A comparative study of some EMG variables of the agonist and antagonist muscles(upper body) using some muscle strength exercises.
The Researchs

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الملخص باللغة العربية

بين العضلات العاملة والمضادة (الجزء العلوي من الجسم) *EMG* دراسة مقارنة لبعض متغيرات باستخدام بعض تمارين القوة العضلية.

أهمية البحث

أهمية هذه الدراسة هي استخدام EMG للتعرف على أماكن الضعف في العضلات المضادة من خلال المقارنة بين العضلات العاملة والعضلات المضادة وتوجيه الاختصاصيين في المجال الرياضي التوجيه الأمثل لكيفية التعامل مع الإصابات الرياضية بأسلوب علمي وفقا لقواعد مدروسة ، وبالتالي السلامة والكفاءة البدنية للرياضي الممارس للنشاط الرياضي.

أهداف البحث:

1- استخدام جهاز EMG للمقارنة بين العضلات الرئيسية والعضلات المضادة في الأداء الرياضي.

2- التعرف على الفروق بين العضلات الرئيسية والعضلات المضادة في بعض متغيرات جهاز EMG بالنسبة للتمارين قيد الدراسة.

3- التعرف على النسبة المئوية لعمل العضلات المضادة في بعض متغيرات جهاز EMG من خلال بعض التمارين المقترحة.

المنهجية:

احتوى هذا الباب على منهجية البحث وإجراءاته الميدانية ، إذ استخدم الباحث المنهج الوصفي بأسلوب المسح والعلاقات الارتباطية ، وقد اختيرت عينة البحث بالطريقة العمدية والتي شملت (30) لاعباً في لعبة كرة القدم ، بالإضافة إلى توصيف لعينة البحث والأدوات والأجهزة المستخدمة مع إجراء التجارب الاستطلاعية ، كذلك تصميم وتحديد أهم متغيرات البحث من خلال استخدام استمارة استبيان ثم تضمن إعطاء شرح وافٍ للتمارين الخاصة في قوة العضلات وكيف يعمل جهازEMG ، فضلاً عن ذلك تضمن أهم المعالجات الإحصائية المناسبة للبحث .

الاستنتاجات

1- وجود نسب مئوية متباينة ومقبولة للعضلات المضادة بالنسبة للعضلات العاملة في الأداء الرياضي.

2- نتائج الفروق بين عضلات لاعبي كرة القدم العاملة والمضادة سوف تساعد على تأكيد أهمية طبيعة ونوعية النشاط في الوصول إلى درجة مناسبة من التوازن العضلي.

إما أهم التوصيات فكانت:

1- التأكيد على مفهوم التوازن العضلي أو نسبة القوة العضلية بين العضلات الرئيسية والعضلات المضادة بين حركات المد والثني للمفاصل وأطراف الجسم المختلفة، لكل المهتمين بمجال الطب الرياضي وصحة اللاعب من مدربين،ولاعبين، وأخصائيي العلاج الطبيعي، وأطباء.

2- الاهتمام بقياس نسب التوازن العضلي بين العضلات الرئيسية والعضلات العاملة لدى الرياضيين بصورة دورية ومنتظمة ،والعمل على أن لاتقل هذه النسبة عن (60%) وخاصة عند لاعبي كرة القدم.

ABSTRACT English

The importance of this study in using (EMG) to find the places of weakness in the counter muscles , by comparison between the agonist and antagonist muscle and guide the specialist in sport to the best way to protect them from sport injuries by scientific way according to studied riles and by that we can get the safety and full ability in physical practices during the sport activity.

The objectives of the research:

1- Using EMG apparatus to compare the main muscles and the antagonist muscles in the sport performance.
2- To know the difference among the agonist muscles and the antagonist muscles in some changes of EMG apparatus in exercises which they are studied.
3- To know the percentage of the antagonist muscles action in the changes of the EMG apparatus through some suggested exercises.

The Methodology:

the researcher used the descriptive curriculum with style of scanning and Correlations . the sample of this study had been selected which included (30) players in the foot ball game . besides , tools which is used in the research , with doing experiment . it also designs and limits the most important elements of research using questionnaire forms which concerns enough statement for the special exercises of performance in power of muscular and how EMG device works , besides included the most important things of statistical means .

