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"follow -up the level of blood lactate and oxygen saturation after 90 minutes of passive recovery after 800 meters running"

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Abstract

The purpose of the present research is to follow-up the level of blood lactate and the oxygen saturation after 90 minutes of passive recovery and after running 800 meters for athletes. **Methods:** Moreover, 9 young male athletes (18.1years; 180 cm height; 60kg weight; 10.5% fat mass) were randomly selected, from a sample formed of 100 volunteers in Al- Najah Sport Complex in Nablus City. Before the test, all the participants joined a program that consisted of warming up, resting, blood sampling, and measuring the lactate level. Thus, blood lactate of the participants was measured before the exercise, and immediately after the exercise, and 1, 3, 5, 8,10, 15, 30, 40, 50, 60 and 90 minutes into passive recovery. **Results:** The results showed that during the passive recovery (up to 60 minutes after exercise) the blood lactate has decreased to 85%, while it decreased to its normal level within 90 minutes. The results have revealed having no relationship between the blood lactate and the saturation of oxygen. **Conclusion:** It can be concluded that 90 minutes of passive recovery was enough for the blood to lactate back to the normal level.

Key words: Blood lactate, Oxygen saturation, Passive recovery, Running.

Introduction

Blood lactate test is often used to monitor the presence of oxygen debt (hypoxia). The metabolism of pyruvate and its conversion to lactate increases in the absence of oxygen. Low oxygen in the cells leads to accumulation rather than elimination of lactate, which increases blood lactate rates. Usually, blood lactate high rate is an indication of hypoxia, or a "normal" physiological response to hard physical exercises. High rates of blood lactate among athletes depend on the intensity and duration of the exercise. When an athlete does vigorous exercise within a period of time, from 20 - 40 seconds, or 60 seconds by maximum, he/she burns carbohydrates or (Glucose) for energy production, through (Glycolysis), where the rate of glycolysis increases during high-intensity exercises that last more than 20 seconds. That rate of glycolysis increases to provide energy during the high-performance (Power SK, Howley E 2014).

Accelerated glycolysis produces more lactic acid, causing the accumulation of lactic acid in the muscles and the reduction of muscles' ability to get rid of it quickly, which raises the level of lactic acid in the blood.

The level of blood lactate at rest varies between 1-2 mmol / L of blood. This rate increases when performing high intensity exercises, and the level of blood lactate increases in players after high physical exertion, and may reach 8-10 mmol / L of blood. (Dong, et. 2016) and sometimes more, depending on the type of sports activity in the first place, and the level of players in the second place. And may go higher to reach 15-25 mmol / L of blood. This is usually observed (3-8) minutes after the vigorous exercise of 30-120 seconds. (Svedahl K, MacIntosh BR.2003) (Matthew L. et. al, 2007).

The level of lactate begins to decline during the recovery. The body needs about 60-90 minutes of recovery to restore the normal level of lactate, depending on the type of recovery whether active or passive (Cairns SP. 2006). Blood Oxygen Saturation is an indicator of the efficiency of the lungs in the distribution of oxygen to the cells. The body monitors the levels of oxygen in the blood to maintain it at a certain level, so that the oxygen is sufficient for the needs of each cell in the body. The normal level of oxygen in the blood ranges between 75-100 mm Hg, and reaching the level of 60 mm Hg causes hypoxia (Linda D. et al. 2015).

The current study came to follow -up the level of blood lactate and oxygen saturation after 90 minutes of passive recovery after running 800 meters, blood lactate level will be measured after the end of the physical exercise and within the following times (immediately after the exercise , 1, 3, 5, 10, 15, 30, 40, 60 and 90 minutes after the exercise) to calculate the highest value for lactate accumulation and to recognize the best time for passive recovery from lactate accumulation after the physical exercise and to examine the relation between lactate level and blood oxygen saturation level.

Materials and Methods

Table1. Anthropomertical data and records of the test subjects

Subject No	Age (yr)	Height (cm)	Weight (kg)	Fat mass (%)	Record for 800 m (year made) (min.s)
1.	19	182	66	8.5	2.2
2.	18	170	67	8.9	2.27
3.	18	181	62	9.9	2.26
4.	18	183	60	9.1	2.21
5.	18	184	63	10.3	2.21
6.	19	186	64	10.4	2.25
7.	19	176	70	11.4	2.43

8.	17	178	73	11.5	2.29
9.	17	180	73	10.5	2.4
Mean ± SD	18.1±.78	180±0.04	66.4±4.7	10.5±1.05	2.28±0.08

Subjects

Nine male sprinters and middle- distance runners, age 19.7±1.8 years, volunteered for the study and gave their informed consent after the risks and benefits of the measurements were thoroughly explained to them. All the subject trained regularly year-round and their records in 800 m ranged from 2.28±0.08 Meter/Sec (Table1). The measurements were carried out at the end of the competitive season on a 400-m outdoor track during 2 days.

