*DR/ Mahmoud Elsayed Ibrahim
** DR/ Ahmed Said Elsayed Mohamed

The Abstract

The main goal of the research is to use the Foam Rolling technique while taking a melatonin supplement after physical effort similar to a soccer match and to know their effects on the degree of improvement in some oxidative stress enzymes and some biochemical variables for soccer players.

The researchers used an experimental design for two experimental groups using pre- and post-exertion measurements (before and after the effort). The researchers selected the research sample intentionally from the football players at Banha Sports Club under 19 years of age for the 2021/2022 training season, numbering (27) players. The players who did not agree to obtain blood samples from them, numbering (3) players, were excluded, and (4) goalkeepers were excluded, bringing the total research sample to (20) players. They were divided into two experimental groups (10 players), the first experimental group which used the Foam Rolling technique with a melatonin supplement, and the second experimental group (10 players) which used the Foam Rolling technique with a placebo supplement (PLACEBO).

The researchers used the football simulation test as a test of physical effort as a simulation of the physiological, motor and skill responses that occur as is the case during the actual playing of the match. Blood variables were measured in the first phase of biochemical variables and oxidative stress enzymes for football players at Banha Sports Club. A weekly training program was applied, and the intensity of the load was (high), with emphasis being made that the day following the pre-measurements, the load would be moderate. Means and methods of recovery from physical effort were used, as the first experimental group used the Foam Rolling technique with a melatonin supplement, and the second experimental group used the Foam Rolling technique with a placebo supplement (PLACEBO). On the fifth

* Assistant Professor, Department of Health Sciences Sports, Faculty of Sport Science, Banha University.

** Lecturer, Department of Sports Training and Kinesiology Sciences, Faculty of Sport Science, Banha University.

day before the post-measurements, the load was moderate, and the measurements and a test simulating a football match were repeated. The foot as in the first stage.

In light of the research procedures, sample limits, and statistical analysis, it was concluded that the recovery training program using the proposed Foam Rolling Technique with a melatonin supplement has a positive effect on some biochemical variables and oxidative stress enzymes (under research) and is better than using the Foam Rolling Technique individually without the nutritional supplement for soccer players.

Within the limits of the research sample and the results reached, the researchers recommend including the proposed program using (Foam Rolling) and taking a melatonin supplement within the contents of the training programs because of its effective effect. Using a melatonin supplement with other recovery programs to study its effect on indicators of muscle damage and oxidative stress.

ملخص البحث

الهدف الأساسى للبحث هو إستخدام تكنيك **(Foam Rolling)** مع تناول **مكمل الملاتونين** بعد مجهود بدني مماثل لمباراة كرة قدم ومعرفة تاثيراتهم على درجة التحسن فى بعض إنزيمات الإجهاد التأكسدى وبعض المتغيرات البيوكيميائية للاعبى كرة القدم ، و إستخدم الباحثان المنهج التجريبي بإستخدام التصميم التجريبي لمجموعتين تجريبتين بإستخدام القياسين القبلي والبعدى (قبل وبعد المجهود). قام الباحثان بإختيار عينة البحث بالطريقة العمدية من لاعبى كرة القدم بنادى بنها الرياضى تحت ١٩ سنة للموسم التدريبى ٢٠٢١ / ٢٠٢٢ م والبالغ عددهم (٢٧) لاعب ، كما تم إستبعاد اللاعبين الذين لم يوافقوا علي الحصول منهم على عينات دم وعددهم (٣) لاعبين وتم إستبعاد (٤) حراس مرمى ليصبح إجمالى عينة البحث (٢٠) لاعب مقسمين إلى مجموعتين تجريبية (١٠) لاعبين تجريبية أولى والتى إستخدمت تكنيك **(Foam Rolling)** مع مكمل الملاتونين (١٠) لاعبين تجريبية ثانية والتى أستخدمت تكنيك **(Foam Rolling)** مع مكمل وهمي (بلاسيبو PLACEBO)، وأستخدم الباحثان **إختبار محاكاة كرة القدم كمحك للمجهود البدنى** كمحاكاة إلى الاستجابات الفسيولوجية والحركية والمهارية التى تحدث كما هو الحال أثناء اللعب الفعلي للمباراة . تم قياس متغيرات الدم فى المرحلة الاولى للمتغيرات البيوكيميائية وانزيمات الاجهاد التاكسدى لاعبى كرة القدم بنادى بنها الرياضى . تم تطبيق برنامج تدريبى أسبوعى وكان شدة الحمل (عالي) مع التأكيد على ان فى اليوم الذى يلي القياسات القبلية يكون الحمل متوسط .حيث تم استخدام **وسائل وطرق الإستشفاء من الجهد البدني** حيث ان المجموعة التجريبية الأولى إستخدمت تكنيك **(Foam Rolling)** مع **مكمل الملاتونين** والتجريبية الثانية أستخدمت تكنيك **(Foam Rolling)** مع مكمل وهمي (**بلاسيبو PLACEBO**)..وفى اليوم الخامس قبل القياسات البعدية يكون الحمل متوسط وتم تكرار قياسات وأختبار محاكاة مباراة كرة القدم كما فى المرحلة الأولى .

فى ضوء إجراءات البحث وحدود العينة والتحليل الإحصائى تم التوصل إلى أن البرنامج التدريبى الاستشفائى باستخدام المقترح بإستخدام تكنيك **(Foam Rolling)** مع **مكمل الملاتونين** له تأثير إيجابى على بعض المتغيرات البيوكيميائية وانزيمات الاجهاد التاكسدى (قيد البحث) افضل من استخدام تكنيك **(Foam Rolling)** فرديا بدون المكمل الغذائى للاعبى كرة القدم.

فى حدود عينة البحث وما تم التوصل إليه من نتائج يوصى الباحثان إدراج البرنامج المقترح بإستخدام (**Foam Rolling**) مع تناول مكمل الملاتونين ضمن محتويات البرامج التدريبية لما لها من تأثير فعال . استخدام مكمل الملاتونين مع برامج إستشفائية أخرى لدراسة تأثيرها على مؤشرات التلف العضلي والإجهاد التأكسدى .

Introduction: -

Football, known for its mix of intense bursts and sustained effort over 90 minutes, sees players covering 9-12 kilometers per match, depending on their position and skill. The typical intensity peaks at 70%-75% of VO2max, with energy primarily expended in rapid movements like dribbling, heading, tackling, and running sideways or backward.(27: 5194)

Ahmed Nasr El-Din, Hussein Heshmat, and Nader Shalabi (2003) define fatigue as a physiological response to physical demands, termed central fatigue, resulting from reduced nerve center efficiency. Others describe it as a temporary decline in physical and functional efficiency due to successive efforts, causing muscle fatigue and inadequate ventilation, affecting continued performance.(3:41) (6:15)

Debolid EP (2015) suggests that muscle fatigue is a complex physiological phenomenon. Some theories propose that increased levels of reactive oxygen species (ROS) following exercise contribute to functional impairment during muscle contraction, leading to weakness and fatigue. ROS primarily affect muscle fatigue by oxidizing cellular proteins such as the Na–K pump and myofilaments, reducing the inhibition and responsiveness of muscle fibers and Ca+2 to contraction.(19:3)

Muhammad Abdel-Zaher (2017) emphasizes that recovery extends beyond breaks within training sessions to encompass rest periods throughout the week and during transitions between seasons and competitions. Therefore, effective recovery planning is crucial for training, facilitating adaptation and improving athletes' ability to achieve their sporting goals.(7:169)

Kellmann M et al. (2018) underscore the critical importance of recovery periods between training sessions and competitive events in aiding athletes' adjustment and attainment of success. They stress the necessity of maintaining equilibrium between training, competition demands, and recovery to sustain peak performance levels. The techniques and tactics employed in the recovery process are tailored towards improving sports performance and preventing potential adverse outcomes like overexertion syndrome and sports-related injuries. (28:240-242)

Abu Al-Ala Abdel Fattah and Bisan Khuraibet (2016) highlight that recovery is a gradual and continual process shaped by the intensity and duration of physical exertion. Its significance becomes especially apparent during the preparatory phase for major competitions, where efforts are concentrated on gradually alleviating the psychological and physiological burdens of daily training to optimize performance during competitions.(2:381)

Aya Farid (2019) asserts that enhancing sports performance is a primary objective for sports practitioners, achieved through the application of scientific methods such as nutritional supplements. These supplements serve a dual purpose of enhancing sports performance and expediting recovery from the effects of training. Competition serves as a stress reliever for athletes, resulting in overall positive effects, particularly in bolstering their performance. (1:5)

Leonardo-Mendonça et al. (2017) highlight the significance of melatonin supplements in combating oxidative stress induced by exercise, muscle damage, and fatigue during intense training phases. They stress the importance of monitoring responses, antioxidant markers, and skeletal muscle enzyme levels as key indicators of muscle tissue's functional state following strenuous training sessions, influenced by metabolic and mechanical factors. (30:2)

Cheikh et al. (2020) emphasize the efficacy of melatonin supplements as potent natural antioxidants, capable of not only directly scavenging reactive oxygen and nitrogen species but also stimulating the intracellular antioxidant enzyme system. They underscore its role in reducing muscle damage, promoting skeletal muscle healing and tissue repair, and containing anti-inflammatory and immunomodulatory properties. These attributes aid athletes in managing heightened training and competition demands, facilitating muscle adaptation to physical exertion. (17:2)

Foam Rolling, as described **by Laffaye** et al (2019) and others, is a technique used for muscle recovery post-exercise or competitions. It employs mechanical means to elongate muscle fibers, reducing tissue thickness, adhesions, and tension while improving athletic performance. (29:6)

Cheatham et al (2015) add that Foam Rolling enhances recovery by increasing blood flow to damaged tissues, aiding lactate removal, reducing tissue tension, and enhancing oxygen delivery to muscles. (15:828)

Additionally**, Montgomery P** (2008) notes that stress and muscle damage lead to elevated levels of enzymes like CK/CPK and LDH. These factors can impair muscle function and performance in functional and kinetic tasks. (36:247-249)

Callegari et al (2017) stress the necessity of monitoring biomarkers and biochemical responses to understand how training affects essential bodily systems, aiding trainers in program adjustment. (13:65-66)

Likewise, Staron & Hikida (2015) underscore the importance of tracking blood serum enzymes to gauge metabolic changes due to physical exertion, assisting in determining optimal rest periods for athletes. (38:68)

The research problem

Through the experience of the researchers and their work in training courses organized by university, trade union and sports bodies in preparing and supporting coaches, where the first researcher teaches sports physiology and the second researcher in the field of sports training, and on a survey sample of coaches, the researchers found a lack of familiarity and lack of coaches' knowledge of good planning for recovery operations in the training program and competitions. Some of them rely on traditional methods, which may result in some sports injuries or expose the players to excessive load, thus negatively affecting the level of the players.

