



Original Article

Title:

The effect of Play off matches on oxidative stress and its relation with some inflammation indicators in volleyball players"

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Abstract

The research aims at defining the effect of play off matches on: Oxidative stress (Malondialdehyde (MDA), Phospho-creatine Kinase (CPK), Lactate) , Some inflammation indicators as (Inter-Lokine 6 concentration (IL-6), Tumor necrosis factor alpha (TNF-a)),Defining the relationship between oxidative stress and inflammation indicators.,The researcher has used the experimental method (pre/ post measurements) on one experimental group. The study variables were studied in the pre and post measurements (immediately after the final match of play offs). The research sample was ten volleyball players from the first male volleyball team of Zamalek Club who are registered in Egyptian Volleyball Federation. The research sample was selected purposely. The main results are: Play off matches lead to oxidative stress raising as Malondialdehyde (MDA), Phospho-creatine Kinase (CPK), Lactate., Play off matches lead to inflammation indicators raising as Inter-Lokine 6 concentration (IL-6), Tumor necrosis factor alpha (TNF-a),There is an significantly correlative relationship between oxidative stress variables as Malondialdehyde (MDA), Phospho-creatine Kinase (CPK), Lactate and inflammation indicators as Inter-Lokine 6 concentration (IL-6), Tumor necrosis factor alpha (TNF-a).,Play offs need special training techniques and recovery procedures to protect players from muscle injuries.

Keywords :

Injuries ; Inter-Lokine ; 6 Oxidative stress ; inflammation indicators

Introduction



Sport is characterized by its modern philosophy in developing physical and physiological fitness level for athletes. That is by adapting with different training loads which are suitable for the activity nature and match conditions. Different intensive physical loads, which athletes expose during training or matches, affect on all vital body systems and increase their efficiency in work. These loads increase the athletes ability to fulfil the best achievements and protection from injuries. This needs physical and psychological preparation for the athletes which conveys with different biological science development and progress.

Increasing training loads, which is not suitable for the athlete's abilities and preparation level, is the first dangerous factor. This makes researchers and scientists research for the ways and methods which help in facing these severe intensive physical loads needed for modern training and competition techniques and protecting athletes from negative sports practices and morbid injuries. That is through planing training programs and balance between loads and recovery techniques before, during and after the training or the match. Neglecting physical effects of these loads on the body leads to negative factors and reaching to stress state so inflammation indicators and oxidative stress are important and necessary variables, through them it is possible to infer negative and positive effects on athletes as a result of performing these training loads. That is because cytokines arrange the body's response for inflammation occurrence. Cytokines are Inter-Leukin(IL), Inter-feron(IFN) and Tumor necrosis factors(TNF). Oxidative stress refers to the body's ability to arrange antioxidants defenses. (10)(14)(15)(19).

Inter-Leukin 6(IL-6) is one of the biochemical indicators for inflammations which are occurred as a result of some muscle ruptures in the contractile components of the muscle during aggressive physical performance in addition to decreasing glucose level in the working muscle. Inter-Leukin 6 concentration levels increase through aggressive physical labour because it has a role in liver alerting to increase liver's glycogen breaking down. From the cytokines which are related to inflammation there is Tumor necrosis factor alpha TNF-a. It is the main mean for inflammatory response which stimulates physiological processes to produce leukocytes and direct them to inflammation sites to reduce and finish inflammation (11)(17)(18)(19)(2)(3).

Sports performance of different exercises increases free radicals and peroxides which cause the cell's components damage as proteins, fats and DNA. This leads to oxidative stress which can be inferred through Malondialdehyde (MDA), Phospho-creatine Kinase (CPK) and Lactate as a result of the body's disability to balance between free radicals production increasing and getting rid of these free radicals.

This may affect on the connection between cells and the signals between them. This also may affect on the athlete's level during training and matches which causes several sports injuries (15)(25).

Through the position of the researcher as sports injury and physical rehabilitation specialist for the first volley ball team in Zamalek club, the researcher noticed the prevailing of muscle injuries among the players of different teams through the finals of premier league and Egypt cup which were played for the first time in Egypt by the play off system where three followed matches



are played to define the winner team which wins two matches of the three ones. This is what motivates the researcher to do this research as an effort to define biochemical changes indicate the oxidative stress and some inflammation indicators happened during the play offs due to loads.

