



Study the Immunologic and Physiological Responses to Crossfit Exercises in Some Athletes

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Abstract

The aim of this research is to study the impact of Crossfit training on immune responses (Granulocyte, Lymphocytes, Monocytes, Killer cells CD-16, killer cells CD-56, Killer toxic cells, Leucocytes), physiological responses (Lactic acid percentage, glycogen, transaminase enzyme (SGOT), Hydrolyzed enzyme (LDH), Creatine phosphokinase (CPK), Speed of red blood cell deposition (ESR). The researcher used the experimental approach using an experimental group and a control group, using pre and post measurements. The sample of the research was chosen purposely, the sample consisted of (10) young football player at Ceramica Cleopatra in Cairo, and were divided into two groups, the experimental group consisting of (5) player and applied to them the Crossfit training program, and control group consisting of (5) player performed the endurance exercises. The researcher recommend with use Crossfit training as one of the exercises high physical loads of intensity to be similar to the effects of immunological and physiological and extreme endurance exercises high intensity, not to practice Crossfit training for young children and to the risks that may occur for the body's vital organs, Reduce the time period for the performance of Crossfit training during the performance of the players of the training units.

Keywords: Crossfit training, Immunologic and Physiological Responses.

- Introduction and Problem of Research:

The aim of the sports training is to improve the physical functional and psychological condition of athletes, but it results in put the body's vital system under the influence of different physical loads intensity, which may often be reflected by the negative on the body systems and their ability to adapt to face the high physical loads, sports training based on basis science fundamentals is the main way to improving the functional level of body systems, which is reflected in their efficacy and resistance to the disease, and improves the level of physical performance and thus access the athlete to achieve the best achievements and victories.

Continuously athletes seek means and devices that increase the level of their performance and their results to the extent that it is possible to exceed their physical and functional abilities and expose them to health problems in order to achieve victories and sporting achievements and achieve advanced centers at the local and international levels, the good training and the use of proper diet and increased training loads no longer satisfy the hopes of athletes, so the sports field is a race in access to means and

tools that ensure the desired development and minimal possible side effects, helping to increase their endurance by improving the mechanisms of energy production and keep the stocks in the muscles and raise the level of nerve excitement.

Both Abo Elela Abd Elfattah, Ahmed Nasreldin (2003) and Garber, C.E. et al. (2011) and Kurosaki T. et al. (2015) mentioned that immunology is one of the most important contemporary sciences because it is related to the various health problems that confront humans in two directions, one is related to the achievement of sports championships through different competitions, the other is related to sports and immunology is related to both directions, immunity is a functional system consisting of many billions of lymph cells and these cells resist the alien beings that attack the human body, the immune system is an important mechanism of internal equilibrium in the body, and it invalidates the work and protects us from bacteria, viruses and cancer cells. (1:34)(11: 1334-1359)

Jeukendrup A.E. (2010) and Degn SE. et al. (2013) Indicates that the human immune system is extremely complex and responsive to any exciting, and includes a variety of physical elements, cell types, hormones and

reactive variables, and these responses are carefully coordinated to protect body tissues against pathogens, Multiple factors affect the athlete's resistance to the disease, and immune system functions can be negatively affected by some of these factors such as genetic immunity efficiency, unhealthy nutrition, physical and psychological stress and disturbances in normal sleep times.(17:54)(9: 181–93)

Farha Alshennawi, Medhat Kassem (2002) and Gibala et al. (2013) Shows that there is a fine line that separates the regular physical load based on basis science fundamentals which leads to a different body efficiency including the immune system, In contrast the physical load is high intensity which is a heavy burden on the body systems, causing damage and relative decline from the situation that had until recovery. (10:13) (12: 51-60)

Amir Refaat (2008) and Restifo NP. et al. (2013) Mentioned that sports training has a great impact on all the different of body systems the most important is the immune system, sports training is a state of physical activity which causes many forms of complex pressure on the player's body especially the immune system which represents the basic line of defense of the body against any hostile and exotic objects included viral and bacterial infections, where the pressure is due to the intensity and duration of the training and the environmental condition surrounding the athlete. (5:26)(24: 556–63)