Test protocol

All sprinters ran a distance of 800m, the subjects had a thorough warm-up for nearly one hour before each run. The subject ran the 800 m with maximal effort. The Final times of each run and the split times of the 800 m were determined by photocells and an electronic timer. The speed curve was calculated from the mean times.

Sample-taking and analysis

Blood samples for the measurement of blood lactate were taken from venous blood obtained by finger-prick (lactate pro 2). Samples were taken at rest (on first day only), 5 min after the warm- up about 30 s before the run and then immediately after the run and 1, 3, 5, 8 ,10, 15, 30, 40, 60, 90 min later to find the highest level of lactate.

The Result

The participant ran the 800 m in 2.28±0.08 min/sec, there has been no relationship between the oxygen saturation and blood lactate. At rest, the lactate was 2.0± .55, and oxygen saturation was 99%±0.00. At warm-up, the lactate was 7.4± .75(mmol\L), and oxygen saturation was 98.6%±0.53. Immediately after running, the lactate was 11.4± .95(mmol\L), and oxygen saturation was 98.4%±0.73. Immediately after running, the lactate was 11.4± .95(mmol\L), and oxygen saturation was 98.4%±0.73. At the (1) min, the lactate was 11.6± .45(mmol\L), and oxygen saturation was 99.0%±0.50. At the (3) min, the lactate was 12.6± .65(mmol\L), and oxygen saturation was 98.7%±0.87. At the (5) min, the lactate was 14.5± .78(mmol\L), and oxygen saturation was 98.8%±0.83. At the (8) min, the lactate was 14.1± .88(mmol\L), and oxygen saturation was 98.4%±.45. At the (10) min, the lactate was 14.0± .87(mmol\L), and oxygen saturation was 98.6%±0.73. At the (15) min, the lactate was 13.5± .82(mmol\L), and oxygen saturation was 97.9%±.88. At the (30) min, the lactate was 11.6± .24(mmol\L), and oxygen saturation was 98.4%±0.53. At the (40) min, the lactate was 8.9± .55(mmol\L) 1, and oxygen saturation was 98.6%±0.53. At the (60) min, the lactate was 5.9± .55(mmol\L), and oxygen saturation was 98.2%±0.83. At the (90) min, the lactate was 2.1± .66(mmol\L), and oxygen saturation was 98.4%±0.53, (Figure 1, and 2).

Peak blood lactate was observed after 5 min of recovery, but the peak of oxygen saturation was observed after 1 min. The correlation between oxygen saturation and peak blood lactate concentration was .147 and no significant (P<*0.05). The blood lactate concentration was statistically significant (P<*0.05) in 1min, 8 min, 3min, 8min, and 90 min (Table 1). Oxygen saturation were statistically significant (P<*0.05) in immediately after running, and 90 min.

Table 2: Correlation between lactate blood, and oxygen saturation.

	REST	Warm -up	Immedi -ately	1min	3min	5min	8min	10min	15min	30min	40min	60min	90min
REST	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Warm-up	.630	.588	.372	.392	.411	.996	.866	.838	.791	.559	.934	.253	.690
Immediately	.594	.579	.629	.865	.828	.687	.914	.343	.981	.754	.347	.406	.835
1min	.810	.092	.067	.381	.653	.699	.774	.482	.524	.441	.060	.152	.678
3min	.886	.221	.063	.655	.211	.468	.818	.601	.703	.286	.088	.275	.079
5min	.148	.221	.157	.161	.336	.147	.302	.113	.514	.276	.141	.137	.065
8min	.252	.058	.118	.281	.334	.317	.651	.247	.531	.249	.106	.125	.086
10min	.197	.086	.085	.452	.284	.668	.672	.675	.485	.846	.252	.309	.245
15min	.551	0.094	.122	.723	.347	.521	.728	.649	.566	.385	.205	.142	.051
30min	.113	.351	.463	.062	.478	.552	.153	.561	.583	.559	.943	.253	.690
40min	.236	.641	.521	.491	.576	.728	.368	.671	.940	.495	.573	.446	.140
60min	.270	.841	.295	.987	.712	.609	.794	.755	.496	.707	.629	.132	.194
90min	.084	.788	.067	.361	.435	.383	.793	.863	.644	.572	.707	.565	.243