The research aims:

The research aims at defining the effects of play offs on:

- 1- Oxidative stress (Malondialdehyde (MDA), Phospho-creatine Kinase (CPK), Lactate)
- 2- Some inflammation indicators as (Inter-Lokine 6 concentration (IL-6), Tumor necrosis factor alpha (TNF-a)).
- 3- Defining the relationship between oxidative stress and inflammation indicators.

The research hypotheses:

- 1- There are significantly correlative differences between the mean of pre and post measurements of oxidative stress(Malondialdehyde (MDA), Phospho-creatine Kinase (CPK), Lactate).
- 2- 2- There are significantly correlative differences between the mean of pre and post measurements of inflammation indicators as (Inter-Lokine 6 concentration (IL-6), Tumor necrosis factor alpha (TNF-a)).
- 3- 3- There is significantly crrelative difference between oxidative stress factors and inflammation indicators.

The research terms:

Oxidative stress:

Oxidative stress is a state of unbalance between oxidants and antioxidants. This unbalance leads sometimes to stop antioxidants function and disorder in their production because there are big amounts of Reactive Oxygen Species (ROS). The free radicals are more than 100 species which are generated inside the tissues and the most notable of them are Reactive Oxygen Species (ROS) which lead to oxidative stress happening. Oxidative stress means changing the balance between oxidants and antioxidants in favor of the oxidants(9).

Or it is a reflection of unbalance produced by increasing active oxygen atoms activity and peroxides which damage all the cell components as protein, fats and DNA and reduce the biological ability of the body to repair the damage and deformation. This is naturally accompanied by increasing antioxidants defenses(11)(25).

Malondialdehyde (MDA):

It is an organic compound symbolized $CH_2(CHO)_2$. It is colorless and highly reactive compound. It is found in urine and blood and produced as a result of fat oxidation. It is an indicator of oxidative stress(3).

Muscle Inflammation:



It is one of Cytokines species. It is divided into pro-anti Inflammation Cytokines. Their concentration levels increase as a result of increasing fatigues wastes which are produced by severe intensive physical loads as (IL-1), (IL-6) and (IL-10). (2)(26)

Inter-Leukin 6(IL-6):

It is an indicator of muscle inflammation and it is responsible for activate nitrophil production in bone marrow. It is produced from mononuclear macrophages, vascular endothelial cells, lymphocytes and fat and muscle tissues. It is one of pro inflammatory Cytokines. After immune processes have finished, the body returns to its nature. Cytokines increasing means there is muscle damage or inflammatory response(22)(24)(27).

- Tumor Necrosis Factor (TNF-a):

It is one of the Cytokines which refers to inflammation happening. It is the main mediator where inflammatory response arouses physiological processes to produce Leukocytes to reduce and remove inflammation(29).

Literature review:

1- **"Byston Akram Ahmed and Diar Maghded" study (2020) (4)** titled "The effect of anaerobic stress on oxidation and some of its antioxidants and its relationship with creatine kinase in football players". The study aims at studying the effect of anaerobic stress on oxidation and some of its antioxidants in blood for football players and defining the relationship between oxidation and its antioxidants with creatine kinase in blood after the anaerobic stress.

The two researchers used the descriptive method because it is suitable for the research nature. The research sample was (10) players from football team of Hendren Club. It is one of premier clubs in Kurdistan Region. These players were tested for jogging test on anaerobic stress rotor bar in temperature from (22-25) by Brain test for research variables scale. The two researchers found out that there are no significant differences in glutathione enzyme before and after anaerobic stress. There are significant differences in Malondialdehyde (MDA) concentration and (Creatine Kinase, Total antioxidants, SuperOxide Dismutase, Total Organic Carbon) before and after the anaerobic stress. There is significant relationship between Malondialdehyde (MDA) and Creatine Kinase after the anaerobic stress.

2- **Casuso et al. study (2018)(16)**, titled "Comparative study between muscle damage and muscle inflammation among swimming and sprint athletes". This study aims at making a comparison between muscle damage, metabolism, muscle inflammation and sodium(Na) and potassium(K) concentration levels as a response of performing speed training unit between sprint and swimming athletes. From most important results is that there are significant differences in (TNF-a) and (IL-10) between the sprint and swimming athletes.