The researchers discovered a deficiency in recovery planning among coaches, with many relying on outdated methods, potentially leading to injuries and performance issues for players. They observed signs of player fatigue in football coaching and youth competitions, exacerbated by frequent matches. They attributed these issues to poor planning between exertion and recovery, along with a lack of familiarity with modern methods and supplements. Additionally, they highlighted Melatonin supplements and Foam Rolling as effective recovery techniques, noting a gap in comprehensive studies on these topics. Furthermore, they found flaws in fatigue assessment methods, particularly in tests focused solely on running, neglecting factors like ball movements in matches, which could underestimate the physical demands on players and impact training intensity.

The researchers will employ the Youth Soccer Match Simulation System (YSMS90), which replicates real soccer gameplay movements, for their study. This includes headers, shooting, dribbling, passing, and intermittent running, mirroring distances covered in youth soccer matches.

Recognizing the significance of their study, the researchers will investigate the effects of Foam Rolling technique and melatonin supplementation on biochemical variables and oxidative stress enzymes post-simulation, aiming to understand their impact on players' physical exertion.

The aim of the research:

The main objective of the research is to utilize the Foam Rolling technique along with melatonin supplementation after a similar physical exertion to a football match and determine their effects on the degree of improvement in:

1. Some oxidative stress enzymes, represented by lactate dehydrogenase (LDH), creatine kinase (CK), aspartate aminotransferase (AST), and alanine aminotransferase (ALT).

2. Some biochemical variables, including lactate (LAC), total protein (TP), uric acid (UR), and creatinine (CRE).

Research hypotheses:

- There are statistically significant differences between pre- and post-exertion measurements (pre- and post-effort) for the first experimental group in favor of the post-exertion measurement.

- There are statistically significant differences between pre- and post-exertion measurements (pre- and post-effort) for the second experimental group in favor of the post-exertion measurement.

- There are statistically significant differences between post-exertion measurements (pre- and post-effort) for both the first and second experimental groups in favor of the post-exertion measurement for the first experimental group.

Research Terminology:

Foam Rolling Technique

It refers to a recovery technique used to stretch and recover tight tissues in muscles, aiming to alleviate muscle pain and improve range of motion after intense exercise sessions. This may facilitate performance and is typically applied for periods ranging from 5 to 10 minutes.(29:828)

Melatonin Supplement:

The melatonin supplement is a potent natural antioxidant that aids in muscle recovery and repair by reducing muscle damage. It contains anti-inflammatory and immune-boosting properties, enabling athletes to endure intensive training and hectic competition schedules. (2:22)

Enzymes:

They are protein molecules that act as biological catalysts to increase the rate of biochemical reactions within living cells by controlling metabolic pathways without being changed or consumed in the reaction. (41:51)

Reference studies of Melatonin Supplement in Recovery Processes:

- **Farjallah Mohamed et al**. (2020) (20) explored how nightly melatonin intake affected recovery from repeated sprint performance during intensive training among football players. Their findings revealed that melatonin supplementation reduced oxidative stress, boosted white blood cell count, minimized cellular damage, and enhanced sprint performance repetition.

- **Mohamed Cheikh et al**. (2020) (17) investigated the impact of melatonin intake post-exercise on young athletes, demonstrating its ability to mitigate muscle damage, oxidative stress, and inflammation.

- Similarly, **Jolanta Czuczejko et al**. (2019) (18) studied "Melatonin Supplements Improve Oxidative and Inflammatory Status in Professional Athletes during the Preparatory Period for Competitions," showcasing melatonin's protective effects against muscle damage and inflammation amid intense training. Their study involved football players, rowers, and sedentary adults.

Reference studies on the Foam Rolling technique in recovery processes:

- **Ramadan Pelana et al**. (2021) (42) explored the impact of the Foam Rolling technique on lactic acid concentration in futsal players, finding positive effects on reducing lactic acid levels and improving recovery speed after exertion.

-**Similarly, Masatoshi Nakamura et al**. (2020) (34) investigated the technique's effect on muscle damage improvement post-exercise, observing reduced muscle pain and faster recovery.

- In another study, **Juillaume Laffaye et al**. (2019) (29) examined the technique's impact on lower limb biomechanics after intense physical training, discovering enhancements in muscle pain relief and recovery speed.

Research Procedures:

Research Methodology:

The researchers employed an experimental approach using a experimental design with two experimental groups, utilizing pre-test and post-test measurements (before and after exertion).

Research Community and Sample:

The research community consists of football players in the youth category registered with the Egyptian Football Association in the Major Sectors League for the Greater Cairo region.

The researchers selected the research sample purposively from football players at Banha Sporting Club under 19 years old for the training season 2021/2022, totaling 27 players. Exclusion Players who did not consent to blood sampling, totaling 3 players, and 4 goalkeepers were excluded. This resulted in a total research sample of 20 players inclusion divided into two experimental groups: the first experimental group of 10 players used the Foam Rolling technique with melatonin supplementation, while the second experimental group of 10 players used the Foam Rolling technique with a placebo.

Table (1)

Classification of the research population and sample

Total number	The research sample (inclusion)	Experimental group (1) (foam rolling+melatonin)	Experimental group (2) (foam rolling)	The excluded
(27) players	(20) players	(10) players	(10) players	(7) players

Criteria for selecting the Research Sample:

- Players must be regular and registered participants in the 2021/2022 sports season for football at Banha Sporting Club.

- Players must consent to volunteer and participate in the research, as well as agree to blood sampling voluntarily.

- Players must agree to take melatonin supplements and be prepared to follow the recommended nutrition, sleep, and rest procedures, ensuring no exertion before the research experiment for several days.

- Ensuring the players' physical and health aspects are adequate before conducting the research experiment on volunteer players.

- Players' training age should not be less than 5 years.

- Ensuring players do not consume anti-inflammatory drugs or diuretics.

Homogeneity of the research sample

Table (2)

Homogeneity of the research sample in terms of the variables of height, weight, and age (N=20)

Variables	Measuring unit	Mean	The standard deviation	The median	skewness coefficient	skewness coefficient	k.s sig
Age	Cm	١٨.٦٣	٠.٣٢	١٨.٦٠	٠.٤٣	٠.٤٣	٠.٠١٧
Height	Kg	١٧٤.٥٠	٣.٨٢	١٧٥.٠٠	٠.٠٦	٠.٠٦	٠.٠١٥
the weight	Year	٦٩.٥٩	١.٠٥	٧٠.٠٠	٠.٨٠-	٠.٨٠-	٠.٠٠
Training age	Year	٥.٤٠	٠.٥٠	٥.٠٠	٠.٤٤	٠.٤٤	٠.٠٠

Table (2) indicates that the skewness coefficients ranged from -0.80 to 0.44, within an acceptable range of ±3. However, the Kolmogorov-Smirnov test did not show statistically significant differences, suggesting that the data distribution for the research sample is not normal. Hence, non-parametric statistics are required.

Table (3)

Homogeneity of the research sample in variables of oxidative stress enzymes (N=20)

	Variables	Measuring unit	Measurement type	Mean	The standard deviation	The median	skewness coefficient	k.s sig
Oxidative stress enzymes	**Aspartate Amino Transfer (AST)**	(IU/L)	Before the effort	٢٦.٣٣	٠.١٨	٢٦.٤٠	٠.٩٤-	٠.٠٠
			After the effort	٢٨.٣٥	١.١٣	٢٩.٠٠	٠.٥٤-	٠.٠٠
	Alanine Amino Transfer (ALT)	(IU/L)	Before the effort	١٧.٥٥	٠.١٩	١٧.٥٠	١.٩٢	٠.٠٠
			After the effort	٢٠.١٥	٠.٨٩	٢٠.٠٠	٢.٣٥	٠.٠٠
	Creatine Kinase (CK)	(IU/L)	Before the effort	١٩١.٤٠	٠.١٧	١٩١.٥٠	٠.٩١-	٠.٠٠
			After the effort	٢٨٩.٥٥	٢.٩١	٢٩٠.٠٠	٢.٣٩-	٠.٠٠
	Lactate dehydrogenase (LDH)	Before the effort	Before the effort	١٥٦.٢٦	٠.١٦	١٥٦.٣٠	٠.٠٠	٠.٠٠
			After the effort	٢٠٠.٠٠	١.١٨	٢٠٠.٠٠	١.١٦	٠.٠٠

Table (3) illustrates that the skewness coefficients ranged from -0.94 to 1.92 before exertion and from -2.39 to 2.35 after exertion, falling within the acceptable range of ±3. However, there were no significant differences observed in the Kolmogorov-Smirnov test, indicating that the data's normal distribution is not moderate. Hence, non-parametric statistics should be employed for analysis.

Table (4)

Homogeneity of the research sample in biochemical variables (N=20)

	Variables	Measuring unit	Measurement type	Mean	The standard deviation	The median	skewness coefficient	k.s sig
Biochemical variables	**Uric acid (UA)**	(MMOL/L)	Before effort	٤.٣٥	٠.٢٤	٤.٣٢	١.٨٧	٠.٠٠
			After effort	٥.٠١	٠.٠٦	٥.٠٢	٢.٨٨	٠.٠٠
	Creatine (CRE)	(MMOL/L)	Before effort	٧٨.١٨	٠.٣١	٧٨.١٠	٢.٠٧	٠.٠٠
			After effort	٨٣.٩٥	٨.٧٩	٨٣.٥٠	٠.٠٤	٠.٠٠
	Total protein (TP)	(G/L)	Before effort	٨٣.٢٩	٠.٧٠	٨٣.١٥	٠.٢٤	٠.٠٠
			After effort	٨٠.٠٠	٠.٢٠	٨٠.٠٠	٠.١٤	٠.٠٠
	Lactate (LAC)	(MMOL/L)	Before effort	١.٩١	٠.١٤	١.٨٨	٠.٠٠	٠.٠٠
			After effort	١٥.٤٨	٠.٤٩	١٥.٥٠	١.٤٠	٠.٠٦

Table (4) indicates that the contortion coefficients before and after the effort were within an acceptable range (±3), but no statistically significant differences were found. The Kolmogorov-Smirnov test showed no significant deviations from normal distribution in all variables except for lactate (LAC), suggesting that non-parametric statistics should be used due to the data's non-satisfactory normal distribution.

Table (5)

Equivalence of the research sample in variables of oxidative stress enzymes N 1= N 2=10

Tests	Measuring unit	measuring type	Experimental group (1)		Experimental group (2)		Mann Whitney	(Z) Value	Sig
			Average rank	Total ranks	Average rank	Total ranks			
Aspartate Amino Transfer (AST)	(IU/L)	Before effort	١١.٢٠	١١٢.٠٠	٩.٨٠	٩٨.٠٠	٤٣.٠٠	٠.٥٤	٠.٥٨
		After effort	١٠.٠٠	١٠٠.٠٠	١.٠٠	١٠.٠٠	٤٥.٠٠	٠.٤٩	٠.٦٠
Alanine Amino Transfer (ALT)	(IU/L)	Before effort	١١.٨٠	١١٨.٠٠	٩.٢٠	٩٢.٠٠	٣٧.٠٠	١.١٧	٠.٢٤
		After effort	١٠.٨٥	١٠٨.٥٠	١٠.١٥	١٠١.٥٠	٤٦.٥٠	٠.٣١	٠.٧٥
Creatine Kinase (CK)	(IU/L)	Before effort	١٠.٤٠	١٠٤.٠٠	١٠.٦٠	١٠٦.٠٠	٤٩.٠٠	٠.٨١	٠.٩٢
		After effort	١٠.٣٠	١٠٣.٠٠	١٠.٧٠	١٠٧.٠٠	٤٨.٠٠	٠.١٨	٠.٨٥
Lactate dehydrogenase (LDH)	(IU/L)	Before effort	١٠.٢٠	١٠٢.٠٠	١٠.٨٠	١٠٨.٠٠	٤٧.٠٠	٠.٤٢	٠.٨٨
		After effort	١٠.٠٥	١٠٠.٥٠	١٠.٩٥	١٠٩.٥٠	٤٥.٥٠	٠.٥٤	٠.٥٨

Table (5) shows that the calculated (Z) values ranged from 0.42 to 1.17 before the effort and from 0.18 to 0.54 after the effort between the first and second experimental groups. These values were lower than the critical (Z) value at a significance level of 0.05. In the oxidative stress enzyme variables, this suggests no statistically significant differences between the two groups, indicating their equality.

