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Comparison of effects of running and playing exercises on differential leucocyte count in young elite athletes

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The aims of the present research are to test the effects of running and playing exercises on leucocyte and differential leucocyte accounts, and to test the possible differences between running and playing exercises in terms of leucocyte accounts. They were thirty two male young soccer players. Participants arrived at the laboratory after a 12-hour fast. Blood samples were collected from an indwelling heparin locked latex venous catheter before and after training protocol. Differential leukocyte counts were performed on K3EDTA-treated blood, using an automated Coulter JT hematology analyzer. Neutrophil, lymphocyte, monocyte and total leucocyte accounts were increased after acute exercise compared to before in playing group. All leucocyte parameters except lymphocyte account were increased after acute exercise compared to before in running group. The differences between two groups were not significant before and after exercise for all parameters except lymphocyte account. It can be stated that acute vigorous exercise in running or playing training results in extremely physical stress. Playing or running do not differs in terms of stress.

Keywords: Acute exercise, playing, running, leucocyte account, differential leucocyte

INTRODUCTION

Leukocyte count with its subpopulations is a clinical marker of inflammatory processes (Farhangi et al., 2013) related to cardio metabolic disorders involved in the development of cardiovascular diseases, especially in overweight individuals (Dixon and O'Brien, 2006).

On the other hand, cardiorespiratory fitness has been considered a protective factor against health problems (Woo, Yu and You, 2013). Prior studies showed an independent negative relation between levels of leukocytes and cardiorespiratory fitness (Michishita, Shono, Inoue, Tsuruta and Node, 2008).

The interrelationships between exercise and leucocyte count have been widely studied. Exhaustive exercise with high-intensity results in tissue damage,

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production of stress hormones, and alterations in the circulating quantity and function of different white blood cells. Many clinical-physical stressors such as surgery, trauma, burns and sepsis induce a pattern of hormonal and immunological response similar to that of exercise. Specific changes that have been observed, both following strenuous exercise and in infectious disease states, include: the acute phase response, leukocyte mobilization and activation, release of inflammatory mediators (cytokines), tissue damage and cell infiltration, the production of free radicals and activation of the complement, coagulation and fibrinolytic pathways (Shephard, 1997; Northoff and Enkel, 1995).

High-intensity training can improve endurance performance and VO2max more effectively than high-volume training. In a recent study, the acute effects on circulating leukocyte differential count of high-intensity training and high-volume training were tested. Biphasic leukocyte enumeration was changed after both high-intensity training and after high-volume exercise. Data revealed significant time and intervention effects for leukocytes, lymphocytes and neutrophils (Mathes, Mester, Bloch and Wahl, 2015).

The aims of the present research are (1) to test the effects of acute heavy exercise and football play exercise on leucocyte and differential leucocyte accounts, and (2) to test the possible differences between heavy and play exercises in terms of leucocyte accounts.

MATERIALS AND METHODS

Participants

Thirty two male young soccer players (Mage = 47.32, SD = 14.01), who are youth system players of professional soccer teams, were included in the study. Participants were divided two equal groups randomly: (1) soccer play group (n=16), and (2) continuous running group (n=16). The difference for age was not statistically significant between these groups. The Ethical Committee of the Faculty of Medicine of the Private University approved this study.

Training Protocol

Training program for playing group contain (1) the warming of 15 minutes, (2) the normal soccer play with load 50% of two teams with two periods of 30 minutes with pause of 10 minutes and (3) the cooling of 15 minutes.

Training program for running group contain (1) the warming of 15 minutes, (2) the continuous running with load 50% at tartan floor with two periods of 30 minutes with pause of 10 minutes and (3) the cooling of 15 minutes.

Blood Sampling

Participants arrived at the laboratory after a 12-hour fast, having refrained from vigorous exercise for at least 24 hours. Blood samples were collected from an indwelling heparin locked latex venous catheter before and after training protocol. Differential leukocyte counts were performed on K3EDTA-treated blood, using an automated Coulter JT hematology analyzer (Coulter Electronics, Hialeah, Florida, USA).