Both Brouns SJ.et al.(2008) and Heinrich et al. (2014) Suggest that intensive exercises lasting one week or more which are frequently observed over a competitive season or underperformance syndrome, may lead to impaired chronic immune function and increased risk of infection, Properly regulated sports activities are among the most important factors that help stimulate the immune system, studies and research have shown that people who exercise more often resist environmental toxins and radiation , In contrast lack of physical activity and lack of exercise lead to the accumulation of harmful metabolic products and bacteria and viruses.(38: 960–4)(16: 789)

Maughan R.J. et al. (2010) and Justin M. G. et al. (2014) Says that the training modules with maximum and high load or endurance competitions such as marathon, biking, running and long distance, are forms of physical stress that lead to severe physiological changes and weak immune system of athletes, which is linked to increased susceptibility to infectious diseases, especially inflammation of the device upper respiratory tract and lungs.(22)(18)

Blannin A.K. (2006) and Broinson P.G. (2007) and Nieman D.C. (2008) Studies have shown that exercise has a positive or negative effect on the effectiveness of the immune system ,and depends on the nature of the exercise, intensity, size, time and rest periods as well as on fitness, age and nutrition, Thus the results are variable and not fixed, for example cortisol hormone is an immunosuppressive hormone especially when it is excreted over and more, but its mild secretion leads to the desired positive effect of immunosuppressive, and all previous factors combined lead to a reduction even partially immune to the athlete.(6: 67–89)(41)(45: 310–320)

Cooper D.M. (2007) and Rua R. et al. (2015) Reached that the chronic effects of the maximum training load not only pose a risk for coronary artery inflammation but also reduced the numbers of leukocytes in comfort compared to people in normal condition and In case of physical activity, low concentration of immunoglobulin's (IgG, IgA and IgM) in saliva, and increased cytotoxic activity, due to several causes such as Weak immune cell function due to repeated bouts of strenuous exercise, high levels of stress hormones and especially cortisol , levels of glutamine in plasma may become a cause of chronic depression, and insufficient time available for the immune system to rest.(42: 700–709)(26: 319–32)

Ahmed Nasrelddin (2014) agrees with Skelly et al. (2014) That the practice of prolonged strenuous training leads to a temporary decline in various aspects of immune functions, the most important of which is the change in the neutral lymph cells neutrophil, the reproduction of the cells of the lymphocyte and the change in monocyte cells , also adds that these previous changes usually persist between 3:24 hours after the completion of the training exercise, depending on the severity of the training load. (4:259)(28: 845-848)

Zagatto et al.(2011) Explains that one of the most important physiological processes affecting the nature of performance is the efficiency of the player in the rapid healing processes during the game itself , during these operations the body can compensate the PC and ATP where it takes (2:3) minutes as possible inhalation of oxygen stored in the muscle is combined with the myoglobin during a period of (1: 2) minutes. Fatigue and muscle stress are accompanied by an increase in blood enzymes, in particular the creatinine kinase enzyme (CK), which is very important in skeletal muscle activity, the high enzyme (CK) after the performance indicates damage to muscle tissue, and is considered an indicator of muscular pain and the occurrence of muscle ruptures. (33)

Thompson et al. (2013) and Mathis Lilley et al. (2014) Explain that the Crossfit program is not a specialized fitness program but a training method aimed at developing and the elements of physical fitness like cardiovascular and respiratory endurance, endurance, strength, flexibility, strength, speed, coordination, agility, balance, and precision with , and focus on multi-joint functional movements that use a wide range of exercises. (30: 215-217)(21)

O'Hara RB. (2012) and Bowles, Nellie (2015) Refers to the Crossfit training is a fitness system like any other exercises that do on a daily basis such as running, rowing, carrying weights, etc., but the method of performing these exercises is different, as the athlete chooses a range of exercises as three to five exercises, such as jump the rope for a number of times or minutes, then run for several minutes and rowing for several minutes, and the trainee continues to repeat these exercises throughout the duration of the training without any rest between these exercises, so the Crossfit exercises are a high intensity exercise. (32: 985-90)(39)

Brigham, Lincoln (2006) and Bolger C. (2011) Said that Crossfit exercises are one of the most widely practiced exercises around the world , and they have become very popular among people of different age groups especially young people , they help to raise the spirits of young people and enable them to feel that they can perform any of the different activities ,the exercises performed by the trainee vary depending on the level of fitness and the desired goal of the exercise, such as increasing muscle mass, weight loss, or increased physical fitness. (40)(7: 1059-1065)