THE CONCLUSIONS :

1- Existence of different and a accepted percentages for the antagonist muscles in comparison with the agonist muscles in sport performance .

2-. The result of differences among the agonist muscles of football players and the antagonist muscles will help to assure the importance of nature and quality of the activity in reaching to the suitable muscular balance.

THE MOST IMPORTANT RECOMMENDATION WERE :

1- Stress on the understanding of muscular balance or the proportion of the muscular power among the agonist muscles and the antagonist muscles among the movement of stretching and bending of joint and the limbs of the human body , to all the interested persons in the sport medical filed , health of players ,coaches, specialists in physical therapy and doctors.

2- Interest in measurement of proportions of muscular balance amp among the agonist muscles and the antagonist muscles with the athletes in general, in regulated periods in condition that this proportion is not less than 60% especially with the football players .

1-1 Introduction and literature review:

Through the wide view to the great and last progress in all fields of life and specially in the sporting field. This progress happened as a result of a great power of joining the different kinds of science and using them in researches to make use of them to improve sport aspects Some of these sciences are medicine and physiology which are considered the real test to find the suitability of the training and teaching curriculums which are prepared to keep the safety of players or people who do the sport activities .The healthy aspect is one of these important aspects in improvement and progress of sport level and it is the fundamental factor to make the real and total sport balance .

The muscles are the sources of motion in human body ,because they are the sources of power which causes the motion. The special studies of anatomy and motion explained the way in which the motion happens according to the anatomic properties and the mechanical laws.(1)

Because of their importance in physical education, a lot of people consider them the subject of their studies and researches .

The sport injuries represent one of the main blockages which prevent the fulfillment of the dynamic progress for the sport level, and confuse the operation of growth and improvement during the stages of sport training which are ordered in scientific way and affect the aims of sport. The injuries of locomotor organs (

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(1) Thomas R. Baechle, Roger W. Earle, Essentials of strength training and Conditioning -3rd Edition. Human Kinetics,2008.pp.66.

bones-joints – nerves) cause a great disorder among body organs ,and stumble the co-operation among them and cause revere actions in all body's parts and their effect move to the other parts, so this state is considered a disease state that affects the sport training and its aims.

When the moving limb reaches to the final limit of the movement range of the joint ,The antagonist muscles contract passing contraction fits with the power of muscles contraction or with the muscles agonist movers, and decreasing the speed of the moving limb to stop its motion to protect the joint from injury, but if when there is a group of muscles around limited joint stronger than the group of muscles which face them around the same joint this is called muscular imbalance .(1)

But (Klaus Klausen 2005) referred to improvement of the power needs to safe level for the inaction of the counter muscles, that means the counter muscles must have decreased resistance by safe training which happen with the common training of the main muscles.(2)

As a result of that we mentioned there are many methods of protection from injury before happening .

Al Bayatti Wahbi referred to the modern scientific devices which are used to help to discover the places of defects and weakness in sportive performance and muscular activity with this sport performance , especially the system (EMG) and its programs in measuring and analysis of electrical activity of the muscle.(3)

The (term) Electromyography is used to describe the electrical signs which result from contraction ,it is also a way to store this sign and the data which appear.

The importance of this study in using (EMG) to find the places of weakness in the counter muscles , by comparison between the agonist and antagonist muscle and guide the specialist in sport to the best way to protect them from sport injuries by scientific way according to studied riles and by that we can get the safety and full ability in physical practices during the sport activities .

The last decades witnessed a notable expansion of the scientific sport applications and practices . Most of the international teams have clear scientific curriculums to apply the science of sport especially the physiology .(4)

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(1) David Fearing, John C. Lincoln: Shoulder problems-are they due to muscular Imbalance or Repetitive type motion, American Journal of Sports Medicine Committee,1997,pp.7.

(2) Klaus Klausen ,Strength and Wight-training .physiology of sports ,2005,pp37 .

(3) Wahbi Al- Baytti : Studying Electric Activity "EMG" for LegsMuscles in Hop and Step phases and the Relation of some Biokinematics Variables for Triple Jump Performance.2009.p 28.

(4) T.Reilly, N. Secher, P. Snell and C . Williams: Physiology of sport ,2005.pp13.