RESULTS

In the present study, neutrophil, lymphocyte, monocyte and total leucocyte accounts were statistically significantly increased after the training protocol compared to before in playing group (group 1) (see Table 1). All leucocyte parameters except lymphocyte account were also statistically significantly increased after the training protocol compared to before in running group (group 2) (see Table 2).

Table 1. The number of leucocyte and leucocyte subsets before- and after exercise in group 1.

Parameters	Before Exercise (Mean ± SD)	After Exercise (Mean ± SD)	*t*	*P*
Leucocyte (WBC)	6950 ± 2093.8	10196.2 ±	4.47	0.00
Neutrophil	3575 ± 1466.74	2603.48	2.02	0.06
Lymphocyte	2312.5 ± 750	4768.8 ± 2261.19	5.05	0.00
Monocyte	643.8 ± 209.66	4275 ± 1422.91	3.17	0.006
		907.5 ± 326.34		

Table 2. The number of leucocyte and leucocyte subsets before- and after exercise in group 2.

Parameters	Before Exercise (Mean ± SD)	After Exercise (Mean ± SD)	*t*	*P*
Leucocyte (WBC)	6550 ± 1326.65	8975 ± 1410.2	6.12	0.00
Neutrophil	3175 ± 1104.84	4556.2 ± 1597.07	3.51	0.003
Lymphocyte	2587.5 ± 636.53	3050 ± 1323.13	1.18	0.25
Monocyte	612.5 ± 166.83	868.8 ± 343.94	2.58	0.02

The differences between two groups were not statistically significant before the training protocol for all leucocyte parameters (see Table 3). The differences between two groups were not statistically significant after the training protocol for all parameters except lymphocyte account (see Table 4).

Table 3. The number of leucocyte and leucocyte subsets before exercise in group 1 and 2.

Parameters	Group 1 (Mean ± SD)	Group 2 (Mean ± SD)	*t*	*P*
Leucocyte (WBC)	6950 ± 2093.8	6550 ± 1326.65	0.66	0.52
Neutrophil	3575 ± 1466.74	3175 ± 1104.84	0.87	0.39
Lymphocyte	2312.5 ± 750	2587.5 ± 636.53	1.12	0.27
Monocyte	643.8 ± 209.66	612.5 ± 166.83	0.48	0.64

Table 4. The number of leucocyte and leucocyte subsets after exercise in group 1 and 2.

Parameters	Group 1 (Mean ± SD)	Group 2 (Mean ± SD)	*t*	*P*
Leucocyte (WBC)	10196.2 ±	8975 ± 1410.2	1.65	0.11
Neutrophil	2603.48	4556.2 ± 1597.07	0.16	0.87
Lymphocyte	4768.8 ± 2261.19	3050 ± 1323.13	2.52	0.17
Monocyte	4275 ± 1422.91	868.8 ± 343.94	0.32	0.75
	907.5 ± 326.34			

DISCUSSION

There are few stresses to which the body is exposed that even nearly approach the extreme stresses of heavy exercise. In fact, if some of the extremes of exercise were continued for even moderately prolonged periods, they might be lethal. Therefore, in the main, sports physiology is a discussion of the ultimate limits to which several of the bodily mechanisms can be stressed. To give one simple example: In a person who has extremely high fever approaching the level of lethality, the body metabolism increases to about 100 per cent above normal. By comparison, the metabolism of the body during a marathon race may increase to 2000 per cent above normal (Guyton and Hall, 2006).

In the present study, neutrophil, lymphocyte, monocyte and total leucocyte accounts were increased after the training protocol compared to before in playing group. All leucocyte parameters except lymphocyte account were also increased after the training protocol compared to before in running group. The differences between two groups were not significant before and after the training protocol for all parameters except lymphocyte account. Therefore, it can be stated that acute vigorous exercise results in extremely physical stress. Playing or running do not differs in terms of stress.

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