and Iron and RBC. The results of Davis's research in 2020 (38) shows that massage isn't directly effective on recovery and athletes' activities. Malekzade in 2013 (1) has represented that the amount of active hybrid recovery effects and sport massage on tiredness indicators, understanding tiredness and feeling more strength are other types of recovery. (13). Also, the results of Nobahar and Mirdar in 2012 (39) indicates that the amount of AST has meaningfully increased after day 1, 4 and 7 of exercise and after 24 hours of rest has shown an impressive decrease and only showed meaningfully difference after exercise day. The researchers have concluded that not paying attention to the appropriate recovery time for work hardness, could maybe lead to reducing the efficiency and muscular damage.

The results were inconsistent to many other research results such as Best (40) in 2008 that is maybe because of the other interfering factors that we could point to the athlete's readiness, recovery time and etc. the results of Best have shown that sport massage is meaningfully effective for restoring skeletal muscle after a hard time exercise. Monedero and Donne have represented in 2000 that they compared the level of initial condition comeback in 4 conditions including passive rest, combination massage, active rest with massage and active rest. They conclude that the combination of massage and active recovery reduces the execution time meaningfully. Also, active recovery and hybrid recovery causes the drainage of the venous blood but none of them effects the heart rate (41). Noticing to the fact that the physical activities could make tissue and cellular damages and these damages could increase the membrane permeability and releasing the cell enzymes (42), a lot of methods could be given such as stretching moves,

massage, ice compress, anti-inflammatory drugs, anti-oxidants, immersion in cold and hot water and recovery using electrical stimulation to compensate those damages (43, 5). The athletes believe that the recoveries and massages have positive effects on their activities and reduce the initial condition comeback time after tiredness results the improving in the next performance in next match (44). Some of the massage effects -without noticing to subject's health condition- are increasing the oxygenation and feeding cells and tissues, releasing endorphin, physical and mental relaxation and feeling becoming better, relaxation and perfection (45).

Conclusion

Noticing to the results, there are meaningful differences between 3 types of recovery in hematocrit, WBC and hemoglobin, using active soft running recovery after track and field matches is suggested. Also noticing to the research results, there's no meaningful difference between 3 types of recovery in Iron, RBC and AST. So, using all 3 recoveries is suggested. In the end, according to the results, performing different methods causes improving the recovery process in athletes. By the way the certain opinion needs more researches on the subject.

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