Gomes CE. et al. (2010) States that Crossfit exercises help break the killer routine that infects many people during exercise, When performing Crossfit exercises you perform different exercises every day, Exercises increase physical fitness and get rid of many other diseases. (13: 199-205)

Helenius I. et al. (2005) and Sibley et al. (2012) Points that despite the many different pros of Crossfit training, it also has some disadvantages that may prevent some people from performing it, The negatives of cross fit exercises usually stem from their high intensity, it does cause a high rate of injury among people, failure to comply with the right way to perform exercises can cause significant injuries. it is also not recommended for people with heart problems as they may be a major a big load on the heart, pregnant women are also not advised to perform these exercises. (15: 565-574)(27: 42-48)

Weisenthal et al. (2014) and Whyte et al. (2010) Confirms Crossfit exercises are not a good exercise for beginners, so the intensity of these high exercises may expose the novice to a number of different injuries, so it is advisable to perform different exercises for beginners instead of these exercises, and it is also important not to exercise Crossfit exercises except under the supervision of the trainer. (34)(35: 1421-1428)

Many studies have pointed to the impact of different training loads on vital system of the body where it may be reflected in the affirmative, such as increasing the preventive strategy of the human body, or as a negative such as the inability of the individual to resist the disease, and the researcher noted through his knowledge of person and scientific research and network Information that none of this research has been subjected to the study of changes in body system as a result of the performance of Crossfit exercises, which prompted the researcher to conduct such a study in order to identify the impact of Crossfit training on the immune and physiological responses , Which could lead to a fall in the players level during training or competitions..

Research Objective:

The aim of this research is to study the impact of Crossfit training on immune responses (Granulocyte, Lymphocytes, Monocytes, Killer cells CD-16, killer cells CD-56, Killer toxic cells, Leucocytes), physiological responses (Lactic acid percentage, glycogen, transaminase enzyme (SGOT), Hydrolyzed enzyme (LDH), Creatine phosphokinase (CPK), Speed of red blood cell deposition (ESR).

Research hypotheses:

There are statistically significant differences between the pre and post measurements in favor of post measurement in the effect of the exercises of Crossfit training on immune responses (Granulocyte, Lymphocytes, Monocytes, Killer cells CD-16, killer cells CD-56, Killer toxic cells, Leucocytes), physiological responses (Lactic acid percentage, glycogen, transaminase enzyme (SGOT), Hydrolyzed enzyme (LDH), Creatine phosphokinase (CPK), Speed of red blood cell deposition (ESR).

Research procedures:

- Methodology: The researcher used the experimental approach using an experimental group and a control group, using pre and post measurements.

- Sample: The sample of the research was chosen purposely, the sample consisted of (10) young football player at Ceramica Cleopatra in Cairo, and were divided into two groups, the experimental group consisting of (6) player and applied to them the Crossfit training program Appendix (1) , and control group consisting of (6) player performed the endurance exercises Appendix (2).

- Conditions for sample selection: The coach's consent to conduct the study, The consent of the players to withdraw the blood sample, Safety of the functional system of the players after signing the initial examination by a specialist doctor, Non-participation of members of the sample in other research requires the performance of physical effort may affect their response during the basic experience.

Table (1)
Research sample description (N=10)

Variables	unit	Mean	S. deviation	Median	skews
Age	year	18.61	3.18	18.01	0.57
Length	cm	177.87	14.02	178.12	0.49
Weight	kg	70.51	3.95	71.50	0.38
Training Age	year	9.57	1.09	9.16	1.13

Table (1) show the Skews of the research sample was limited to (± 3) in the variables under study, indicating the homogeneity of the research sample.

Table (2)
Research sample description in immunological and physiological variables (N=10)

Variables	unit	Mean	S. deviation	Median	skews
Granulocyte	Mic/L	3.17	0.12	3.2	0.44-
lymphocytes	Mic/L	1.28	0.14	1.6	1.09-
monocytes	Mic/L	0.43	0.02	0.43	0.36
killer cells CD-16	Mic/L	15.96	0.90	16.0	0.74
killer cells CD-56	Mic/L	14.52	0.77	15.0	1.34-
killer toxic cells	Mic/L	41.52	0.63	41.33	0.42
Leucocytes	Mic/L	5.51	0.13	5.4	1.16
Lactic acid ratio	%	19.63	0.73	19.35	1.96
Glycogen	%	11.01	0.49	11.05	0.11
Transaminase enzyme (SGOT)	IU / L	23 .25	0.61	25.13	1.02-
Hydrolyzed enzyme (LDH)	IU / L	180.95	2.38	180.65	79 .0-
Creatine phosphokinase (CPK)	IU / L	445.05	12.33	443.50	0.059
ESR deposition	Mil / h	14.30	0.470	14.00	0.945