3- **Wadley A. et al. study (2016) (31)** titled "The effect of high and low intensity exercises on anti inflammation and antioxidants". The study aims at making a comparison between the happening changes in direct responses in oxidative stress and inflammation in relax state, in low intensive exercises and Low-volume high-intensity exercises. The most important results are: in



the end of all exercise units, there is increasing in Inter-leukin 6, Inter-leukin 10 and Total antioxidants after 30 minutes of the post measurement.

4- **Ehab M. Ismail study (2015)(3)**, titled "Inter-leukin 6 and 10, Tumor necrosis factor alpha, Glutamic-oxaloacetic transaminase (GOT)enzyme and Glutamate Pyruvate Transaminase(GPT) enzyme responses for speed exercises and muscle endurance as indicators of muscle inflammation among football players". This study aims at defining Inter-leukin 6 and 10, Tumor necrosis factor alpha, Glutamic-oxaloacetic transaminase (GOT)enzyme and Glutamate Pyruvate Transaminase(GPT) enzyme responses for speed exercises and muscle endurance as indicators of muscle inflammation among football players. The important result was that speed and muscle endurance exercises lead to increasing Inter-leukin 6 and 10, Tumor necrosis factor alpha, Glutamic-oxaloacetic transaminase (GOT)enzyme and Glutamate Pyruvate Transaminase(GPT) enzyme responses immediately in post measurement and the concentration percentage of these responses were reduced during recovery period.

5- **Rana Fadel Kassem (2013)(6)**, titled "Studying the effect of sports exercises on some antioxidants levels and lipid peroxidation among female students in Faculty of physical education". The study aims at defining the effect of sports exercises on antioxidants levels, enzymatic and non-enzymatic oxidation levels and lipid peroxidation among female students of Faculty of physical education through measuring the effectiveness of SuperOxide Dismutase (SOD) and Glutathione Peroxide as enzymatic antioxidants, and the concentration of Glutathione, uric acid and vitamine E as non-enzymatic antioxidants in addition to measure Malondialdehyde(MDA) as an indicator of lipid peroxidation. The study was applied on (24) of female students in fourth grade of Faculty of physical education. Their ages were (18-24) years. The results were compared with (21) female students of the same ages but they do not practice sport. The results defined significant increasing in Malondialdehyde(MDA) and significant decreasing in concentration of uric acid, vitamine E and glutathione among these female students (experimental group) in comparison with control group. The result was that severe sports exercises increase oxidative stress and reduce antioxidants levels.

Material and Methods

The research method:

The researcher used the experimental method (pre/post) measurements on one experimental group. The variables were studied directly in pre and post measurements (after finishing the last match of play offs).

The research sample:

The research sample was selected purposely form the first male volleyball team in Zamalek club who are registered in Egyptian volleyball federation. They are (18) at first and reduced to (10) because (8)players are not suitable for the experiment and are excluded.

The conditions of the research sample selection:



- 1- To be from the first volleyball team in Zamalek club in the sports season 2021/2022.
- 2- Actual participation in Egypt Cup final play off matches. The participation rate should be 75% at least of the time of the three matches.
- 3- Acceptance of participation and taking blood samples for the research.

Statistical characterization of the research sample

Table (1) Statistical characterization of the research sample in variables under consideration

Variables under consideration		Measuring unit	Arithmetic mean	Median	Standard deviation	Skewness modulus
Growth rates	Age	Year	27.6	27.5	2.88	0.10
	Height	Cm	191.45	190.75	6.17	0.34
	Weight	Kg	84.3	84.25	4.49	0.03
Oxidative variables	MDA	Nmol/L	16.58	16.69	0.41	0.80-
	CPK	Mg/dl	101.03	100.95	1.60	0.15
	Lactate	Mmol/L	1.63	1.70	0.21	0.10-
Inflammation indicators	IL-6	Pg/ml	1.60	1.64	0.23	0.52-
	TNF-a	Pg/ml	2.22	2.22	0.14	0.00

From table (1), it is clear that skewness modulus for the study variables of some growth rates under consideration in the research sample are from -3 to +3 which means moderation of the research sample data.