(P<*0.05 . P<0.01)**

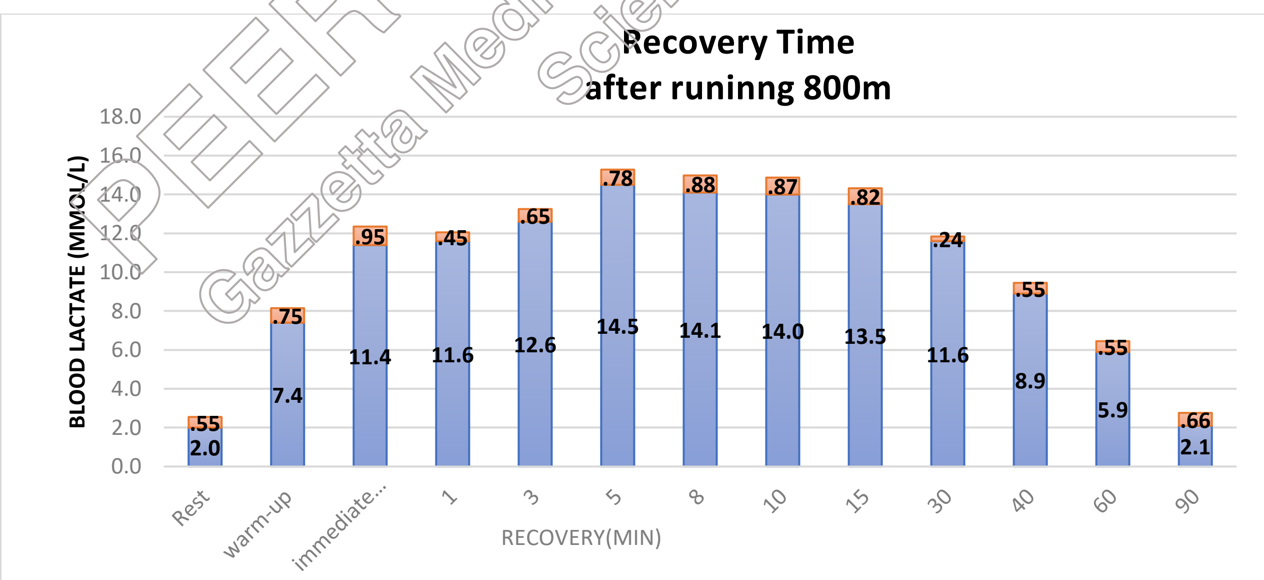

Figure 1. Change in blood lactate "LA" (mmol\L) accumulation for the different recovery time until 90 min. Values are exp*/ressed as means±SD.