The muscular power is an element of preparatory and competitive elements in sport and it is one of the most important aspects in technical and artistic sufficiency , for this cause it plays a decisive role in sport phaces.

Injury may happen when the body of the athlete moves , because of many reasons, it may arise from the environment or from the player himself. To day all the involved people try to know the causes of the sport injuries to avoid them or to reduce their harm.

In the medical field is defined as the attempt to avoid or reduce the repeating of any deterioration that may affect the health of the person in negative way, and for the protection from sport injuries ,it means the protection from happening or repeating the injury ,and the protection from increasing the intensity of the injury and also the protection from the decrease or insufficiency of the ability such as the arthritis that caused the weakness of the tendons and muscles which act on the joint .(3)

The shortage of physical fitness and the sudden excessive activities cause many injuries The physically unfit players are more exposed than others to have indirect muscles injuries.

It is noticed that a lot of skills of games need a suitable degree of muscular balance in the element of power among the acting muscles and the muscles in front of them during the performance.

The problem of the unbalanced muscular state between the agonist muscles and antagonist muscles struck the attention of a lot of researchers recently , because it has a relation to the sport injuries .

The researcher notices that the proportion of the muscular powers between the agonist muscles and the antagonist muscles is an important indicator to define the degree of muscular balance which we can depend on of estimating the physical state of the players . This proportion can be calculated by many ways,the simplest and the most important one is the concept which put by (Ajard) and his colleagues, which is studied by the researcher , and by which he calculates the ratio of highest contraction of the antagonist muscles on the highest contraction of the agonist muscle , and multiplication the result by 100,that has been done in limited speed and in the same kind of contraction .(1)

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(3) Hassan, Adel Ali: school sports injuries, Riyadh, Saudi Federation for Physical Education and Sports, Issue 7, 1419 .

(1) Aagaard,P.,Simonsen,E.,Magnusson,S.,and et.al. :A new concept of isokinetic hamstring:Quadriceps muscle strength ratio. American Journal of SportsMedicine. March, April, 1998; 26(2):pp.231-237.

The researcher noticed through the study and observation that the Iraq society to has a little interest in studying this problem except some studies that deal with the EMG variables and did not deal with the muscular balance.

The researcher felt through his interest in the filed of sport injuries that many players of different ages at all the levels which caused negative results ether in sport performance or in training or competition . This represents a great economical and moral loss at the time that the researcher noticed the rarity of interest to do scientific studies to help limit the volume of the problem and it quality and the cause of its happening especially about the phenomenon of the reduction of muscular balance among the agonist muscles and the antagonist muscles that the researcher agreed that it has a strong linkage with the happening of the injury.
This assures the need to do this study either in the country of the study of the researcher or in the country from which he came, which tries to answer the following question:
Is there any relation between the proportion of the muscular power of the agonist muscles and the antagonist muscles and the happening of the sport injuries.

1-2 The objectives of the research :

1-Using EMG apparatus to compare the main muscles and the antagonist muscles in the sport performance.
2-To identify the difference among the agonist muscles and the antagonist muscles in some changes of EMG apparatus in exercises which were studied .
3-To identify the percentage of the antagonist muscles action in the changes of the EMG apparatus through some suggested exercises.

1-3 Hypotheses the research :-

The recent study attempts to compare the agonist muscles with the antagonist muscles to support or refute the following hypothesis at the level of statistical indication (0.05).

1- Existence of differences of changes of the EMG apparatus among the agonist muscles and antagonist muscles in some suggested exercises.
2- Existence of different and accepted proportions in the action of the antagonist muscles in comparison with the agonist muscles in exercises which are being studied and to the changes of EMG apparatus.

1-4 Scopes of the research: -

1-4-1: The human frame : This study was carried out on (30) players from team football from University .
1- 4-2 : The time frame: from 1 / 3 / 2010 to 1 / 3 / 20 12 .
1- 4-3: The space frame : physiology laboratory at the Faculty of Physical Education in University Maysan and University Babble ,University Karbala .

2- REVIEW OF LITERATURE:

2-1 Introduction:

Electromyography is the only method of objectively assessing when a muscle is active. It has been used to establish the roles that muscles fulfill both individually and in group actions. The EMG provides information on the timing, or sequencing, of the activity of various muscles in sports movements. By studying the sequencing of muscle activation, such as any overlap of agonist and antagonist activity and the onset of antagonist activity at the end of a movement. .