The tools and devices used in the research:

- 1- Data registration forms: the researcher designed a form for research sample data registration and forms for putting the medical analysis results for biochemical variables (attachment 1)
- 2- Scaling measuring tape (for measuring height in cm.)
- 3- Calibrated medical scale (for measuring weight in kg.)
- 4- Desk top computer
- 5- Spectrophotometer and centrifuge for blood components separation
- 6- Some plastic tubes for putting blood samples with anti-coagulant substance
- 7- Ice box for keeping blood samples until transporting them to the medical analysis lab in El kassr El einy Faculty of medicine
- 8- Syringes and disinfectants
- 9- Analytical reagents are used to define the biochemical changes as (Kits)(TNF-a elisa kit/ IL-6 elisa kit/ MDA competitive eia elisa kit)

Research executive steps:

Pilot Study:



The researcher did the pilot study on Saturday 16/4/2022 - Monday 18/4/2022 to define the medical labs where there are analytical reagents (kits) which are necessary for measuring biochemical changes under consideration as:

- variables of oxidative stress Malondialdehyde (MDA), Phospho-creatine Kinase (CPK), Lactate)
- Inflammation indicators as (Inter-Lokine 6 concentration (IL-6), Tumor necrosis factor alpha (TNF-a).

The researcher went to alot of labs and finally set the samples to biochemistry lab of Elkasr Eleiny medicine Faculty in Cairo University.

1- The pre measurment:

Blood samples were taken from the team players (18) in pre measurment and every blood sample has a code on the tube. The blood samples were put in tubes contained anti-coagulant substance on Wednesday 21/4/2022 before the final match in Egypt cup play offs between ElAhly and Zamalek two days after the camping of the team during the rest and transported to Elkasr Eleiny medicine Faculty lab in Cairo University.

2- The stage of play off match:

The final match was played between the research sample members of the first volleyball team by play offs system where three matches were played on (Friday 22/4/2022, Saturday 23/4/2022, Sunday 24/4/2022)(attach. 2)

3- Post measurment:

The post measurement was performed immediately after the play offs third match on Sunday 24/4/2022. The blood samples were put in the fridge and transported to the lab of Elkasr Eleiny medicine Faculty lab in Cairo University on Monday 25/4/2022.

Statistical processes:

The researcher used the suitable statistical processes by using Statistical Package for the Social Sciences (SPSS). The following statistical processes were used: Arithmetic mean , Median , Standard deviation , Z- test , Correlation coefficient

Results and Discussion

First: The results presentation:

Achieving the research objectives and testing the hypotheses, the researcher shows the research results and discusses them as follows: First: Showing and discussing the first hypothesis results: there are significant differences between the pre and post measurements arithmetic mean in oxidative stress variables (Malondialdehyde (MDA), Phospho-creatine Kinase (CPK), Lactate)



Table (2) : The significance of the pre and post measurements differences for the research sample in oxidative stress variables (Malondialdehyde (MDA), Phospho-creatine Kinase (CPK), Lactate)

Measurements Variables	Measurement units	Pre measurement		Post measurement		The difference between the two measurements	Z value
		Mean	-/+ S	Mean	-/+ S		
MDA	Nmol/L	16.58	0.41	46.05	1.17	29.47	225.08-
CPK	Mg/DL	101.03	1.60	230.78	6.35	129.75	256.32-
Lactate	Mm/L	1.63	0.21	6.48	0.45	4.85	72.69-

N= 10
Z value= 1.96+/-

Table (2) reveals that there are significant differences between the arithmetic mean of pre and post measurements in oxidative stress variables (Malondialdehyde (MDA), Phospho-creatine Kinase (CPK), Lactate) because the calculated Z value is bigger than tabular Z value.