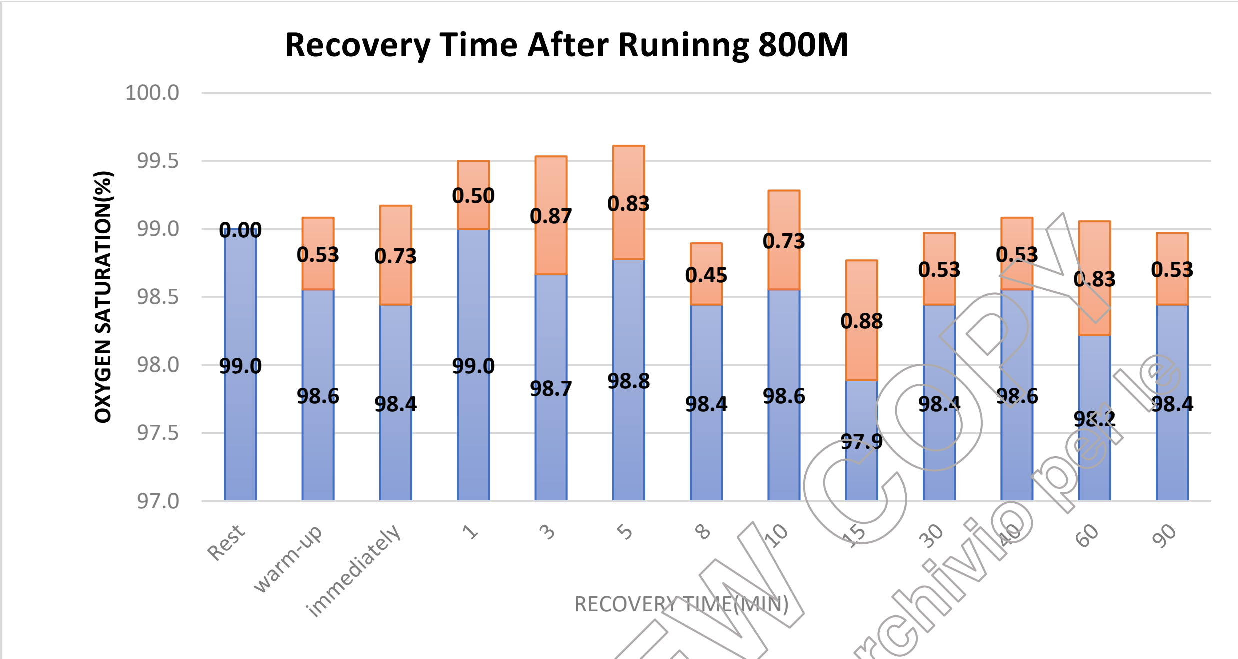

Figure 2. Oxygen saturation in blood (mm Hg) for the different recovery time until 90 min. Values are expressed as means±SD.

Discussion

The current study focused on testing the levels of lactate in the blood after running a distance of 800 meters, for a period of up to (90) minutes of passive recovery, where the results indicated that the average level of lactate after the physical effort reached (11.44 mmol / L) and after 5 minutes of the passive recovery, it went up to the highest level to reach (14.5 mmol / L). Most studies showed that the level of lactate in the blood reaches the maximum level between 3-8 minutes of the recovery period whether the recovery was passive or active (Mondero, 2000).

In this context, many studies have indicated that the active recovery is better than the passive when the period of recovery ranges between 30-60 minutes. Such studies explained that the active recovery increases the blood flow to the active muscles and accelerates the process of getting rid of lactates. Furthermore, the liver and heart play a key role in speeding the process of getting rid of lactate (Tanner, R., & Gore, C., 2018). However, the current study is trying to test the level of lactate in the blood after long time, about 90 minutes of passive recovery, to determine the time is goes to normal level, and to find whether 90 minutes is enough for the lactate go back to its normal level or no.

In this, both Bogdan's et al. (1994;1995;1996), and Ahmaïdi et al. (1996) found that active recovery was effective for 60 minutes but they did not find any difference between the passive and active recovery after 60 minutes.

This could be explained by the fact that (90) minutes of passive recovery is enough to allow blood to go the active and inactive muscles, thus increasing oxygen consumption to accomplish equilibration in PH value, blood acids, and to restore phosphocreatine to its normal level.

In addition, that time of passive recovery also allows both the heart and the liver to help get rid of lactate and return to rest status. Most studies have agreed that the getting rid of lactate is faster when doing moderate physical activity during the recovery period. However, researchers did not agree to the optimal or appropriate intensity to get rid of lactate faster. Stamford et al., 1981, and Weltman et al., 1979 confirm that active recovery is more effective in eliminating or reducing lactate when the training load is below the anaerobic threshold compared to that when the training load is above the anaerobic threshold, and when the time to recovery is 30-60 minutes. The study explained that workout above the anaerobic threshold would increase the imbalance between the rate of energy production and the rate of getting rid. By taking biopsies of active and inactive muscles, Bangsbo et al., 1994 noted in his study that the period of recovery of lactate in blood and muscle was similar until the first 10 minutes of warm-up and the differences began to appear to the favor of active recovery up to 30 minutes and then no differences were attributed to the used method. (Hermansen and Stensvold, 1972) confirm that effect of active recovery lasts for 15-20 minutes only.

According to the same study, a passive recovery for 90 minutes decreased lactate level in the blood to until it reached its level before the workout, (2.1 mmol / L) as shown in Figure (1). In this regard, many researchers have confirmed that passive recovery for 90 minutes contributes to the increase of muscle-stored glycogen after intense exercise or racing (Mondero, 2000). (Vandoorne et al., 2017) confirmed that the muscles begin to get rid of excessive glycogen after the long rest of up to 90 minutes regardless of the recovery type.