2-1-1 EMG Technique:

(Its such electromyography device used to study the electricity signals of muscle, detecting ,recording and storing the Electromyography signals, in which the biological signal represented as electrical currents generated inside muscle throughout the contraction operation (action .)

A recording of the external electrical activity from a muscle is called an EMG, or electromyogram. EMG also refers to electromyography, the recording technique used to obtain an electromyogram (Basmajian J.V., and C.J.De luka 1985),[6] (Loeb and Gans, 1986) [1], (Cram and Kasman, 1998) [2].

EMG recordings from human skeletal muscle offer a simple and reliable educational tool .

2.1.2 Relation between EMG signal and power:

* The kinetic activated unit and number.
* contraction the kinetic unit and power.
* Reaction mechanism between muscle fibers.
* Kinetic unit and aggravation average.
* Picker and kinetic units number detected.
* Kinetic unit action potential, forms, period and amplitude.
* Kinetic unit aggravation continuous .

2-1-3 Muscular Injuries:

It more common occurring in society, because it is the main tool executed for the daily works needs [3].

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[1] Basmajian,J.V.and C.J.De Luca ,eds.1985.muscles Alive: Their Function Revealed by Electromyography ,5th ed.Williams and Wilkens,Baltimore,pp 516.

[2] Loeb,G.E.and C.Gans.1986.Electromyography for Experimentalists.Universty of Chicago Press,Chicago,pp373.

[3] Cram,J.R.and G.S.Kasman.1998.Introduction to Surface Electromyography .Aspen publishers,Inc,Gaithersburg,MD,pp408.

[1] Ammar Abdul Rahman : sports medicine. House of Wisdom for printing, the University of Mosul, 1988, pp 199.

There are studies that pointed that muscular injuries form ratio of (10-30%)of injuries , which happened by clashing and indirect injuries as result of high tension[4].

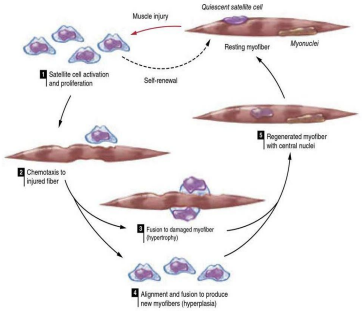

Figure (1): The satellite cell response to muscle injury..[1]

2-1-4 Muscle under study:

The researcher work is concentrated on muscles action mechanism which participated on selected exercises, whether that be main muscles or adverse on function, which their action could cause injures happening at athletic exercises performing. Thus researcher has selected muscles of upper and muscles torso of body to study.

2-1-4-1 MUSCLES OF UPPER LIMB:

2-1-4-1-1 Biceps Brachial: [2].

A t t a c h m e n t s:

* Long head of the biceps brachial:

Function: Flexion and adduction of the shoulder joint and flexion and external rotation of the elbow joint. Stabilizes shoulder joint.

* Short head of the biceps brachial:

Function: Flexion and adduction of external rotation of the elbow joint.

2-1-4-1-2 Triceps Brachii :

A t t a c h m e n t s:

* Long head of the triceps brachial:

Function: Extension of the elbow joint; extension and adduction of the shoulder joint.

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[2] *Faleh Francis: Almaekerotoma when athletes in Iraq. Conference Althanilaeliat Journal of Physical Education, University of Basra, Alaa Press, 1986, pp. 15-17.*

[3] *W. Larry Kenney, and others: Physiology of sport and exercise :.5th ed. Human kinetics ,2012. . pp234.*

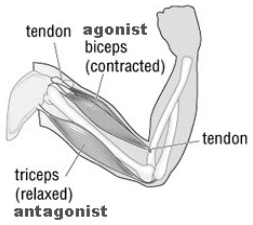
[2] *Jari Ylinen: Stretching therapy for sport and manual therapies. Edinburgh London New York Oxford Philadelphia ST Louis Sydney Toronto 2008.pp. 140, 141.*

* Medial head of the triceps brachial:
Nerve, supply: Radial nerve, C6-8.
Origin: Dorsal surface of the middle and lower third of the humerus.
Insertion: Olecranon of the ulna.
Function: Extension of the elbow joint.
* Lateral head of the triceps brachial:
Function: Extension of the elbow joint.