Table (6)
Equality of research sample in biochemical variables (N1=N2=20)

Tests	Measuring unit	Measuring type	Experimental group (1)		Experimental group (2)		Mann Whitney	(Z) Value	Sig
			Average rank	Total ranks	Average rank	Total ranks			
Uric acid (UA)	(MMOL/L)	Before effort	١٢.٠٠	١٢٠.٠٠	٩.٠٠	٩٠.٠٠	٣٥.٠٠	١.٢٥	٠.٢١
		After effort	١١.٠٠	١١٠.٠٠	١٠.٠٠	١٠٠.٠٠	٤٥.٠٠	١.٠٠	٠.٣٦
Creatine (CRE)	(MMOL/L)	Before effort	٩.٩٠	٩٩.٠٠	١١.١٠	١١٠.٠٠	٢٤.٠٠	٠.٥١	٠.٥٩
		After effort	١٠.٠٠	١٠٠.٠٠	١١.٠٠	١١٠.٠٠	٤٥.٠٠	٠.٤٣	٠.٦٦
Total protein (TP)	(G/L)	Before effort	١٠.٧٥	١٠٧.٥٠	١٠.٢٥	١٠٢.٥٠	٤٧.٥٠	٠.٢١	٠.٨٣
		After effort	١٠.٩٥	١٠٩.٥٠	١٠.٠٥	١٠٠.٥٠	٤٥.٥٠	٠.٤٠	٠.٦٨
Lactate (LAC)	(MMOL/L)	Before effort	١٠.٣٠	١٠٣.٠٠	١٠.٧٠	١٠٧.٠٠	٤٨.٠٠	٠.٦٧	٠.٨٦
		After effort	١٠.٣٠	١٠٣.٠٠	١٠.٧٠	١٠٧.٠٠	٤٨.٠٠	٠.١٧	٠.٨٦

Table (5) indicates that the (Z) values before and after the intervention for both experimental groups ranged from 0.21 to 1.25 and 0.17 to 1.00, respectively. These values were lower than the significance level of 0.05, suggesting no significant differences between the groups in certain biochemical variables, affirming their equality.

Data collection methods and tools:

The two researchers used multiple and varied methods to collect data in accordance with the nature of the research and the data to be obtained through:

Classification of data collection tools and methods:

Registration and Data Entry Form:

The two researchers prepared a set of registration cards for the research sample members in order to record data, which are:

1- Research sample data registration form (age - height - weight).

2- A form for recording measurements of oxidative stress enzyme variables and biochemical variables.

Tools and devices used in research:

- Resta meter device for measuring total body length and weight in kilograms.
- Centrifuge machine for separating blood components.
- Set of 5 cm plastic tubes.
- Disinfectant materials with cotton and gauze.
- Set of specialized and labeled plastic tubes for blood collection.
- Heparin to prevent blood clotting.
- Cooler box with crushed ice for storing blood sample tubes until they are delivered to the laboratory.
- Football field for conducting football simulation tests.
- Foam Rolling cylinders for implementing recovery program.

- Melatonin supplement with a concentration of 6 mg.

Football simulation test:

The simulated football match test replicated real-game physiological, motor, and skill responses, ensuring that players experienced similar physical loads as in actual matches, whether with or without the ball. Key ball handling skills like passing, dribbling, shooting, and heading were integrated into various segments of the test sessions, detailed in Figure No. (1). The intensity of participants' movements was regulated by test instructions and audio cues, indicating the timing and nature of each activity. Audio signals comprised a 15-minute activity profile, with one-minute segments repeated three times to simulate the first half of a football match.

Ball handling skills were assigned based on players' movements during the match, following Link and Hoernig's conceptualization. Each player completed 120 repetitions of ball handling over 90 minutes, involving passing, dribbling, shooting, and heading the ball.

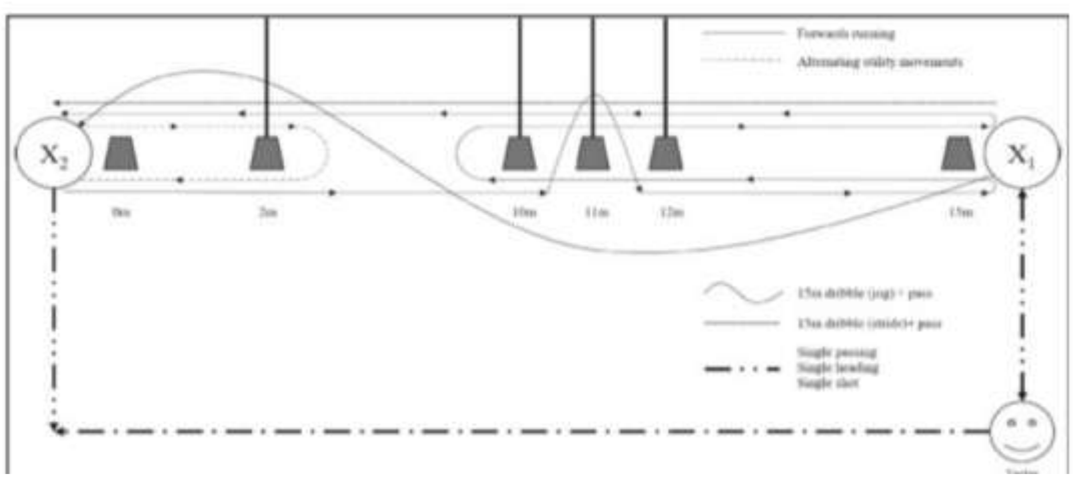


Figure No. (1)
Demonstrates a football simulation test
Prepared by Mohammad Nor Nordin and others (35) (2022)

Table (7)
The kinematic profile of players during the performance of a football match simulation test for each performance cycle

(15)M		(10)M		(5)M	
S	**Performance**	S	**Performance**	S	**Performance**
١٠	Jumping	١٠	Jumping	٤	Standing up
٧	.Side steps then shooting	١٧	Walking	١٠	Jump and pass
٧	Side steps	١٠	Sideways running	١٧	Walking
١٠	Jumping then passing	٦	Sprinting then shooting	٧	Side steps
١٧	Walking	٤	Standing	١٧	Walking
١٠	Sideways running	١٠	Jumping	١٠	Jumping
٤	Walking	١٧	Walking	٦	Fast running then passing
١٧	Walking	١٠	Sideways running	٤	stand up
١٠	Jumping then passing	١٧	Walking	١٠	Lateral running
١٧	Walking	٧	Side steps then shooting	١٧	Walking
٧	Side steps	١٧	Walking	١٠	Jump and pass
١٧	Walking	١٠	Sideways running	١٧	Walking
١٠	.Jumping then heading the ball	١٧	Walking	٧	Side steps
٤	Standing	١٠	Jumping	١٧	Walking
١٧	Walking	١٠	Running then dribbling for a .distance of 15 meters	٤	Standing
١٠	Sideways running	١٠	Sideways running	١٠	Jumping and hitting ball with head
١٧	Walking	٤	Standing	١٧	Walking
١٠	Jumping	١٧	Walking	١٠	Sideways running
٦	Sprinting then shooting	١٠	Jumping then passing	١٠	Jogging, then running for a distance of 15 meters with the ball
٤	Standing	١٧	Walking	١٠	Jumping
١٠	Sideways running	٧	Side steps	١٧	Walking
١٧	Walking	١٧	Walking	١٠	Sideways running
١٠	Jumping then passing	١٠	Jumping	١٧	Walking
١٧	Walking	١٧	Walking	٧	.Side steps then shooting
٧	Side steps	١٠	Sideways running	٤	standing
١٧	Walking	١٧	Walking	١٧	Walking
١٠	Jumping	٤	Standing	١٠	Side steps
٧	Side steps then dribbling for a .distance of 15 meters	١٠	Jumping	١٧	Walking

Means and methods of recovery from physical exertion

1- **Melatonin supplement:**

The two researchers conducted a comprehensive survey of Arab and foreign studies that used melatonin supplement as an antioxidant and muscle fatigue countermeasure in studies (16), (17), (18), (20), (21), (22), (23), (24), (25), (30) to determine:

- The appropriate dose and concentration of melatonin supplement to be used before muscle fatigue.
- The period during which melatonin supplement should be taken before physical exertion.

The two researchers concluded the following:

1. A concentration of 5 mg is common in the dose of melatonin supplement.
2. The appropriate dose is one capsule daily.
3. It is preferable to take the appropriate dose before physical exertion from (30 minutes to 45 minutes).

2- Foam Rolling Technique

The two researchers conducted a comprehensive survey of Arab and foreign studies that used the Foam Rolling technique as studies (9), (12), (14), (26), (29), (32), (33), (34), (35), (38) to determine:

- The best types of techniques used in Foam Rolling.
- The appropriate duration for recovery using Foam Rolling.
- The most important muscle areas that can be used with Foam Rolling during the recovery process.

The two researchers concluded the following:

1. The most common types of techniques used are Non-Vibration Foam Rolling.
2. The duration used ranges from 10 to 15 minutes.
3. The most commonly used areas are the calf muscles, front and back thighs, iliotibial band, and back muscles.

Physiological Variables Under Research

Reference Survey:

The two researchers conducted a reference survey of studies that utilized training exercises and recovery methods and their effects on the biochemical variables associated with muscle fatigue and oxidative stress enzymes. It was agreed upon that the variables are:

1- Enzymes associated with oxidative stress:

- Lactate dehydrogenase (LDH) enzyme.
- Creatine kinase (CK) enzyme.
- Aspartate aminotransferase (AST) enzyme.
- Alanine aminotransferase (ALT) enzyme.

2- Biochemical Variables

- Lactate (LAC)
- Total Protein (TP)
- Uric Acid (UR)
- Creatinine (CRE)

Research Procedures

1- Preliminary Procedures:

Research Procedures

Ensure players haven't engaged in high physical activity 48 hours prior, abstain from dietary supplements, and obtain 6-8 hours of sleep. Obtain written consent from club, players, and guardians for blood sampling and supplement intake. Seek assistance from a specialized physician nearby. Conduct medical examinations to ensure players' suitability for participation and address any medical concerns related to blood sampling.