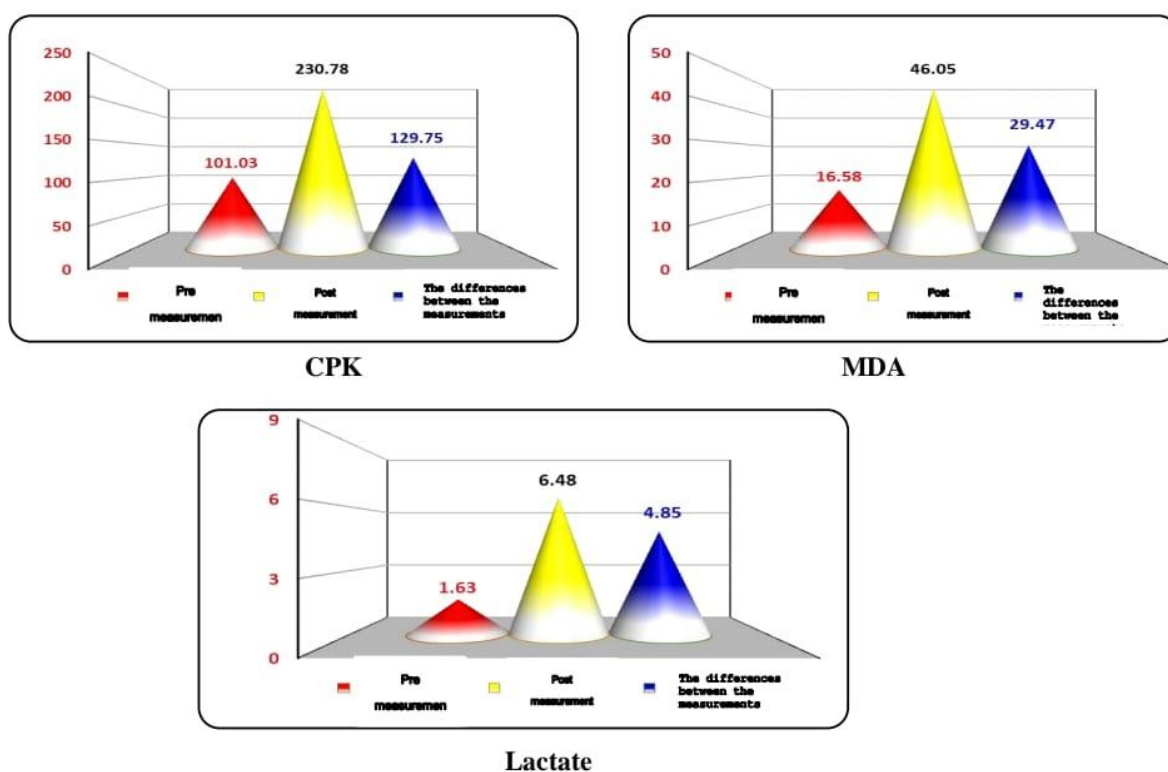


Figure (1) :The differences between pre and post measurements mean in oxidative stress variables Malondialdehyde (MDA), Phospho-creatine Kinase (CPK), Lactate)



By considering the mean of pre and post measurements of oxidative stress variables as Malondialdehyde (MDA) we find the pre measurement is 16.58 nmol/L but the post measurement is 40.06 nmol/L and the difference is 29.47. The pre measurement in Phospho-creatine Kinase (CPK) is 101.03 mg/dl, the post measurement is 230.78 mg/dl so the difference between the two measurements is 129.75 mg/dl. The pre measurement in Lactate is 1.63 mm/l , the post measurement is 6.48 mm/l so the difference between the two measurements is 4.85 mm/l.

The researcher attributes this big difference between the pre and post measurements in oxidative stress variables as Malondialdehyde, Phospho-creatine Kinase and Lactate to the nature of play offs where the matching load is intensive and needed to play three consecutive days.

The sports performance of different exercises increases the production of Free radicals and Peroxides which cause the damage of cell components as protein, fats and DNA. This damage leads to oxidative stress and it is inferred by Malondialdehyde, Phospho-creatine Kinase and Lactate. In this state the body is not able to make the balance between increasing free radicals and getting rid of them so this unbalance affects on the connection between cells, cellular signals, the sports level during the matches and causing several sports injuries(15)(25)

Moderate amount of oxidative stress leads to adaptation process but big amount of oxidative stress damages cells and plays a role from the genetic levels to non-genetic pattern. The effect of oxidative stress depends on the kind and intensity of the exercise which may protect or damage this state (20)(28).

These results are in accordance with a study used a graduated exercises with moderate intensity and other exercises with high intensity to analyze the oxidative stress (58). The study found that moderate intensity exercises do not increase oxidative stress but high intensity exercises increase oxidative stress and muscle damage. Well trained trainees are able to deal with oxidative stress easily during exercises (8). This is in accordance with what Volek et al (2002)(30), the study of Rasha Esameldeen (2002)(5) and the study of Sahar Mahoud Gohar (2002)(7). All these studies ensured that Malondialdehyde (MDA) level increased greatly after the severe physical load.