2-1-5: The balance between muscles (Agonist) and (Antagonist):

Virtually all body movements involve the action of more than one muscle. The muscle most directly involved in bringing about a movement is called the prime mover, or agonist. A muscle that can slow down or stop the movement is called the antagonist. The antagonist assists in joint stabilization and in braking the limb toward the end of a fast movement, thereby protecting ligaments and cartilaginous joint structures from potentially destructive forces. During throwing, for example, the triceps acts as an agonist, extending the elbow to accelerate the ball. As the elbow approaches full extension, the biceps acts as an antagonist to slow down elbow extension and bring it to a stop, thereby protecting elbow structures from internal impact.(1)

A muscle is called a synergist when it assists indirectly in a movement. For example, the muscles that stabilizes the scapula act as a synergist during upper arm movement. Without these synergists, the muscles that move the upper arm (many of which originate on the scapula) would not be effective in bringing about this movement. Synergists are also required to control body motion when the agonist is a muscle that crosses two joints. For example, the rectus femoris muscle crosses the hip and knee, acting to flex the hip and extend the knee when contracting. Rising from a low squat involves both hip and knee extension. If the rectus femoris is to act to extend the knee as a person rises without inclining the trunk forward, then hip extensor muscles such as the gluteus maximus must act synergistically to counteract the hip flexion that would otherwise result from tension in the rectus femoris.(2)



(1) *Brian Sharkey:Fitness Illustrated. Human Kinetics.2010,pp178.*
(2) *Brian Sharkey : Ibid . pp 178.*

Figure. 2. Biceps and triceps muscles as antagonistic pair control elbow flexion and extension. Not shown are the brachialis muscle (attaching to humerus and ulna) and the brachioradialis muscle (connecting humerus with radius) which act together with the biceps as a synergistic flexor group .[3]

Muscle balance is a vital component to injury prevention. Whether you chose to lift weights or use exercises to maintain muscle strength and endurance, we need to focus on muscle balance. The major muscle group's work in pairs and those muscle pairs need to be balanced in terms of strength and flexibility. For example, we bend our elbow by using the biceps muscle. It's pair is the triceps muscle. The triceps muscle must be willing to stretch for the bicep muscle to contract and bend the elbow fully.

There are two opposing muscle groups: the agonist, and the antagonist, which moves it in the opposite direction. . A good fitness program requires that the workout include exercises for both agonists and antagonists to achieve proper balance. This is not intuitive, and many adults who do exercise on a regular basis often do it improperly, excessively favoring a specific muscle group during their workout in order to acquire a desirable body feature.

Virtually all body movements are caused by simultaneous contraction of agonist and antagonist muscles on opposite sides of joints. This is called co-activation of the agonist and
antagonist muscles, and it is controlled by the motor control centers of the brain and spinal cord.
The position of each separate part of the body, such as an arm or a leg, is determined by the relative degrees of contraction of the agonist and antagonist sets of muscles.[2]

2-2 Literature Review:

By briefing on the literatures related with research project, researcher didn't find any project that relation with EMG device using and muscles. So researcher recourses some studies and researches related with how EMG device using, to get a wide view over device work and measurement method and else .

3 - The Research Methodology and Procedures of Field:

3-1 Research Methodology:

Requires a methodology used in scientific research and a test analysis of the problem addressed by the researcher, and that the nature of the problem are

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[3] Lionel Bender, and other: the facts on file illustrated guide to the human body skeletal and muscular systems ,2005,pp. 26.

[2] Arthur C. Guyton, John E. Hall. : Textbook of medical physiology . 11th ed. 2006.pp 82.

determined by the selection of one of the methods to be adopted in the scientific research to achieve accurate and reliable results. On the basis of it felt researcher use descriptive method being fit and solve the research problem, since it is the most efficient means of access to reliable knowledge, when it can be used in solving problems And to give a more comprehensive and accurate in the development of the facts.

3-2 The Study Sample:

This study was carried out on (30) players from team football from University Maysan , and players who have been exposed to infection during the previous months of the test or were involved in any program of strength training.