2- Basic search procedures

first stage:(2/02/2022)

Players arrived at the club for height, weight measurements, and medical check-ups to ensure their fitness for the research and biochemical measurements.

Arrival of players to the club for height, weight measurements, and medical examination to ensure players are free from any symptoms of diseases or health issues that may hinder the research experiment or the collection of biochemical measurements.

Second stage (3 /02/2022)

Doctor from smart lap has taken Blood samples were taken during rest from the anti-bacterial vein to measure biochemical variables, as follows:

- Blood samples were collected from the forearm vein during rest in a sitting position and after performing a football simulation test (pre-1 and post-1 measurements).
- Distinct tubes were used for blood collection in this study. Heparin tubes were used to measure aspartate aminotransferase (ASAT), alanine aminotransferase (ALAT), creatine phosphokinase (CPK), creatinine (Cre), urea (Ur), total protein (TP), and lactate

dehydrogenase (LDH). The second tube containing sodium chloride was used to determine lactate concentration in plasma (Lac).

- On the same day, the first group of players was given melatonin supplement, and the second group was given a placebo in the evening.

Third stage (From 4/02/2022 To 8/02/2022)

Weekly training program with high intensity, emphasizing:

- On the day following the pre-measurements, the workload is moderate.
- Implementation of a recovery program using Foam Rolling technique after each training session.
- Players in the first group receive melatonin supplement, while players in the second group receive a placebo.
- On the fifth day before the post-measurements, the workload is moderate.

Fourth stage (9/02/2022)

Repeat measurements and football match simulation test as in Phase Two.

"The statistical processors used:

Data collected on physiological variables underwent statistical analysis using IBM SPSS Statistics to achieve research objectives and validate hypotheses. The statistical methods used to interpret the results of the research sample measurements were as follows:

- Arithmetic mean - standard deviation - skewness

- Median - Mann-Whitney test

- Wilcoxon test - rate of change

- Kolmogorov-Smirnov test to test the normal distribution of the sample.

Presentation, discussion, and interpretation of the results:
Presentation of the results:

Table (8)

Significance of the differences between the mean pre-test and post-test measurements for the first experimental group in some variables of oxidative stress enzymes under investigation (N=10)

Tests	Measuring type	"post-measurements ".Mean rank"		Pre- measurement Total rank		(Z) value	Sig
		Positive signals	Negative signals	Positive signals	Negative signals		
Aspartate Aminotransferase (AST)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٥	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٩١	٠.٠٠
Alanine Amino Transfer (ALT)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٧	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٦	٠.٠٠
Creatine kinase (CK)	Before effort	٥.٥٠	٠.٠٠	٥٥.٠٠	٠.٠٠	*٢.٨٧	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٦	٠.٠٠
Lactate dehydrogenase (LDH)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٤	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٤	٠.٠٠

Table (8) indicates that the calculated (Z) values ranged between (1.79: 3.93) before and (3.21: 3.93) after exertion for both experimental groups. These values were higher than the tabulated (Z) value at a significance level of (0.05) for most oxidative stress enzymes, except AST and ALT before exertion. This suggests significant differences favoring the first experimental group in certain oxidative stress enzyme variables compared to the second experimental group.

Table (9)

The arithmetic mean and rate of change between pre-test and post-test measurements for the first experimental group of the research sample in some variables of oxidative stress enzymes under investigation. (N=10)

	Variables	Measurement	pre-arithmetic mean	post-arithmetic mean	Rate of change
Oxidative stress enzymes	Aspartate Aminotransferase (AST)	Before effort	٢٦.٣٠	٢٤.٠٨	٨.٤٤
		After effort	٢٨.٨٠	٢٥.٩٠	١٠.٠٦
	Alanine Amino Transfer (ALT)	Before effort	١٧.٤٩	١٦.٠٨	٨.٠٦
		After effort	٢٠.٦٠	١٨.١٧	٩.٢٢
	Creatine kinase (CK)	Before effort	١٩١.٣٥	١٩٩.٧٠	٤.٣٦
		After effort	٢٩١.١٠	٢٦٠.٩٠	١٠.٣٧
	Lactate dehydrogenase (LDH)"	Before effort	١٥٦.٢٤	١٢٦.١٠	١٩.٢٩
		After effort	٢٠٠.٤٠	١٦١.٠٠	١٩.٦٦

Table (9) reveals the rate of change between pre- and post-measurements for the first experimental group in various oxidative stress enzyme variables. Before exertion, the rate of change ranged from 4.36 to 19.29, and after exertion, it ranged from 9.22 to 19.66. Specifically, for AST, the rate increased from 8.44 before exercise to 10.06 after exercise, for ALT it increased from 8.06 to 9.22, and for CK it increased from 4.36 to 10.37. LDH remained constant at 19.29 before effort and 19.66 after effort.

Table (10)

The significance of the differences between the means of the pre- and post-measurements for the second experimental group a sample of research into some of the biochemical variables under investigation (N=10)

Tests	Measuring type	Post-measurement		Pre-measurement		(Z) Value	Sig
		Average rank		Total ranks			
		Positive signals	Negative signals	Positive signals	Negative signals		
Uric acid (UA)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٢	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٧	٠.٠٠
Creatine (CRE)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٤	٠.٠٠
	After effort	٥.٥٠	٠.٠٠	٥٥.٠٠	٠.٠٠	*٢.٨٤	٠.٠٠
Total protein (TP)	Before effort	٠.٠٠	٥.٠٠	٠.٠٠	٤٥.٠٠	*٢.٧٢	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٤	٠.٠٠
Lactate (LAC)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٤	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٠	٠.٠٠

Table (10) indicates that the calculated (z) value exceeds the tabulated (z) value at a significance level of 0.005, suggesting significant differences favoring post-measurements in uric acid (UA), total protein (TP), creatine (CRE), and lactate (LAC) variables after exertion among football players in the research sample. To assess the practical significance of the independent variable, the hospital program's use of Foam Rolling exercises on the dependent variables, rates of improvement between pre- and post-measurements were calculated.

Table (11)

The arithmetic mean and rate of change between the pre- and post-measurements for the second experimental group, the research sample, in some of the biochemical variables under investigation (N=10)

	Variables	Measurements	pre-arithmetic mean	post-arithmetic mean	Rate of change
Biochemical variables	Uric acid (UA)	Before effort	٤.٣٩	٣.٩٢	١٠.٧٠
		After effort	٥.٠٢	٤.١٧	١٦.٩٣
	Creatine (CRE)	Before effort	٧٨.١٢	٧٥.٣٠	٣.٦٠
		After effort	٧٥.٤٠	٨٦.٩٠	١٥.٢٥
	Total protein (TP)	Before effort	٨٣.٢٠	٨١.٣٠	٢.٢٨
		After effort	٨٠.٩٠	٧٧.١٠	٤.٦٩
	Lactate (LAC)	Before effort	١.٩٠	١.٥٤	١٨.٩٤
		After effort	١٥.٥٧	١٣.١٦	١٥.٤٧

Table (11) illustrates the rate of change between pre- and post-measurements for the first experimental group in certain biochemical variables under investigation. Before exertion, the rate ranged from 2.28 to 18.94, and after exertion, it ranged from 4.69 to 16.93. Specifically, for uric acid (UA), it increased from 10.70 before exercise to 16.93 after exercise, for creatine (CRE) from 3.60 to 15.25, for total protein (TP) from 2.28 to 4.69, and for lactate (LAC) from 18.94 to 15.47.

Table (12)

The significance of the differences between the means of the pre- and post-measurements for the second experimental group in some variants of oxidative stress enzymes under investigation (N=10)

Tests	Measuring type	Post-measurement		Pre-measurement		(Z) value	Sig
		Average ranks		Total ranks			
		Positive signals	Negative signals	Positive signals	Negative signals		
Aspartate Amino Transfer (AST)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٢	٠.٠٠
	After effort	١.٠٠	٥.٠٠	١.٠٠	٤٤.٠٠	*٢.٦٨	٠.٠٠
Alanine Amino (Transfer ALT)	Before effort	٥.٥٠	٠.٠٠	٥٥.٠٠	٠.٠٠	*٢.٨٥	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٤٥.٠٠	*٢.٧٥	٠.٠٠
Creatine Kinase (CK)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٤	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٦	٠.٠٠
Lactate dehydrogenase (LDH)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٢	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٦	٠.٠٠

Table (12) reveals that the calculated (z) value exceeds the tabulated (z) value at a significance level of 0.005, indicating statistically significant differences favoring post-measurements in aspartate aminotransferase (AST), alanine aminotransferase (ALT), creatine kinase (CK), and lactate dehydrogenase (LDH) variables among football players in the research sample. To assess the practical significance of the independent variable, the hospital program's use of Foam Rolling exercises on the dependent variables, rates of improvement between pre- and post-measurements were calculated.

Table (13)

The arithmetic mean and the rate of change between the pre- and post-measurements for the second experimental group, the research sample, in some variables of oxidative stress enzymes under investigation (N=10)

	Variables	Measurement	pre-arithmetic mean	post-arithmetic mean	Rate of change
oxidative stress enzymes	Aspartate Amino Transfer (AST)	Before effort	٢٦.٣٦	٢٤.٧٠	٦.٠٦
		After effort	٢٨.٩٥	٢٧.٧٥	٤.١٤
	Alanine Amino Transfer (ALT)	Before effort	١٧.٤٦	١٦.٥٠	٥.٤٩
		Before effort	٢٠.٥٠	١٨.٩٠	٦.٦٦
	Creatine Kinase (CK)	After effort	١٩١.٤٦	٢١٣.٧٠	١١.٦١
		Before effort	٢٩١.٢٥	٢٧٠.٣٠	٧.١٩
	Lactate dehydrogenase (LDH)	Before effort	١٥٥.٣٦	١٣٠.٢٠	١٦.١٩
		After effort	٢٠٠.٥٠	١٦٨.٦٠	١٥.٩١

Table (13) illustrates the fluctuations in oxidative stress enzyme levels within the second experimental group before and after exertion. Prior to the effort, enzyme levels ranged between 5.49 and 16.19, while after exertion, they spanned from 4.14 to 15.91. Notably, aspartate amino transferase (AST) decreased from 6.06 to 4.14, alanine amino transferase (ALT) increased from 5.49 to 6.66, creatine kinase (CK) decreased from 11.61 to 7.19, and lactate dehydrogenase (LDH) slightly decreased from 16.19 to 15.91 post-exercise.