The results also indicated that there was no statistically significant relationship between blood oxygen saturation and lactate level in the blood during 90 of the passive recovery after running 800 meters. The researchers found that the level of oxygen saturation did not change during the period of recovery, where it maintained the normal level between (97% -99%). Researchers also noted that the lactate usually moves from muscle to blood plasma. Lactate usually goes from plasma to red blood cells via the red blood cell membrane, and the lactate concentration in blood plasma is usually higher than its concentration in red blood cells by twice (Matthew l. et. al, 2007). According to Donnan's theory, lactate is distributed by the charge of molecules inside the cell. Hemoglobin, the primary constituent of red blood cells, has a negative charge. The concentration of negative ions in red blood cells is usually less than that of the plasma negative ions, which increases the concentration of lactate in plasma (Juel C, et al., 1990). This means that the increase in blood lactate does not affect the ability of hemoglobin to carry oxygen.

The researchers also confirmed that oxygen saturation may be adversely affected in unusual conditions, and may be as low as 50% in high intensity exercises at high altitudes (j.b.west.1962) or low oxygen level (O2) which may lead to an imbalance in oxygen saturation and thus instability of breathing, which explains the results of the current study (Bernard et al., 1998).

Conclusions

In the light of the results of the study; the two researchers point out that (90) minutes of passive recovery after running for 800 meters is enough for blood lactate to go back to the normal levels before the physical effort. The high level of blood lactate after physical exercise does not affect the level of oxygen saturation, and has no relationship with it.

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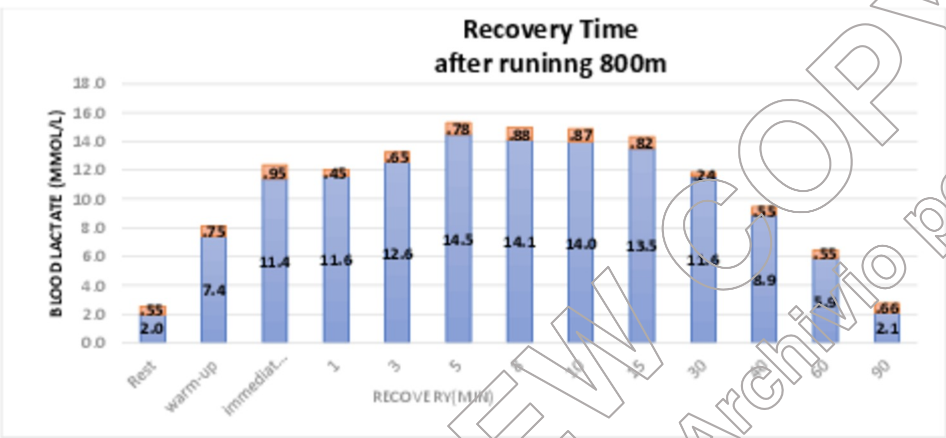

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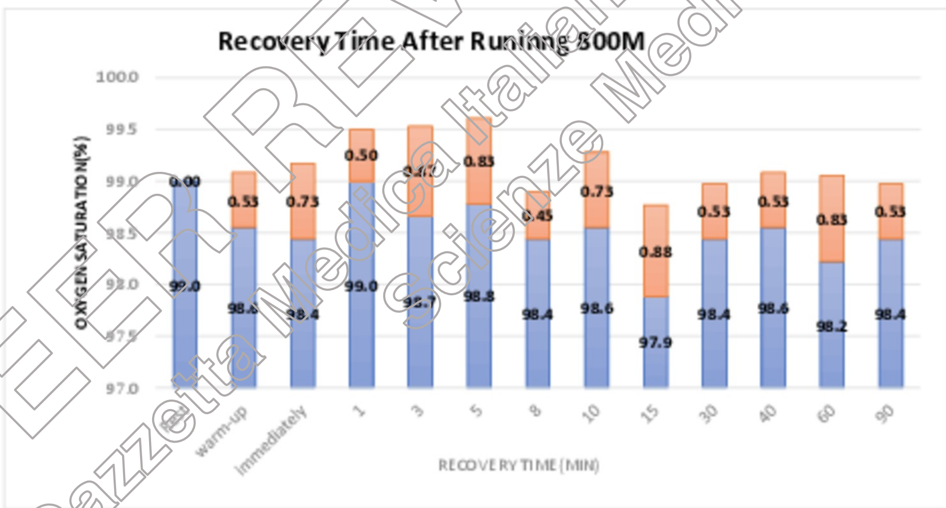

Figure 2. Oxygen saturation in blood (mm Hg) for the different recovery time until 90 min. Values are expressed as means±SD.