It is clear from table (2) that the skews coefficient in the immunologic and physiological variables ranged from (1.96:1.34-) to ± 3 which indicates that the sample is homogeneous in the immunological and physiological variants and that the differences between them will not affect the results of the research experience.

Equivalence of the research sample: The researcher found the equivalence between the two groups of research (experimental - control) using (T. test) for the variables under consideration as shown in Table (3).

Table (3)

Indication of differences between the two groups (experimental - control) in search variables (N1=N2=10)

Variables	Unit	experimental group		Control group		T value
		M	± Z	M	± Z	
Granulocyte	Mic/L	3.19	0.11	3.07	0.12	1.31
lymphocytes	Mic/L	1.24	0.13	1.28	0.15	0.84
monocytes	Mic/L	0.49	0.02	0.43	0.05	0.52
killer cells CD-16	Mic/L	14.98	0.94	14.91	0.97	1.61
killer cells CD-56	Mic/L	13.22	0.77	13.51	0.71	0.96
killer toxic cells	Mic/L	41.52	0.61	41.66	0.63	0.33
Leucocytes	Mic/L	5.51	0.36	5.42	0.34	0.36
Lactic acid ratio	%	16.48	0.31	16.83	0.96	1.28
Glycogen	%	11.07	0.481	11.94	0.516	0.73
Transaminase enzyme (SGOT)	IU / L	25.24	0.44	25.80	0.73	1.53
Hydrolyzed enzyme (LDH)	IU / L	181.84	2.34	180.05	2.14	1.66
Creatine phosphokinase (CPK)	IU / L	450.10	14.44	451.00	6.73	1.90
ESR deposition	Mil / h	14.42	0.51	14.22	0.42	0.90

T Value significant level of 0.05 = 2.10

Table (3) shows that T values are less than tabular values, indicating the equivalence of the two research groups in the immune and physiological variables, as well as the absence of statistically significant differences at a significant level of 0.05 between the experimental group and the Indicates the equivalence of the two research groups.

Research Fields:

- Human field: (10) young football player, age (18) years , a doctor helped in taking Viennese blood samples to measure changing of count and function .

- Geographical area: Ceramica Cleopatra Stadium in Cairo and al-slama Laboratory for medical Analysis.

-Time period: 26/7/2018 to 30/10/2018 .

Data Collection and Tools:

The researcher has read the Arabic and English References, scientific research and the World Wide Web.

-Pre Measurements: The pre measurements were conducted during 26-27/7/2018 at Ceramica Cleopatra Stadium in Cairo and al-slama Laboratory for medical Analysis.

-The basic Study: The basic study took place from 1/8/2018 until 30/10/2018 as the following:

- Crossfit Training program: Attachments (1)

The Crossfit training program was applied in Ceramica Cleopatra stadium in the period it was designed on the following bases :

-Each exercise session took approximately one hour, including a warm-up, WOD, and a cool-down.

-Participants were educated on the workout each day, and instructed on how to properly perform each movement in order to ensure safety and decrease the risk of injury.

-The participants were allowed to attend whatever class worked best for their schedule on each given day, so there was not a specific amount of rest between each training session for the 6-week period.

-CrossFit recommends following a 3 day on 1 day off cycle or 5 days on and 2 days off cycle.

-The 5 days on and 2 days off cycle was used for this study due to possible scheduling conflicts over the weekends.

-Participants were asked to participate in CrossFit exercise sessions spread out over a six-week .

-Post measurements: The post measurements were carried out after the end of application of the training program on the study group subjects during 28/10/2018 according to the pre measurement.

- Tools and devices used in Research:

- Medical balance to measure weight in kilograms.

- Restameter for high.

- Sphygmomanometer and a medical headset for measuring blood pressure.

- Digital stopwatch to measure pulse rate per minute.