From table (2), it is clear that there are statistically significant differences between the pre and post measurements in Lactate variable. Pre measurement is 1.63 mm/l and the post measurement is 6.48 mm/l and the difference between the two measurements is 4.86 mm/l.

Lactate level is greatly increased in the post measurement as a result of severe physical loads during the following matches. It is known that during high intensive exercises there is high oxygen consumption in metabolism process and this increases electron deposition inside mitochondria which increases free radicals and this leads to increase Malondialdehyde (MDA), carbon dioxide and Lactic Acid inside the skeletal muscles.

This is in accordance with Abu Elelaa Ahmed Abdelfatah (2005)(1). He ensures that the more increasing oxygen consumption ($v O_2 \max$) the more stress exerted and the more leaking



cracks in the respiratory chain especially in mitochondria which increases lipid radicals and causes oxidative stress.

From table (2), there are statistically significant differences between the mean of the pre and post measurements in Phospho-creatine Kinase (CPK). The pre measurement is 101.03 mg/dl, the post measurement is 230.78 mg/l and the difference between the two measurements is 129.75 mg/dl. Phospho-creatine Kinase level increasing refers to severity of the stress and damage of the skeletal muscles. Phospho-creatine Kinase rate increasing is due to several illness states and in athletes as a result of muscle severe damage and Rhabdomyolysis during severe exercises, muscle inflammation, Potassium shortage and muscular dystrophy (23)(13).

Elosua (2003) refers to the unbalance between free radicals production and protection systems of antioxidants leads to oxidative stress. Body produces Reactive Oxygen Species in small amounts during rest period and they are free radicals called Reactive Oxygen Species and antioxidants get rid of them but during sports exercises, body produces ROS more than the ability of the antioxidants mechanism to get rid of them, so the body cells and tissues are damaged. The more the exercises intensity is, the more ROS production is.

Enzymatic and non-enzymatic antioxidants which are taken in nutrients or body produces them are used to protect the cell from the oxidation dangers through removing Reactive Oxygen Species and turn them into less active molecules (21).

From the previous discussion, play offs matches need special physical rehabilitation, special nutrition system and recovery procedures to protect athletes from oxidative stress.

Here the first hypothesis is fulfilled which is: There are significant differences between the arithmetic mean of pre and post measurements in variables of oxidative stress (Malondialdehyde (MDA), Phospho-creatine Kinase (CPK) and Lactate).

Second: Presentation and discussion of the second hypothesis: There are significant differences between the arithmetic mean of pre and post measurements in variables of inflammation indicators as Interleukin 6, Tumor necrosis factor alpha (TNF-a).

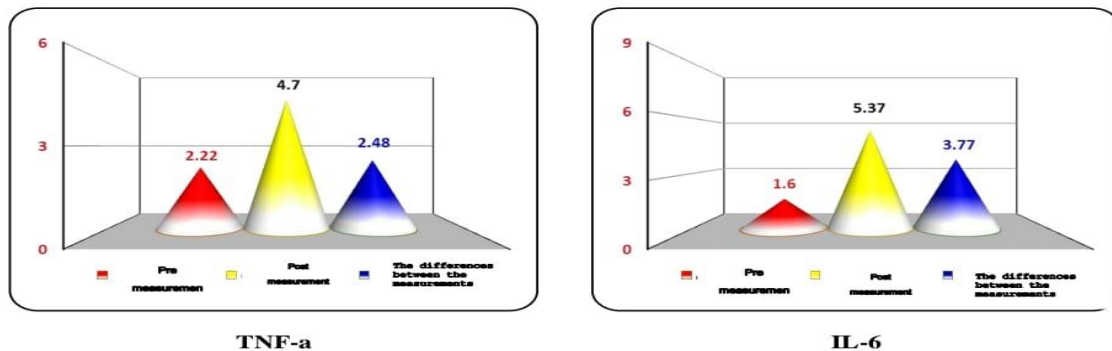
Table (3) : The significance of the differences between the pre and post measurements for the research sample in inflammation indicators as Interleukin 6 (IL-6) and Tumor necrosis factor alpha (TNF-a)