Table (14)

The significance of the differences between the means of the pre- and post-measurements for the second experimental group a sample of research into some of the biochemical variables under investigation (N=10)

Tests	Measuring type	Post-measurement		Pre- measurement		(Z) value	Sig
		Average ranks		Total ranks			
		positive signals	Negative signals	positive signals	Negative signals		
Uric Acid (UA)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٥	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٤	٠.٠٠
Creatine (CRE)	Before effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٢	٠.٠٠
	After effort	٠.٠٠	٥.٥٠	٠.٠٠	٥٥.٠٠	*٢.٨٣	٠.٠٠
Total protein (TP)	Before effort	٠.٠٠	٥.٠٠	٠.٠٠	٤٥.٠٠	*٢.٨٣	٠.٠٠
	After effort	٥.٥٠	٠.٠٠	٥٥.٠٠	٠.٠٠	*٢.٨٢	٠.٠٠
Lactate (LAC)	Before effort	١.٠٠	٦.٠٠	١.٠٠	٥٤.٠٠	*٢.٧٣	٠.٠٠
	After effort	٥.٥٠	٠.٠٠	٥٥.٠٠	٠.٠٠	*٢.٨٤	٠.٠٠

Table (14) indicates that the calculated (z) value exceeds the tabulated (z) value at a significance level of 0.005, revealing statistically significant differences favoring post-measurements in uric acid (UA), total protein (TP), creatine (CRE), and lactate (LAC) levels after exertion among football players in the study. To assess the practical significance of the independent variable (the hospital program's use of Foam Rolling exercises) on the dependent variables (UA, TP, CRE, and LAC), the rate of change was calculated to characterize improvements between pre- and post-measurements.

Table (15)

The arithmetic mean and rate of change between the pre- and post-measurements for the second experimental group, the research sample, in some of the biochemical variables under investigation (N=10)

	Variables	Measurement	pre-arithmetic mean	post-arithmetic mean	Rate of change
Biochemical variables	Uric acid (UA)	Before effort	٤.٣١	٤.١٢	٤.٤٠
		After effort	٥.٠١	٤.٨٠	٤.١٩
	Creatine (CRE)	Before effort	٧٨.٢٢	٧٦.٦٠	٢.٠٧
		After effort	٧٥.٥٠	٨٩.٤٠	١٨.٤١
	Total protein (TP)	Before effort	٨٣.١٨	٨١.٧٠	١.٧٧
		After effort	٨٠.٨٠	٧٨.١٥	٣.٢٧
	Lactate (LAC)	Before effort	١.٩١	١.٦٣	١٤.٦٥
		After effort	١٥.٦٢	١٤.٢٠	٩.٠٩

Table (15) reveals the rate of change between pre- and post-measurements among the second experimental group, representing the research sample, across certain biochemical variables. Before exertion, these variables ranged from 2.07 to 18.94, while after exertion, they ranged from 3.27 to 18.41. Specifically, uric acid (UA) decreased from 4.40 before exertion to 4.19 after exertion, creatine (CRE) increased from 2.07 before exertion to 18.41 after exertion, total protein (TP) increased from 1.77 before exertion to 3.27 after exertion, and lactate (LAC) decreased from 14.65 before exertion to 9.09 after exertion.

Table (16)

Significance of differences between the means of the two-dimensional measurements for the first experimental group and the second experimental group in the variables of oxidative stress enzymes under investigation (N1=N2= 10)

Tests	Measuring type	first experimental group		second experimental group		Mann Whitney	(z) value	Sig
		Average ranks	Total ranks	Average ranks	Total ranks			
Aspartate Amino Transfer (AST)	Before effort	٧.٣٠	١٣.٧٠	٧٣.٠٠	١٣٧.٠٠	١٨.٠٠	٢.٧١	٠.٠٧
	After effort	٥.٥٠	١٥.٥٠	٥٥.٠٠	١٥٥.١٠	٠.٠٠	*٣.٩٥	٠.٠٠
Alanine Amino Transfer (ALT)	Before effort	٨.٥٠	١٢.٥٠	٨٥.٠٠	١٢٥.٠٠	٣٠.٠٠	١.٧٩	٠.٠٧
	After effort	٦.٤٠	١٤.٦٠	٦٤.٠٠	١٤٦.٠٠	٩.٠٠	*٣.٢١	٠.٠٠
Creatine Kinase (CK)	Before effort	٥.٥٠	١٥.٥٠	٥٥.٠٠	١٥٥.٠٠	٠.٠٠	*٣.٩٣	٠.٠٠
	After effort	٥.٥٠	١٥.٥٠	٥٥.٠٠	١٥٥.٠٠	٠.٠٠	*٣.٩٣	٠.٠٠
Lactate dehydrogenase (LDH)	Before effort	٥.٥٠	١٥.٥٠	٥٥.٠٠	١٥٥.٠٠	٠.٠٠	*٣.٩٣	٠.٠٠
	After effort	٥.٥٠	١٥.٥٠	٥٥.٠٠	١٥٥.٠٠	٠.٠٠	*٣.٩٣	٠.٠٠

Table (16) indicates that the calculated (Z) value ranged from 1.79 to 3.93 before exertion and from 3.21 to 3.93 after exertion between the first and second experimental groups. These values surpassed the tabulated (Z) value at a significance level of 0.05. Significant differences were observed in all oxidative stress enzymes after exertion and before exertion, except for aspartate amino transferase (AST) before exertion and alanine amino transferase (ALT) before exertion. This suggests statistically significant variations favoring the first experimental group in certain oxidative stress enzyme variables.

Table (17)

The significance of the differences between the means of the two dimensional measurements for the first experimental group and the second experimental group in some of the biochemical variables under investigation (N1=N2=10)

Tests	Measuring type	first experimental group		second experimental group		Mann Whitney	(z) value	Sig
		Average ranks	Total ranks	Average ranks	Total ranks			
Uric acid (UA)	Before effort	٥.٨٠	١٥.٢٠	٥٨.٠٠	١٥٢.٠٠	٣.٠٠	*٣.٧٨	٠.٠٠
	After effort	٦.٥٠	١٤.٥٠	٦٥.٠٠	١٤٥.٠٠	١٠.٠٠	*٣.١٠	٠.٠٠
Creatine (CRE)	Before effort	٦.٧٥	١٤.٢٥	٦٧.٥٠	١٤٤.٥٠	١٢.٥٠	*٣.٠٨	٠.٠٢
	After effort	٦.٠٥	١٤.٩٥	٦٠.٥٠	١٤٩.٥٠	٥.٥٠	*٣.٥٠	٠.٠٠
Total protein (TP)	Before effort	٨.٣٥	١٢.٦٥	٨٣.٥٠	١٢٦.٥٠	٢٨.٥٠	١.٨٥	٠.٠٦
	After effort	٦.٦٠	١٤.٤٠	٦٦.٠٠	١٤٤.٠٠	١١.٠٠	*٣.٠٣	٠.٠٠
Lactate (LAC)	Before effort	٧.٦٠	١٣.٤٠	٧٦.٥٠	١٣٤.٠٠	٢١.٠٠	*٢.٨٨	٠.٠١
	After effort	٥.٥٠	١٥.٥٠	٥٥.٠٠	١٥٥.٠٠	٠.٠٠	*٣.٩٤	٠.٠٠

Table (17) shows that the calculated (Z) value ranged from 1.85 to 3.78 before exertion and from 3.03 to 3.94 after exertion between the first and second experimental groups. These values exceeded the tabulated (Z) value at a significance level of 0.05. Significant differences were observed in some biochemical variables, except for the total protein (TP) variable before exercise. This suggests statistically significant variations favoring the first experimental group in certain biochemical variables.

Discussion of the results and their interpretation:

(1) Discussion of the results that confirm the validity of the first hypothesis, which states:

"There are statistically significant differences between the pre- and post-measurements (before and after exertion) for the first experimental group in favor of the post-measurement."

Table (8) indicates significant differences between pre- and post-measurements in certain oxidative stress enzyme variables, favoring the post-exertion measurements. The calculated (z) values ranged from 2.85 to 2.87 before exertion and from 2.84 to 2.91 after exertion, surpassing the significance threshold of 0.05. Specifically, for aspartate amino transfer (AST), the calculated (z) value was 2.85 before exertion and 2.91 after exertion, and for alanine amino transfer (ALT), it was 2.87 before exertion and 2.86 after exertion.

In Table (9), the results display variations in some oxidative stress enzyme variables between pre- and post-exertion for the first experimental group. Before exertion, enzyme levels ranged from 4.36 to 19.29, and after exertion, they ranged from 9.22 to 19.66. Notably, aspartate amino transfer (AST) increased from 8.44 before exercise to 10.06 after exercise, alanine amino transfer (ALT) increased from 8.06 before exercise to 9.22 after exercise, and creatine kinase (CK) increased from 4.36 before exercise to 10.37 after exercise. Lactate dehydrogenase (LDH) levels remained consistently high, at 19.29 before exertion and 19.66 after exertion.

Table (10) reveals significant differences between pre- and post-measurements in certain chemical variables, favoring the post-measurement. The calculated (z) values ranged from 2.48 to 2.84 before exertion and from 2.80 to 2.87 after exertion, surpassing the tabulated (z) value at a significance level of 0.05. Specifically, for uric acid (UA), the calculated (z) value was 2.82 before exertion and 2.87 after exertion, for creatine (CRE), it was 2.48 before exertion and 2.84 after exertion, for total protein (TP), it was 2.72 before exertion and 2.84 after exertion and for lactate (LAC), it was 2.84 before exertion and 2.80 after exertion.

Similarly, Table (11) displays the rate of change between pre- and post-measurements for the first experimental group in certain biochemical variables. Before exertion, the rate of change ranged from 2.28 to 18.94, and after exertion, it ranged from 4.69 to 16.93. Specifically, uric acid (UA) increased from 10.70 before exercise to 16.93 after exercise, creatine (CRE) increased from 3.60 before exercise to 15.25 after exercise, total protein (TP) increased from 2.28 before exercise to 4.69 after exercise, and lactate (LAC) levels decreased from 18.94 before exertion to 15.47 after exertion.

The researchers credits the improvement in oxidative stress and biochemical variables to a recovery program combining Foam Rolling exercises and melatonin supplementation for football players. Specifically, this program enhances energy enzymes such as lactate dehydrogenase (LDH) and creatine kinase (CK), reduces lactic acid (LAC) levels, prolongs performance, and delays fatigue. Moreover, it decreases enzymes linked to muscle damage and oxidative stress like aspartate amino transfer (AST) and alanine amino transfer (ALT), along with biochemical markers like uric acid (UA) and total protein (TP), indicating enhanced performance and reduced risk of injury or fatigue. This underscores the positive impact of the recovery program on the first experimental group.

The researcher observed an increase in indicators of oxidative stress and certain biochemical variables following a soccer match simulation test before the implementation of a recovery program. This aligns with findings by **Becatti et al**. (2017)(10) indicating significant changes in muscle damage markers after soccer matches and training. However, following the recovery program involving Foam Rolling techniques and melatonin supplementation, there was a reduction in muscle damage rates and an increase in energy enzyme levels post-exertion. This was aimed at combating muscle fatigue and enhancing players' endurance while delaying fatigue onset and muscle exhaustion, highlighting the positive impact of the proposed program for the first experimental group.

The results of this hypothesis are consistent with what was stated by **Cheikh et al** (2020) (17) that taking a melatonin supplement (MEL) during high-intensity exercise is effective in reducing the degree of oxidative stress (reducing fat peroxidation, with a significant increase in the activity of antioxidant enzymes). Which leads to maintaining cell integrity and reducing secondary tissue damage.