- 3 cm syringes for venous blood sampling.
- Vacutaner ampoules containing anti-coagulation fluids (EDTA) for blood retention until analysis.
- Ice Box to store ampoules containing blood until it reaches the laboratory.
- Flow cytometer.
- NK cytotoxicity

-Statistical Analysis:

The researcher used the SPSS program to conduct the following statistical transactions, Arithmetic mean , Median , Standard deviation , skews , T. Test to denote statistical differences , coefficient of change rates of averages.

Results:

Table (4)

Indication of differences between the post and pre measures of the experimental group In physical variables (N = 5)

Variables	Unit	Post measures		Pre measures		T value)%(
		M	± Z	M	± Z		
Granulocyte	Mic/L	3.19	0.11	3.57	0.13	*4.36	0.38
lymphocytes	Mic/L	1.24	0.13	1.39	0.14	*4.29	0.15
monocytes	Mic/L	0.49	0.02	1.55	0.05	*6.15	1.06
killer cells CD-16	Mic/L	14.98	0.94	15.99	0.97	*3.68	1.01
killer cells CD-56	Mic/L	13.22	0.77	14.82	0.78	*4.22	1.6
killer toxic cells	Mic/L	41.52	0.61	42.72	0.69	*7.31	0.04
Leucocytes	Mic/L	5.51	0.36	5.78	0.39	*4.18	0.14
Lactic acid ratio	%	16.48	0.31	16.55	0.63	*8.45	16.52
Glycogen	%	11.07	0.481	10.38	0.57	*2.66	31.52
Transaminase enzyme (SGOT)	IU / L	25.24	0.44	27.14	0.51	*5.58	6.61
Hydrolyzed enzyme (LDH)	IU / L	181.84	2.34	177.54	5.58	*3.25	3.63
Creatine phosphokinase (CPK)	IU / L	450.10	14.44	371.40	37.7	*1.9	13.38
ESR deposition	Mil / h	14.42	0.51	13.61	1.56	*7.23	11.26

The value of T in table at a significant level of 0.05 = 2.26

It is clear from table 4 that there are statistically significant differences between the post and pre measurements of the experimental group in the immune and physiological variables.

Table (5)

Indication of differences between the post and pre measures of the control group in physical variables (N = 5)

Variables	Unit	Post measures		Pre measures		T value)%(
		M	± Z	M	± Z		
Granulocyte	Mic/L	3.07	0.12	3.34	0.14	*2.46	0.25
lymphocytes	Mic/L	1.28	0.15	1.12	0.13	*4.71	0.16
monocytes	Mic/L	0.43	0.05	0.41	0.03	*2.63	1.26
killer cells CD-16	Mic/L	14.91	0.97	14.34	0.92	*6.84	1.61
killer cells CD-56	Mic/L	13.51	0.71	13.33	0.66	*2.74	1.54
killer toxic cells	Mic/L	41.66	0.63	41.14	0.56	*3.61	0.34
Leucocytes	Mic/L	5.42	0.34	5.23	0.25	*5.14	0.21
Lactic acid ratio	%	16.83	0.96	13.12	0.44	3.22	6.26
Glycogen	%	11.94	0.516	10.32	0.42	5.47	4.25
Transaminase enzyme (SGOT)	IU / L	25.80	0.73	22.24	0.22	1.88	2.91
Hydrolyzed enzyme (LDH)	IU / L	180.05	2.14	167.64	5.25	7.81	14.20
Creatine phosphokinase (CPK)	IU / L	451.00	6.73	348.30	53.45	2.61	11.80
ESR deposition	Mil / h	14.22	0.42	12.00	0.66	6.67	2.40

The value of T in table at a significant level of 0.05 = 2.26

It is clear from table (5) that there are statistically significant differences between the post and pre measurements of the control group in the immune and physiological variables.