Measurements	Measuring units	Pre measurement		Post measurement		The difference between the two measurements	Z value
		Mean	S -/+	Mean	S -/+		
IL-6	Pg/ml	1.60	0.23	5.37	0.34	3.77	52.31-
TNF-a	Pg/ml	2.22	0.14	4.70	0.36	2.48	54.32-

Tabular Z value= 1.96-/+

From table (3), it is clear that there are significant differences between the mean of pre and post measurements in variables of inflammation indicators as Interleukin 6 (IL-6) and Tumor necrosis factor alpha (TNF-a) because calculated Z value is bigger than tabular Z value.

Figure (2) :The differences between the mean of pre and post measurements in variables of inflammation indicators as Interleukin 6 (IL-6) and Tumor necrosis factor alpha (TNF-a)



The difference between the two measurements

From table (2), it is clear that the mean of pre measurement for Interleukin 6(IL-6) is 1.6 pg/ml but the mean of post measurement is 5.37 pg/ml and the difference is 3.77 pg/ml in favor of the post measurement. The mean of pre measurement for Tumor necrosis factor alpha (TNF-a) is 2.22 pg/ml but the mean of post measurement is 4.70 pg/ml and the difference is 2.48 pg/ml in favor of the post measurement.

The researcher inferred the increase in inflammation indicators in the post measurement to severe physical stress through the play off matches for sequenced three days.

These results are in accordance with Wadley A J (2016), Chen Y W, Lip G Y and Fisher J P study (31). This study aims at comparing between different inflammation responses as a result of performing a training unit for muscle power on athletes. The sample of the study was (14) of trained youth and (14) of untrained youth (total=28). First blood samples were collected before the training unit and the second blood samples were after an hour of performing the training unit. The result is statistically significant increasing in Interleukin6 level in both groups for one hour after the training unit. The study found out that training unit makes statistically significant variables in inflammation indicators in the untrained group more than the trained group. The study of Ehab M. Ismail (2015)(3) aims at defining Interleukin6,10, Tumor necrosis factor alpha, Glutamic oxaloacetic transaminase Enzyme (GOT) and Glutamate pyruvate transaminase Enzyme (GPT) responses for speed exercises and muscle endurance as indicators of muscle inflammation among football players. The results of the study refer to the decrease of Interleukin6,10, Tumor necrosis factor alpha level is during recovery period of speed and muscle endurance exercises, so the



researchers discovered the training units of speed endurance, strength endurance and aerobic endurance which lead to statistically significant differences between pre and post measurements by 60 m. and the recovery period for 60 minutes is not enough for Interleukin6,10, Tumor necrosis factor alpha and MDA concentration levels to return to normal state as in pre measurement in these three experimental units.

Severe physical loads for long periods are the first factors of making athletes suffer from muscle injuries and affect on inflammation indicators as Interleukin, Interferon and Tumor necrosis factors levels which cause stress and muscle injuries (10)(14)(15)(19).

Interleukin6 (IL-6) is one of biochemical indicators of inflammation which happens as a result of some muscle rupture in the Systolic components of the muscle during severe physical performance in addition to glucose decreasing in the working muscles. Interleukin6 level increases during severe physical stress to activate liver to break glycogen and Cytokines rotated to inflammation. Tumor necrosis factor alpha activates physiological processes to produce leukocytes and direct them to inflammation positions to reduce and get rid of them (11)(17)(18)(19)(2)(3).

From the previous discussion, the second hypothesis is fulfilled which is: There are significant differences between the mean of pre and post measurements in variables of inflammation indicators as Interleukin6 (IL-6) and Tumor necrosis factor alpha (TNF-a).

Third: Presentation and discussion of the third hypothesis: There are significant correlative relationship between oxidative stress and inflammation indicators.

Table (4) :Matrix of correlation coefficients between the variables under consideration in post measurement

Variables under consideration	Oxidative stress			Inflammation indicators	
	MDA	CPK	Lactate	MDA	TNF-a
oxidative stress	MDA				
	CPK	0.65 *			
	Lactate	0.67 *	0.71 *		
Inflammation indicators	IL-6	0.79 *	0.75 *	0.72 *	
	TNF-a	0.77 *	0.70 *	0.68 *	0.54

Tabular Z value when (N- 2)= 8, significance level (0.05) in both directions= 0.632.