The results of this hypothesis are also consistent with what was stated by **MacDonald GZ et all** (2013) (34) that the use of Foam Rolling technique exercises specifically has physiological effects during recovery programs. High physical loads have a negative impact on the entire underlying tissue, which may lead to decreased blood flow and thus fatigue and muscle damage, while when using Foam Rolling technique exercises, it can lead to positive physiological responses such as increased blood flow, which leads to reducing lactic acid levels. Reducing the production of prostaglandins and thus reducing inflammation and muscle damage.

The results of this hypothesis agree with the positive effects of using a melatonin supplement on improving some responses to oxidative stress enzymes, as in the study of **Farjallah et al** (2018) (20), where taking a melatonin supplement during a training camp for soccer players led to an improvement in variables of oxidative stress enzymes (lactate). Dehydrogenase (LDH) and creatine kinase (CK), which in turn work to eliminate muscle fatigue and acid accumulation. Lactate in the blood, thus the ability to continue for a long period of time without feeling tired.

The results of this hypothesis are consistent with the positive effects of using a melatonin supplement on improving some oxidative stress enzyme responses, as in the study of **Cheikh et al** (2020) (17), where taking a melatonin supplement before performing a physical fitness test for volleyball players led to an improvement in oxidative stress enzyme variables (Aspartate Amino Transfer(AST) , Lactate dehydrogenase (LDH) and creatine kinase (CK), as taking a melatonin supplement can serve as a recovery measure that provides protection against exercise-induced stress, lipid peroxidation, and muscle damage the next morning in adolescent male athletes.

The results of this hypothesis are consistent with the positive effects of using a melatonin supplement on improving some biochemical variables, as in the study of **Farjallah et al** (2022 AD) (25), where taking a melatonin supplement before performing a physical fitness test for soccer players led to an improvement in some biochemical variables lactate (LAC) Uric acid (UA), total protein (TP) and creatine (CRE). Taking a melatonin supplement before extreme running training can provide protection from muscle damage and be a preventive measure against the negative biochemical effects resulting from physical exertion, thus reducing the rate of lactate in the body. Blood and muscle damage after exertion.

The results of this hypothesis are consistent with studies that used foam rolling exercises on indicators of oxidative stress enzymes, such as the study of **Hossein Moradi and Amir Abbas** (2020) (26) where foam rolling exercises led to an improvement in enzyme levels. Oxidative stress (lactate dehydrogenase (LDH) and creatine kinase CK for soccer players.

The results of this study agree with the study of both Laffye and all (2019) (29) and the study of **Nakamura and all** (2021) (34), as the recovery programs using the Foam Rolling technique in those two studies led to a Decrease in stress and damage. Muscle (DOMS) to a large extent.

The results of this hypothesis are consistent with studies that used foam rolling exercises on some biochemical variables such as lactate (LAC), such as the study of **Belana et al** (2021) (42), where recovery programs using the foam rolling technique led to a decrease in acid concentration. Lactate and delay the onset of muscle fatigue.

MacDonald et al (2014)(32) suggest that the biochemical changes observed during foam rolling massage may be due to the continuous pressure applied to the muscles. This pressure might trigger biochemical alterations and mitigate the negative effects of stress and muscle damage.

Thus, the validity of the hypothesis stating "there are statistically significant differences between the means of pre-test and post-test measurements in some respiratory system variables under investigation for soccer players" is confirmed.

(2) Discussion of the results that confirm the validity of the second hypothesis, which states:

"There are statistically significant differences between the pre-test and post-test measurements (before and after exertion) for the second experimental group in favor of the post-test measurement."

The results from Table (12) show significant differences between pre-test and post-test measurements of certain oxidative stress enzyme variables. These differences favor the post-test measurements, with calculated (Z) values ranging from 2.82 to 2.85 before exertion and from 2.68 to 2.86 after exertion. These values exceed the critical z-value at a significance level of 0.05. For example, aspartate aminotransferase (AST) measured 2.82 before exertion and 2.68 after exertion, while alanine aminotransferase (ALT) measured 2.85 before exertion and 2.75 after exertion. Similarly, creatine kinase (CK) measured 2.84 before exertion and 2.86 after exertion, and lactate dehydrogenase (LDH) measured 2.82 before exertion and 2.86 after exertion.

The results from Table (13) illustrate the rate of change between pre- and post-measurements for the second experimental group in certain variables of oxidative stress enzymes under investigation. Before exertion, this rate ranged from 5.49 to 16.19, while after exertion, it ranged from 4.14 to 15.91. Specifically, for aspartate aminotransferase (AST), the rate before exercise was 6.06 and after exercise was 4.14, and for alanine aminotransferase (ALT), it was 5.49 before exercise and 6.66 after exercise. Creatine kinase (CK) showed a rate of 11.61 before exercise and 7.19 after exercise, while lactate dehydrogenase (LDH) exhibited rates of 16.19 before exercise and 15.91 after exercise.

The results from Table (14) regarding the significance of differences between pre- and post-measurements in certain biochemical variables show statistically significant differences favoring the post-measurements. The calculated (z) values ranged between 2.82 and 2.85 before exertion and 2.82 to 2.84 after exertion, surpassing the tabulated (z) value at a significance level of 0.05. For instance, in measuring uric acid (UA), the calculated (z) value was 2.85 before exertion and 2.84 after exertion, while for creatine (CRE), it was 2.82 before exertion and 2.83 after exertion. Similarly, in measuring total protein (TP), the calculated (z) value was 2.83 before exertion and 2.82 after exertion, and for lactate (LAC), it was 2.73 before exertion and 2.84 after exertion.

Table (15) reveals the rate of change between pre- and post-measurements for the second experimental group in certain biochemical variables under investigation. Before exertion, this rate ranged from 2.07 to 18.94, while after exertion, it ranged from 3.27 to 18.41. Specifically, for uric acid (UA), the rate before exercise was 4.40 and after exercise was 4.19, and for creatine (CRE), it was 2.07 before exercise and 18.41 after exercise. Total protein (TP) showed a rate of 1.77 before exercise and 3.27 after exercise, while lactate (LAC) levels were 14.65 before exertion and 9.09 after exertion.

The researcher attributes the differences in pre- and post-measurement averages and the rate of change in oxidative stress and biochemical variables to the positive effects of the Foam Rolling technique in the recovery program for football players. This technique enhances certain variables, including energy enzymes like lactate dehydrogenase (LDH) and creatine kinase (CK), while reducing lactic acid (LAC) levels. This improvement enables players to sustain performance longer and delays fatigue. Additionally, enzyme levels related to muscle damage and oxidative stress, such as AST and ALT, decrease. Biochemical variables indicating muscle damage, like UA, TP, and CRE, also decrease. These enhancements support sustained performance and reduce obstacles leading to fatigue or injuries, highlighting the positive impact of the program for the second experimental group.

Beardsley and Škarabot (2015) (11) highlight that the Foam Rolling technique training improves muscle fascia function, promoting increased muscle blood flow and oxygen delivery. This facilitates adenosine triphosphate reconstitution in mitochondria and active calcium transport back to the sarcoplasmic reticulum, thereby enhancing muscle function and reducing muscle damage and fatigue.

This is consistent with what was mentioned by **Sadeeq Mustafa et al** (2021) (38) that performing foam rolling exercises similar to massage can increase muscle blood flow and lead to enhanced recovery from stress and muscle damage (DOMS), as it also leads to muscle responses. Other methods include biochemical changes associated with massage This method results in a smaller increase in creatine kinase in plasma after exercise and improves mechanosensory functions, which increases mitochondrial activity and thus accelerates muscle recovery and reduces immune cytokine proteins that cause muscle damage, which reflects less cellular stress and inflammation.

The results of this hypothesis are in agreement with the positive effects of using the Foam Rolling technique , as studied by **Hossein Moradi and Amirabbas** (2020) (26). The Foam Rolling exercises led to improvements in the levels of oxidative stress enzymes (lactate dehydrogenase (LDH) and creatine kinase (CK)) for football players.

The results of this hypothesis align with a study by **Belana et al.** (2021) (42). The recovery programs using Foam Rolling technique led to a decrease in lactate concentration and delayed onset of muscle fatigue.

This is explained by **Pearcey et al** (2015) (11) as Foam Rolling exercises can serve as a stimulus for inducing structural or neural changes leading to alterations in delayed onset muscle soreness and enhancing lactate removal in the blood, thus improving tissue recovery. This is primarily attributed to increased muscle blood flow.

The results of this hypothesis are also consistent with studies that have used Foam Rolling exercises on some biochemical variables, such as lactate (LAC), as demonstrated in the study by **Casanova et al.** and others (2019) (14).

Thus, the validity of the hypothesis stating "there are statistically significant differences between the means of pre-test and post-test measurements in some respiratory system variables under investigation for football players" is confirmed.

(3) Discussion of the results that confirm the validity of the third hypothesis, which states: "There are statistically significant differences between the post-measurements (before and after exertion) for the first and second experimental groups in favor of the post-measurement for the first experimental group."

The results from Table (16) demonstrate significant differences in oxidative stress enzyme post-measurements between the first and second experimental groups, favoring the first group. Calculated (Z) values ranged between 1.79 and 3.93 before exertion and between 3.21 and 3.93 after exertion, exceeding the tabular (Z) value at a significance level of 0.05 for all enzymes except AST and ALT before exertion. This highlights the intervention's notable efficacy in influencing oxidative stress enzyme levels, particularly benefiting the first experimental group.

Similarly, Table (17) shows significant differences in post-measurements for some biochemical variables between the two groups. Calculated (Z) values ranged from 1.85 to 3.78 before exertion and from 3.03 to 3.94 after exertion. These differences were statistically significant, except for TP before exertion. Notably, the first experimental group exhibited favorable outcomes. Specifically, UA had a calculated (Z) value of 3.78 before exertion and 3.10

after exertion, while CRE had values of 3.08 and 3.50 before and after exertion, respectively. TP showed values of 1.85 and 3.03 before and after exertion, and LAC had values of 2.88 and 3.94 before and after exertion.

The differences observed in both oxidative stress variables and biochemical variables between the two post-measurements are attributed to the positive effects of the recovery program, which included Foam Rolling technique exercises and a melatonin supplement. This led to improvements in various oxidative stress enzymes and biochemical variables among soccer players. The first experimental group, which received both interventions, exhibited different outcomes compared to the second experimental group, which solely underwent Foam Rolling technique exercises.

The researcher attributes the significant differences favoring the first experimental group in certain oxidative stress enzymes and biochemical variables to the positive impact of the melatonin supplement provided to that group. This supplement contributed to the improvement of energy enzymes such as AST, ALT, LDH, and CK, as well as reduced levels of LAC, UA, TP, and CRE. Acting as an antioxidant, the melatonin supplement diminished muscle damage and stress induced by physical exertion during matches and training sessions.

This is consistent with what was mentioned by **Reiter et al** (2000) (40). It is known that melatonin is an immune molecule capable of acting on the cells of the immune system and establishing a bidirectional link between the nervous and immune systems and preventing the effects of many pro-inflammatory cytokines and muscle fatigue.