Table (6)
Indication of differences between the two groups (experimental - control) in search variables (N1=N2=10)

Variables	Unit	experimental group		Control group		T value
		M	± Z	M	± Z	
Granulocyte	Mic/L	2.34	0.14	2.57	0.13	*2.16
lymphocytes	Mic/L	1.12	0.13	1.39	0.14	0.47
monocytes	Mic/L	0.41	0.03	1.55	0.05	*2.48
killer cells CD-16	Mic/L	14.34	0.92	15.99	0.97	1.85
killer cells CD-56	Mic/L	13.33	0.66	14.82	0.78	0.97
killer toxic cells	Mic/L	41.14	0.56	42.72	0.69	1.36
Leucocytes	Mic/L	5.23	0.25	5.78	0.39	2.11
Lactic acid ratio	%	13.12	0.44	16.55	0.63	*2.66
Glycogen	%	16.32	0.42	14.36	0.557	*8.34
Transaminase enzyme (SGOT)	IU / L	22.24	0.22	27.14	0.51	*4.71
Hydrolyzed enzyme (LDH)	IU / L	167.64	5.25	177.53	5.58	*2.30
Creatine phosphokinase (CPK)	IU / L	348.30	53.45	371.40	37.7	*2.17
ESR deposition	Mil / h	12.00	0.66	13.61	1.56	*2.13

T Value significant level of 0.05 = 2.10

Table (6) shows statistically significant differences between the Control an experimental groups in the immune and physiological variables.

Discussion of Results:

Table 4 shows the existence of statistically significant differences between the post and pre measurements of the experimental group in the immunological and physiological variables under study , the ratio of granulocyte to 3.57, lymphocytes to 1.39, monocytes to 1.55, killer cells CD-16 to 15.99, killer cells CD-56 to 14.82, killer toxic cells to 42.72, Leucocytes to 5.78, The ratio of the glycogen to 16.55, the glycogen to 10.38, the transaminase enzyme (SGOT) to 27.14, the hydrolyzed enzyme (LDH) to 177.54, the creatine phosphokinase (CPK) to 371.40, the (ESR) deposition to 13.61 .

This is due to the fact that the training of the athlete by using the Crossfit training, which is similar to the maximum physical exercise in terms of the occurrence of a range of immune and physiological changes, In stimulating the body to release hormones such as cortisol, which reduces the number and function of white blood cell and is called stress hormone, as the level of cortisol can increase when the intensity of training or the multiplicity of training doses or tournaments or also at a low proportion of carbohydrate in meals or at the lack of sleep.

Weisenthal et al. (2014) In the case of physical rest circulates less than half the number of white cells in the

vascular system while the rest are kept under the cover of microvascular vessels in the lungs, liver and spleen, and may affect the cardiac activity of the heart and the proliferation of blood vessels and fine hairs in the movement and release of white cells as a result of physical training, It was observed that the white cells are mobilized during physical exercise to concentrate on the muscular fibers in which the training intensifies and also which is affected by the intensity of the muscle work.(34)

This is consistent with the study of O'Hara et al. (2012) and Yaser Ismail (2017) which indicated the effects of repeated exercise periods on the same day on the number of white blood cells and activity of NK cells, and showed an increase in white cells and nitrophil cells, and lymphocyte cells to a lesser degree, and NK cells after the evening session of the rates after the morning exercise and indicates that there is interaction between the exercise and intensity.(23: 985–90)(36:45)

Also Mathis-Lilley, Ben (2014) and Ahmed Zahran (2017) The violent training leads to an increase in the number of white blood cells, nitrophil cells, to a lesser extent, the number of lymphocytes, while not affecting naturally occurring NK cells cells, and the (LDH) extract is used to extract the hydrogen atom from lactic acid and thus inhibits the accumulation of lactic acid which is one of the causes of muscle fatigue, Lactic acid is the final image of glycogen consumption in anaerobic way and metabolic processes, which leads to the decomposition of adenosine triphosphate to produce the necessary energy of stmrrar in

physical performance by aerobic oxidation process.(21)(3:45)

Coutinho A.(2015) Report that continuing to perform high-intensity physical exercises while not eliminating the fatigue caused by previous intensity by giving the necessary interruptions to the players leads to low efficiency of the immune system, The lymphocytes during training decrease in the number of players after the marathon , There is an increase in the number of lymphocytes with increased rate and intensity of training and level of physical fitness.(8: 151–68)

Taha Abdelrahim (2015) Explains that long term sports require a large amount of calories to produce energy based on carbohydrates as their primary source. Glycogen in muscle converts to glucose and then supplies the muscles with the energy required by blood glucose, Liver production of glucose, the proportion of dependence on fat is gradually increasing, and regular sports training leads to physiological and chemical changes in the blood and increase the ability of muscles to cope with fatigue caused by repeated performances of muscle contractions and the player's ability to Bear the pain and fatigue resulting from the concentration of lactic acid in the muscles and blood. (29:23)