From table (4), there is directly significant correlation Coefficient between oxidative stress variables as (Malondialdehyde (MDA), Phospho-creatine Kinase (CPK) and Lactate) and Inflammation indicators variables as Interleukin6 (IL-6) and Tumor necrosis factor alpha (TNF-a).

This is in accordance with the results of Beston Akram Ahmed and Diar Maghded Ahmed (2020) study which refers to insignificant inverse correlation coefficient between Malondialdehyde (MDA)(one of oxidative stress variables) and antioxidants, there is positive correlation between Malondialdehyde (MDA) and Creatine Kinase among football players.

Rana Fadel Kassem study (2013) refers to direct correlative Coefficient between Lactate and vitamin E. The study found that practice of regular sports exercises and loads are not severe increases the amounts of vitamins E,C because they protect tissues from damage (6).

Severe physical exercises accompany with various physiological changes on the level of the cell, as oxygen and antioxidants shortage, Lactate level increasing and Phospho-creatine Kinase level increasing. These factors lead to oxidative stress which increases Cytokines which leads to inflammation then muscle damage. This explains significant correlative Coefficient between oxidative stress variables and inflammation indicators. (32)

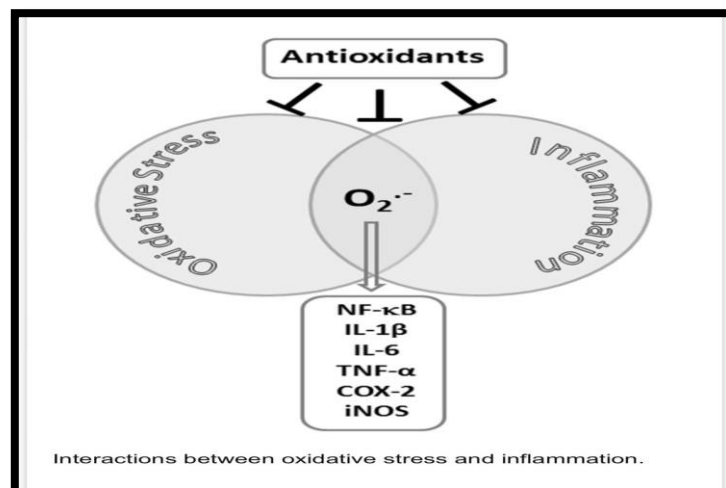


Figure (3) explains the relationship between oxidative stress variables and inflammation variables

From the previous discussion, the third hypothesis result is fulfilled which is: There are significant correlative relationship between oxidative stress variables and inflammation indicators.

Conclusion(s)

According to the research aims, hypotheses, results and the sample: the researcher reached the following conclusions:

- 1- Play off matches lead to increasing of oxidative stress variables as (Malondialdehyde (MDA), Phospho-creatine Kinase (CPK) and Lactate).
- 2- Play off matches lead to increasing inflammation indicators as Interleukin6 (IL-6) and Tumor necrosis factor alpha (TNF-a).



- 3- There is direct correlative Coefficient between oxidative stress variables Malondialdehyde (MDA), Phospho-creatine Kinase (CPK) and Lactate) and Inflammation indicators as Interleukin6 (IL-6) and Tumor necrosis factor alpha (TNF-a).
- 4- Play off matches need special training and procedures for recovery and protect athletes from muscle injuries.

Recommendations:

- 1- The researcher recommends the importance of making more applied studies to help the trainers to design training programs to fit the competition system in the specialized activity.
- 2- The importance of making more applying studies using several procedures for recovery and defining the effect of them on biochemical indicators techniques which refer to inflammation and oxidative stress during the match period.
- 3- The importance of making regular diagnosis for oxidative stress and inflammation indicators during the sports season to protect athletes from muscle injuries.
- 4- Guiding procedures should be followed which are metered on scientific bases to reduce oxidative stress danger during matches.
- 5- It is important to give athletes antioxidants during training and matches periods to get rid of free radicals and reduce oxidative stress.
- 6- Sports Federations should announce the competition system before the training season which is suitable for the global competition. This has important role in planning and athletes' efficiency. This protects them from injuries and save labor in national teams.

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