Both **Abu Al-Ala Abdel-Fattah** and **Raysan Khuraibet** (2016A) (2) and **Muhammad Abdel-Zaher** (2017) (7) agree that one of the most important preventive measures for the rapid return of the body's systems to their normal state is how to use the ideal relationship between the different training loads and the methods of restoring recovery, which aims to raise the level of The ability to perform athletically through the stage of overcompensation for a group of physiological and biochemical changes affecting performance.

This is explained by **Acuna-Castroviejo** (2011) (8), who states that one of the positive effects of taking melatonin supplements during the recovery phase from training sessions and matches is that it works to reduce oxidative stress-related enzymes. It also exerts a balancing effect on mitochondrial function, improves the activity of heart muscles, the diaphragm, skeletal structure, and ATP production.

This is confirmed by the study of **Shaimaa Al-Jaber** (2004) (4), indicating that antioxidant dietary supplements, as well as enzymes, play an important role in protecting muscles from exercise-induced damage.

This is consistent with what was stated by **Leonardo-Mendonça et all** (2017) (30) that melatonin supplements are considered one of the most important supplements that can be used to combat oxidative stress resulting from exercise, muscle damage and fatigue during periods of intense training. The responses are also... Antioxidant variables and skeletal muscle enzyme levels are biomarkers of the functional status of muscle tissue, which may be identified after intense training. As a result of metabolic and mechanical factors.

Thus, the validity of the hypothesis stating "there are statistically significant differences between the two post-measurements (before and after exertion) for the first and second experimental groups, in favor of the post-measurement for the first experimental group" is confirmed.

Conclusions and Recommendations:

Conclusions:

In light of the research objectives and within the limits of the sample and the results obtained, the following has been concluded:

• The recovery program using Foam Rolling technique, combined with melatonin supplement intake for the first experimental group, has a positive effect on improving some variables of oxidative stress enzymes. These include aspartate amino transferase (AST), alanine amino transferase (ALT), creatine kinase (CK), and lactate dehydrogenase (LDH) levels for the sampled football players.

• The recovery program using Foam Rolling technique, combined with melatonin supplement intake for the first experimental group, has a positive effect on improving some biochemical variables. These include uric acid (UA), total protein (TP), creatine (CRE), and lactate (LAC) levels for the sampled football players.

• The magnitude of improvement seen in the training program using the recovery technique of Foam Rolling, combined with melatonin supplement intake for the first experimental group, demonstrated significant changes and effects on biochemical variables and oxidative stress enzymes for football players.

• The recovery program using Foam Rolling technique for the second experimental group has a positive effect on improving some oxidative stress enzymes, including aspartate amino transferase (AST), alanine amino transferase (ALT), creatine kinase (CK), and lactate dehydrogenase (LDH) levels for the sampled football players.

• The recovery program using Foam Rolling technique for the second experimental group has a positive effect on improving some biochemical variables, including uric acid (UA), total protein (TP), creatinine (CRE), and lactate (LAC) levels for the sampled football players.

• The rate of improvement in the training program using the recovery technique of Foam Rolling for the second experimental group demonstrated significant changes and effects on biochemical variables and oxidative stress enzymes for football players.

• Adding melatonin supplement to the recovery program for the first experimental group has a better positive effect compared to the second experimental group in all variables of oxidative stress enzymes and biochemical variables used in the recovery exercises alone.

Recommendations:

In light of the research findings, the researcher recommends the following:

• Implementing the proposed program involving Foam Rolling technique along with melatonin supplementation for individuals in the field of football training.

• Incorporating the suggested program involving Foam Rolling technique and melatonin supplementation into the training program contents due to its effective impact.

• Using melatonin supplementation alongside other recovery programs to study its effect on indicators of muscle damage and oxidative stress.

• Studying the impact of other dietary supplements and conducting comparative studies to determine the best sources for delaying the onset of fatigue.

• Implementing new studies to understand the effect of the proposed program on various other biochemical and physiological variables.

• The necessity of having a nutrition specialist within the coaching and administrative staff of football teams at different levels.

Declaration of interest

There are no conflicts of interest of the authors with the information contained within the manuscript.

Arabic and Foreign References:
First: Arabic References:

1- **Abu Al-Ala Abdel Fattah and Ahmed Nasr El-Din** (2003): "Physiology of Physical Fitness: Theories and Applications," Dar Alfikr Alearbaa, Cairo.

2- **Abu Al-Ala Abdel Fattah and Bisan Kharibat** (2016): "Sports Training," Dar Alfikr Alearbaa, Cairo.

3- **Ahmed Nasr El-Din** (2003): "Sports Physiology: Theories and Applications," Dar Alfikr Alearbaa , Cairo.

4- **Al-Shaimaa Gaber** (2004): "The Effect of High-Intensity Training and Antioxidant on Some Antioxidant Indices, Special Physical Abilities, and 100m Hurdles Digital Race," Doctoral Thesis, College of Education for Girls, Al-Jazeera University, Helwan University.

5- **Aya Fareed** (2019): "The Effect of Beta-Alanine Supplementation on Some Physiological and Biochemical Variables and Delaying Fatigue Appearance in Athletes," Master's Thesis, Faculty of Physical Education, Mansoura University.

6- **Hussein Ahmed Heshmat, Nader Shalaby** (2003): “Physiology of Muscle Fatigue”, Al-Kitab Publishing Center, Cairo.

7- **Muhammad Abdel-Zaher** (2017): “Physiology of Fatigue and Sports Recovery”, 1st edition, Modern Al-Kitab Publishing Center, Cairo.

Second: Foreign References:

8- Acuna-Castroviejo D, Lopez LC, Escames G, Lopez A, Garcia JA, Reiter RJ(2011) Melatonin-mitochondria interplay in health and disease. Curr Top Med Chem. 11(2):221–240**.**

9- Aynollah Naderi, Mohammad Hossein Rezvani ,Hans Degens,(2020) Foam Rolling and Muscle and Joint Proprioception After Exercise-Induced Muscle Damage, Journal of Athletic Training 2020;55(1):58–64 doi: 10.4085/1062-6050-459-18.

10- Becatti M, Mannucci A, Barygina V, Mascherini G, Emmi G, Silvestri E, Wright D, Taddei N, Galanti G, Fiorillo C. 2017: Redox status alterations during the competitive season in élite soccer players: focus on peripheral leuko- cyte-derived ROS. Intern Emerg Med. 12:777–788. doi:10.1007/s11739-017-1653-5.

11- Beardsley c, Škarabot J.(2015) : Effects of self-myofascial re- lease: a systematic review. J Bodyw Mov Ther. 2015; 19(4):747–758; doi: 10.1016/j.jbmt.2015.08.007.

12- Blanca Romero-Moraleda , Jaime González-García , Ángel Cuéllar-et al (2019) : Effects of Vibration and Non-Vibration Foam Rolling on Recovery after Exercise with Induced Muscle Damage, Journal of Sports Science and Medicine (2019) 18, 172-180 http://www.jssm.org.

13- Callegari, G. A., Novaes, J. S., Neto, G. R., Dias, I., Garrido, N. D., & Dani, C. (2017): Creatine Kinase and Lactate Dehydrogenase Responses after Different Resistance and Aerobic Exercise Protocols. Journal of human kinetics, 58, 65–72. https://doi.org/10.1515/hukin-2017-0071.

14- casanova N, reis JF, Vaz Jr, Machado r, Mendes B, Button Dc, et al(2018): Effects of roller massager on muscle recovery after exercise-induced muscle damage. J Spor t s Sci. 2018;36(1):56–63; doi: 10.1080/02640414.2017. 1280609.

15- **Cheatham, S. W., Kolber, M. J., Cain, M., and Lee, M. (2015).** The effects of self-myofascial release using a foam roll or roller massager on joint range of motion, muscle recovery, and performance: a systematic review. Int. J. Sport. Phys. Ther. 10, 827–838.

16- **Cheikh, M., Hammouda, O., Gaamouri, N., Driss, T., Chamari, K., Cheikh, R. B., Dogui, M., & Souissi, N**. (2018). Melatonin ingestion after exhaustive late-evening exercise improves sleep quality and quantity, and short-term performances in teenage athletes. Chronobiology International, 35(9), 1281–1293. https://doi.org/10.1080/07420528.2018.1474891.

17- **Cheikh, M., Makhlouf, K., Ghattassi, K., Graja, A., Kallel, C., & Houda, M. (2020)**: Melatonin ingestion after exhaustive late-evening exercise attenuate muscle damage, oxidative stress, and inflammation during intense short term effort in the following day in teenage athletes. Chronobiology International, 37(2), 236–247. **https://doi.org/10.1080/07420528.2019. 1692348.**

18- **Czuczejko, J., Sielski, Ł., Woźniak, B., Woźniak, A., & Szewczyk-Golec, K. (2019)**. Melatonin supplementation improves oxidative and inflamma- tory state in the blood of professional athletes during the preparatory period for competitions. Free Radical Research, 53(2), 198–209. https:// doi.org/10.1080/10715762.2018.1563688.

19- **Debold EP(2015**): Potential molecular mechanisms underlying muscle fatigue mediated by reactive oxygen and nitrogen species. Front Physiol. 2015;6:239.

20- **Farjallah, M. A., Hammouda, O., Ben Mahmoud, L., Graja, A., Ghattassi, K., Boudaya, M., Jammoussi, K., Sahnoun, Z., & Souissi, N. (2018).** Melatonin supplementation ameliorates oxida- tive stress, antioxidant status and physical performances recovery during a soccer training camp. Biological Rhythm Research, 51(3), 441–452. https://doi.org/10.1080/09291016.2018.1533749.

21- **Farjallah, M. A., Hammouda, O., Zouch, M., Ghattassi, K., Graja, A., Driss, T., Chamari, K., & Souissi, N. (2018).** Effect of melatonin inges- tion on physical performance, metabolic responses, and recovery after an intermittent training session. Physiology International, 105(4), 358–370. https://doi.org/10.1556/2060.105.2018.4.24.

22- **Farjallah, M. A., Ghattassi, K., Ben Mahmoud, L., Graja, A., Boudaya, M., & Elleuch, H. (2020**). Effect of nocturnal melatonin intake on cellular damage and recovery from repeated sprint performance during an intensive train- ing schedule. Chronobiology International, 37(5), 686–698. https://doi.org/ 10.1080/07420528.2020.1746797.

23- **Farjallah, M. A., Ghattassi, K., Ben Mahmoud, L., Graja, A., Boudaya, M., & Elleuch, H. (2020):.** Effect of nocturnal melatonin intake on cellular damage and recovery from repeated sprint performance during an intensive train- ing schedule. Chronobiology International, 37(5), 686–698. https://doi.org/ 10.1080/07420528.2020.1746797.

24- **Farjallah, M. A., Ghattassi, K., Ben Mahmoud, L., Graja, A Et al** (2021) : Effects of melatonin ingestion on physical performance and biochemical responses following exhaustive running exercise in soccer players, DOI: https://doi.org/10.5114/biolsport.2022.106385.

25- **Farjallah, M., ., Sahnoun, Z., & Souissi,, Graja, A., Ghattassie tal(2022):**Melatonin Ingestion Prevents Liver Damage and Improves Biomarkers of Renal Function Following a Maximal Exercise. Research Quaeterly for Exercise and sport.