3-3 Devices and Tools used :

A - Surface receptors :

After that, the researcher out cleaning [hair removal mediated by a razor blade and wipe with alcohol to remove the secretions secreted by the skin as well as skin to the surface of the skin [where to place the detector] to get the skin less resistant to signal power enables us to get the signal EMG good, it was put the detector surface above the middle of the top of each of the muscles of the upper and lower sides.

B - Additional detector:

Each device in the pickup there is one additional and remove any electrical job, the body of picked them up around [the ocean] and is called ground and that the place and put it in your device to study in any part of the body parts.

The work of the device in the present experiment is the absorption frequencies that under the [20 Hz], where passing reference candidate passing a high [High pass filer] which removes this filter any noise coming from surrounding organs and power lines, also indicate pass a candidate passage and low [Low pass filter] in order to interrupt any signal after [500 Hz] and removes the artificial movements of the wire as a result of movement of the device or the device itself discourage mobility activities.

3-4 Program Myo Research xp 1.06.67:

This should be a program existed within the software and its features is the display and storage of reference EMG so as to be in the form of reference crude and is above the name of the muscle, also has other features which can make multiple processors for signal EMG later RMS and Packaging linear, another advantage program, a map that contains all the muscles of the body front and rear and the location of the muscle as well as where to place the detector on the surface of the muscle, so that the program registers the name of the muscle

when you put the cursor on the muscle and pressure it shows the channel number that will show the signal EMG, extension shows that .

3-5 Signal analysis of muscle under study :

The researcher analyzed the signals and all the muscles under study according to their time and capacity [peak] and an area, and then around to the data for statistical operations. Through the correspondence between the movement or exercise performed by the laboratory and the reference device EMG that result from the action of the muscles of the study, which we observe during the filming, and then analyze the relationship between space and capacity and the time of muscle activity for the study and during contraction and extraversion and using the program May Research Xp,

3-6 Speed of wave propagation :

The speed of wave propagation and along the muscle means the period in which the effort to do the muscle between the detector, where he found the people sick and that there is rapid spread of the wavelength of [4 m / s], i.e., the meaning is as the duration of effort to do the muscle shorter as the speed high.

Detection of amplitude and duration of the effort to do the muscle in the laboratory:

Through contractions involuntary, we disclose in the laboratory for the duration of effort to do the muscle and the amplitude directly from the signal EMG device, where we use the computer to be able to see the change in the direction of signal EMG device or analysis of succession in an effort to do the muscle and all this is produced by analyzing the signals athletic movements .

3-7 Amplify the signal of EMG device:

In order to get a clear signal found in all organs of the EMG amplifiers of the signal, where there is no need to amplify the signal of biological and represents the sum of the effort to do muscle accumulated, and that any such reference must be free of the reference synthetic, noise and undistorted.

3-8 Exercises used in the study:

This chapter discusses for strength training exercises. The exercises are grouped into those that target the upper body, and torso.

Before you get started strength training, you should review several safety issues. at no time should you compromise safety.

3-8-1: Upper Body Exercises:

There are an infinite number of exercises that you can perform to strengthen the upper body. In this part, i am focus on the fundamental exercises that strengthen the muscles of the arms (figure 3, a through b).[1]

The exercises in this part serve several purposes. They can help you achieve fitness, improve athletic performance, and prevent injuries. As you perform each of these exercises, pay particular attention to your exercise technique. Properly executing movements will ensure you will maximize your strength gains and minimize your chances of injury. This creates a balance in both the strength and appearance of the muscle groups and ensures joint stability.

3-13-1-1 Dumbbell Biceps Curl, biceps brachii:

Starting Position:

1. Stand with the feet shoulder-width apart, the knees slightly bent, and the back flat and in a neutral spine position.
2. Hold the dumbbells with an underhand grip, wrapping the thumbs around the dumbbells and extending the arms fully.

Action:

3. Raise the dumbbells in a controlled and smooth fashion by bending at the elbows until they are fully flexed.
4. Lower the dumbbells, following the same path used for the upward movement.

Notes:

Maintain the starting body position and use the same movement path every repetition.

Avoid flexing and extending at the knees and hips to initiate the movement.