This is confirmed by Jaime Fernández et al.(2015) Reported the acute physiological and cognitive response of two Crossfit training systems per day to determine whether the exercise meets the criteria set for improving and maintaining cardiovascular fitness in healthy adults, the measurements included maximum oxygen consumption (VO₂)(HR), and Lactate (LA) , the most important results are the acute physiological requirements of the Crossfit that have been measured resulting in significant energy consumption due to exercise intensity in healthy adults.(19: 114-124)

It is clear from Table (5) that there are statistically significant differences between the post and pre measurements of the control group in the immunological and physiological variables under study ,The ratio of granulocyte to 3.34, lymphocytes to 1.12, monocytes to 0.41, killer cells CD-16 to 14.34, killer cells CD-56 to 13.33, killer toxic cells to 41.14, and Leucocytes to 5.23, respectively. For the physiological variables, Lactic acid ratio was 13.12, Glycogen was 10.32, Transaminase enzyme (SGOT) was 22.24, Hydrolyzed enzyme (LDH) decreased to 167.64, Creatine phosphokinase (CPK) decreased to 348.30, ESR deposition To 12.00.

The researcher pointed out that to the long periods of stress training may lead to weakness in the immune

variables such as the function of isoniafil cells, lymphocytes and killer cells CD-16 , CD-56, on the contrary, moderate and controlled training may not have an effect on these variables or have a simple effect.

This is in line with the results of the Ahmed Saad study (2017) which indicates that high-intensity physical exertion leads to a decrease in the number of white blood cells and a decrease in all immune proteins, and exercises that reach stress and intensive physical exercise and stress negatively affect the efficiency of the immune system, Oxidation and weakness of antioxidants, especially enzymatic, and a significant increase in the proportion of aldehyde.(2:34)

Also the results of Kurosaki T. et al. (2015) and Medzhitov R. (2017) consistent which resulted in an increase in granulocytes, during exercise a lot of nitrophil enters the bloodstream through the bone marrow, where it helps to remove damaged cells from the muscle tissue, especially during the muscular contraction , Long term training leads to the consumption of marrow stock Bones from nitrofile faster than untrained people, which gives the opportunity to get cold and infection.(20: 149–59)(44: 819–26)

Ahmed Nasreldin (2014) and Rua R. et al. (2015) Emphasize that low-to-moderate sports training benefits the body's immune system by increasing the number of lymphocytes which improves the immune status of the player, on the other hand High and long duration lead to negative results related to the immune system and extends the impact period between 3-24 hours after training, and contributes to the physical stress experienced by the player in some training conditions in addition to a number of other metabolic and hormonal factors in inhibiting the immune system. (4: 108)(26: 319–32)

Bowles, Nellie (2015) and Ahmed Zahran (2017) indicates an increase in monocytes during high-intensity training, which is produced in large numbers and is concentrated in the musculoskeletal muscle during the occurrence of the muscular contractions, which destroys the microbes that are exposed to the body and contributes to the high efficiency in resisting and reducing the effects of inflammation, Positive effect on improvement of morphological variables of nitrophil cells, pulse rate, oxygen ratio in blood, improvement of biomagnetic variable, improvement of digital variable variable for 100 m freestyle. (39: 96)(3:45)

Gomes CE, Stone V, Florida-James G (2010)According to when the high intensity exercises are completed, the amino acid levels in the muscles are at their lowest for

(4:6) hours after training. The body needs more than (24) hours until the acid and enzymes content the protein acts as an adjunct to the performance of athletes. It plays an important role in increasing glycogen storage in the liver, which helps to increase the intensity of training. (13: 199–205)

Hatem Sabri (2012) Reached a change in the percentage of white blood cells (bazophil, monoset) a change in red blood cells represented in the concentration of hemoglobin and the amount of red blood cells relative to the total volume, and an improvement in systolic blood pressure, Physical variables (muscular strength, muscular strength, speed, agility, endurance) for footballers during the training season. (14:156)

It is clear from Table (6) that there are significant statistical differences between the pre measurements of the experimental and control groups in the immunological and physiological variables. The results can be found to be similar in the physical loads of the crossover training and endurance exercises aimed at developing the elements of fitness strength, , speed, agility, balance, focusing on multi-joint functional movements that use a wide range of exercises, as well as a range of immunological and physiological changes.