26- **Hossein Moradi and Amirabbas Monazzami(2021) :** Effects of Cryotherapy and Foam Rolling Recovery Methods on Performance and Muscle Damage Indices in Young Male Soccer Players After Simulated Soccer Match J Arch Mil Med. 2020; 8(1):e109361.

27- **Julia H. Goedecke Justin Durandt , Michael I. Lambert et al (2013):** The Effect of Carbohydrate Ingestion on Performance during a Simulated Soccer Match, Nutrients 2013, 5, 5193-5204; doi:10.3390/nu5125193.

28- **Kellmann M, Bertollo M, Bosquet L, Brink Met al(2018):** Recovery and performance in sport: consensus statement. Int J Sports Physiol Perform. 13 (2):240–245. doi:10.1123/ijspp.2017-0759.

29- Laffaye **G,Debora Torrinha Da Silva and Arnaud Delafontaine(2019) :**Self-Myofascial Release Effect With Foam Rolling on Recovery After High-Intensity Interval Training, Front. Physiol., 16 October 2019 Sec. Exercise Physiology Volume 10 - 2019 | https://doi.org/10.3389/fphys.2019.01287 .

30- Leonardo**-Mendonça RC, Ocaña-Wilhelmi J, de Haro T, de et al (2017):** The benefit of a supplement with the antioxidant melatonin on redox status and muscle damage in resistance trained athletes. Appl Physiol Nutr Metab. 42:700–707. doi:10.1139/apnm-2016-0677.

31- **Link D, Hoernig M (2017) :** Individual ball possession in soccer. PLoS ONE 12(7):e0179953.

32- **Macdonald GZ, Button Dc, Drinkwater EJ, Behm DG(2014) :** Foam rolling as a recovery tool after an intense bout of physical activity. Med Sci Sports Exerc. 2014;46(1): 131–142; doi: 10.1249/MSS.0b013e3182a123db.

33- **Marina Maren Reiner • Christoph Glashüttner • Daniel Bernsteiner et al (2021) :** A comparison of foam rolling and vibration foam rolling on the quadriceps muscle function and mechanical properties, European Journal of Applied Physiology (2021) 121:1461–1471.

34- **Masatoshi Nakamura Koki Yasaka , Ryosuke Kiyono et al(2021) :** The Acute Effect of Foam Rolling on Eccentrically-Induced Muscle DamageInt. J. Environ. Res. Public Health 2021, 18, 75. https://dx.doi.org/10.3390/ijerph18010075.

35- **Mohammad Nor Aliff Nordin , Muhamad Hamdan , Hosni Hasan et al (2022)** : Physiological response during match simulation in youth soccer playersm 2023, Malaysian Journal of Movement, Health and Exercise – Medknow.

36- **Montgomery P, Pine D , Cox A , Hopkins W and hunt p .(2008):** Muscle damage Inflammation and Recovery Interventions During a 3day Basketball . European Journal of sport science.

37- **Pearcey GEP, Bradbury-Squires DJ, Kawamoto J-E, Drinkwater EJ, Behm DG, Button Dc**(2015) : Foam rolling for delayed-onset muscle soreness and recovery of dy- namic performance measures. J Athl Train. 2015; 50(1):5–13; doi: 10.4085/1062-6050-50.1.01

38- **Sadeeq Mustafa, Eliza Hafiz, Lim Boon Hooi, Sri Sumartiningsih and Rajesh Kumar(2021):** Effect of foam rolling on delayed onset muscle soreness (DOMS) with pain scores and power performance in varsity rugby players, Journal of Sports Science and Nutrition 2021; 1(2): 84-8.

39- **Staron, R. S., & Hikida, R. S. (2000):**Muscular responses to exercise and training. Exercise and sport science, edited by Garret WE and Kirkendall DT. Philadelphia: Lippincott Williams && Wilkins, 163-76.

40- **Reiter RJ, Calvo JR, Karbownik M, Qi W, Tan DX.(2000):** Melatonin and its relation to the immune system and inflammation. Ann NY Acad Sci. 917:376–386.

41- **Robergs, R.A. and Roberts, S.O., 2000:** Fundamental Principles of Exercise Physiology for Fitness, Performance and Health, McGrow -Hill Publishers, Boston.

42- **RAMDAN PELANA , TOMMY APRIANTONO , BAGUS WINATA BAGUS et al (2021)**: Effects OF Foam Rolling on Bood Lactate Concentration in Elite Fustal Payers, HUMAN MOVEMENT (ISSN 1899-1955),2021,22(1) : 72-79.

Attachment (1)

Foam Rolling Program

NO	Muscle	Exercise
1	HIP ADDUCTORS	
2	Quadriceps	
3	ILIOTIBIAL BAND	
4	HAMSTRING	

Attachment (1)

Foam Rolling Program

NO	Muscle	Exercise
5	ADDUCTORS	
6	Calves	
7	Tibialis Interior	
8	Peroneus longus	

Attachment (2)

Model of Recovery

Load			No of Eercises	Time	Muscle	
Time of Rest	Rep	Time of Performance				
٣٠-٢٠sec	3 – 5	٣٠-٢٠sec	(١)	3 MIN	HIP ADDUCTORS	Foam Rolling Eercises
٣٠-٢٠sec	3 – 5	٣٠-٢٠sec	(٢)	3 MIN	Quadriceps	
٣٠-٢٠sec	3 – 5	٣٠-٢٠sec	(٣)	3 MIN	ILIOTIBIAL BAND	
٣٠-٢٠sec	3 – 5	٣٠-٢٠sec	(٤)	3 MIN	HAMSTRING	
٣٠-٢٠sec	3 – 5	٣٠-٢٠sec	(٥)	3 MIN	ADDUCTORS	
٣٠-٢٠sec	3 – 5	٣٠-٢٠sec	(٦)	3 MIN	Calves	
٣٠-٢٠sec	3 – 5	٣٠-٢٠sec	(٧)	3 MIN	Tibialis Interior	
٣٠-٢٠sec	3 – 5	٣٠-٢٠sec	(٨)	3 MIN	Peroneus longus	

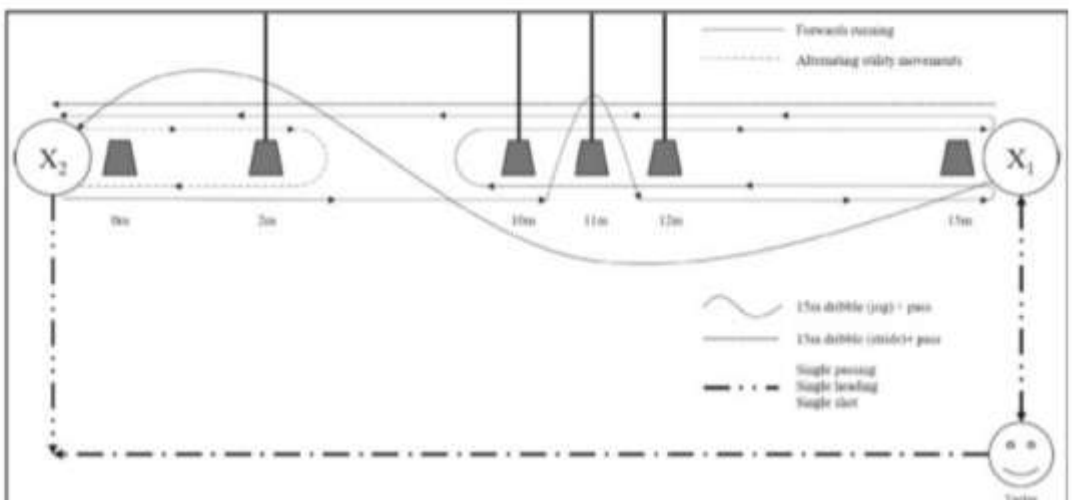
Attachment (٣)

Time distribution of the content of the training modules during the week

STIM MATCH	TUES	MON	SUN	SAT	FRI	STIM MATCH	DAY / Load
			●				MAX Load
		●		●			High Load
	●				●		Moderate Load
							Rest
	٦٠	٨٥	١٢٠	٩٠	٨٥		Total Time
	-	٢٠	٥٠	٣٠	٢٠		Physical
	٧٠	٣٠	٢٥	٣٠	٤٥		Technical
	٣٠	٥٠	٢٥	٣٠	٢٠		Tactics

Attachment (4)

Football simulation test and movement profile during performance



The kinematic profile of players during the performance of a football match simulation test for each performance cycle

(15)M		(10)M		(5)M	
S	**Performance**	S	**Performance**	S	**Performance**
١٠	Jumping	١٠	Jumping	٤	Standing up
٧	.Side steps then shooting	١٧	Walking	١٠	Jump and pass
٧	Side steps	١٠	Sideways running	١٧	Walking
١٠	Jumping then passing	٦	Sprinting then shooting	٧	Side steps
١٧	Walking	٤	Standing	١٧	Walking
١٠	Sideways running	١٠	Jumping	١٠	Jumping
٤	Walking	١٧	Walking	٦	Fast running then passing
١٧	Walking	١٠	Sideways running	٤	stand up
١٠	Jumping then passing	١٧	Walking	١٠	Lateral running
١٧	Walking	٧	Side steps then shooting	١٧	Walking
٧	Side steps	١٧	Walking	١٠	Jump and pass
١٧	Walking	١٠	Sideways running	١٧	Walking
١٠	.Jumping then heading the ball	١٧	Walking	٧	Side steps
٤	Standing	١٠	Jumping	١٧	Walking
١٧	Walking	١٠	Running then dribbling for a .distance of 15 meters	٤	Standing
١٠	Sideways running	١٠	Sideways running	١٠	Jumping and hitting ball with head
١٧	Walking	٤	Standing	١٧	Walking
١٠	Jumping	١٧	Walking	١٠	Sideways running
٦	Sprinting then shooting	١٠	Jumping then passing	١٠	Jogging, then running for a distance of 15 meters with the ball
٤	Standing	١٧	Walking	١٠	Jumping
١٠	Sideways running	٧	Side steps	١٧	Walking
١٧	Walking	١٧	Walking	١٠	Sideways running
١٠	Jumping then passing	١٠	Jumping	١٧	Walking
١٧	Walking	١٧	Walking	٧	.Side steps then shooting
٧	Side steps	١٠	Sideways running	٤	standing
١٧	Walking	١٧	Walking	١٧	Walking
١٠	Jumping	٤	Standing	١٠	Side steps
٧	Side steps then dribbling for a .distance of 15 meters	١٠	Jumping	١٧	Walking

Attachment (5)

Foam Rolling Cylinders

Attachment (6)

Melatonin supplement

Attachment (7)

Data registration form (height - weight - chronological age)

N0	Name	Height	weight	Age

Attachment (8)

A form to record data on oxidative stress enzymes and biochemical variables

Name	AST	ALT	CK	LDH	UA	CRE	TP	LAC

Attachment (9)

Rhystameter device for measuring height and weight

Attachment (10)

Centrifuge to separate blood components

Attachment (11)

Plastic tubes for blood administration

Attachment (12)

Draw blood