This is consistent with the results of O'Byrne KJ. et al. (2011) Which indicated that the white cells are the main component of the immune system and decrease the functional capacity and the preparation of these cells because of repeated doses of intensive training long-term, and may be due to increased level of pressure hormones during training and decreased supply of leukocyte cells in the blood circulation of bone marrow and low concentration of glutamine in Which causes a decrease in immunity in the body.(31: 473–83)

This is consistent with the results of Matzinger P. (2012) where acute doses of sports activities to produce indicators that are somewhat similar to those resulting from infection such as a significant increase in the number of lycosites, mostly nitrovil and this is strongly related to the duration of physical training, and there is also an increase in the concentration of plasma components that urge On the smooth flow of lycosite, including inflammatory agents such as interferon, interleukin 1, 2, 6, C-reactive protein, an increase in Lactic acid ratio Glycogen, Transaminase enzyme (SGOT), Hydrolyzed enzyme (LDH), Creatine phosphokinase (CPK) deposition and ESR deposition.(34: 301–5)

This is consistent with Murphy K, Weaver C. (2016) The practice of long-term stress training leads to a temporary

decline in various aspects of immune function, most notably the change in neutrophil lymphocytes, The growth of lymphocyte cells and the change in monocyte cells, He adds that these previous changes usually continue between 3:24 hours after the completion of the training exercise, depending on the intensity of the size of the training load (23: 259)

Farha Alshenawi, Medhat Kassem (2002) and Romero P, et al. (2006) The standardized sports training improves and increases the activation of the cells of the immune system, and is a strong line of defense to prevent the injuries that can be exposed to the player, and that continuing training with the use of training loads high intensity for a long time leads to reduced white blood cells and low The functions of defense in the body, therefore, the possibility of emergence of diseases and the large number of injuries and prolong the duration of treatment. (10: 71)(25: 187–224)

Cooper D.M.(2007) and Degn SE., Thiel S. (2013) Found that severe physical exercise leads to a temporary increase in cell activity, killing cell NK, leading to reduced lymphocyte responses, and high exercise activation of the nitrophil cells, however, reduces their response to excitation by secreting LPS, which inhibits lymphocyte function and decreases its lethal ability after physical training lasting several hours. (42)(9: 181–93)

Blannin A.K. (2017) Reported that during the recovery of the physical training, the activity and number of cells killed by the NK is less than before the physical training, The number of lymphocytes may be reduced for several hours after physical training, especially when the training doses are acute or long-term. Also, the activity of T-lymphocytes , occurs after long term training that stops the activity of B-lymphocytes in the production of immunoglobulin ion of antibodies.(6: 67–89)

Ahmed Hashem (2016) Asserts that the accumulation of lactic acid in muscle and muscle rupture during exercise causes pain due to the stimulation of sensory neuromuscular inflammation. Lactic acid is responsible for pain during exercise, as lactic acid does not remain in the muscle more than (3:50) minutes after the training and then turns into muscle glycogen or stockpile in the liver or glucose or Lactic acid ATP. (2: 134)

Agerberth B., Gudmundsson GH. (2006) which reached an increase in red blood cells, hemoglobin and hemotecrit for volleyball players, T & B lymphocytes increased after the training test and improved significantly during rest, Cortisol levels increased after exercise directly and during rest compared to the section the basic, Core cortisol levels

and after training were higher in statistical terms at the end of the season than at the beginning.(37: 67–90)

Conclusions:

Crossfit training leads to some immune responses (Granulocyte, lymphocytes, monocytes, killer cells CD-16, killer cells CD-56, killer toxic cells, Leucocytes), physiological responses (percentage Lactic acid, glycogen, transaminase enzyme (SGOT), Hydrolyzed enzyme (LDH), Creatine phosphokinase (CPK), Speed of red blood cell deposition (ESR).

Recommendations:

In light of the research objectives and the findings of the researcher, the following recommendations were made:

1 - use Crossfit training as one of the exercises high physical loads of intensity to be similar to the effects of immunological and physiological and extreme endurance exercises high intensity.

2 - not to practice Crossfit training for young children and to the risks that may occur for the body's vital organs.

3 - Reduce the time period for the performance of Crossfit training during the performance of the players of the training units.

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