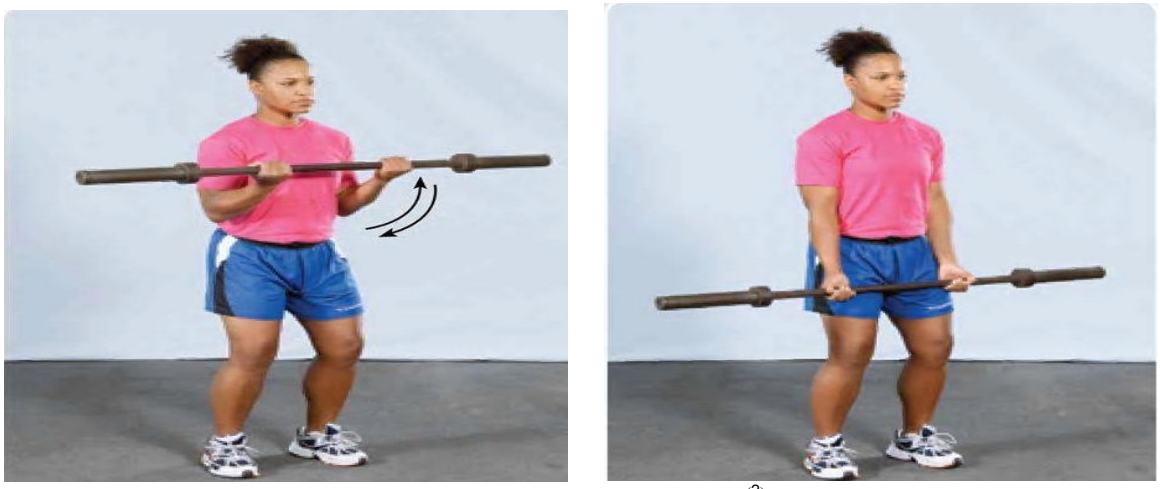

Figure 3: Upper Body Exercises. [2]

[1] *Thomas R. Baechle, Roger W. Earle, editors:Op cit. p.339.*

3-13-1-2 Push-Ups :

Push-ups build the chest, shoulder, and arm muscles. revert to the standard push-up
technique.

1. Starting position:

• Standard push-ups: Start in the push-up position, with your body supported by your hands and feet.

• Modified push-ups: Start in the modified push-up position, with your body supported by your hands and knees.

2. Lower your chest to the floor with your back straight, and then return to the starting position.(figure 4, a through b).

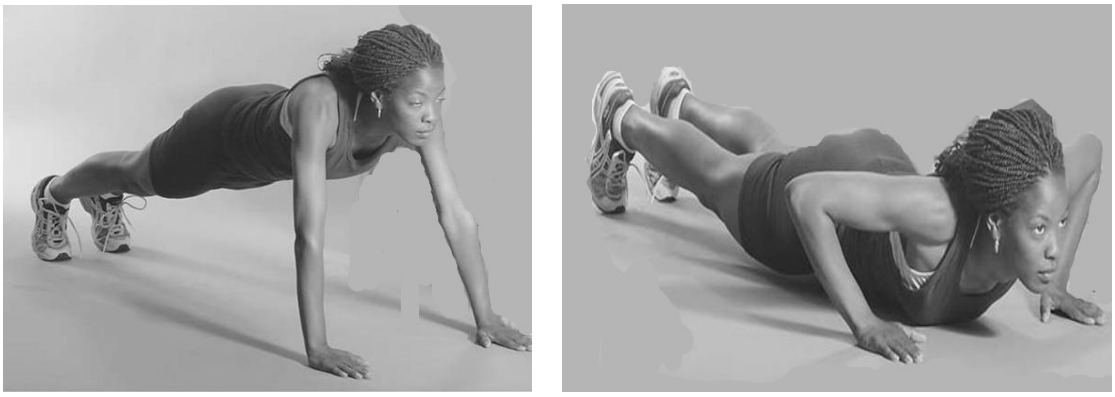

Figure 4 Push-Ups (a through b) .[1]

3-14 Statistical analysis:

The researcher used All statistical analyses through the use of a statistical software package (SPSS, Version 19.0, SPSS Inc., Chicago, Illinois, USA.

Statistical significance was set at $p < 0.05$.

4. finding:

Electromyography can be used to validate assumptions about muscle activity that are made when calculating the internal forces in the human musculoskeletal system.

And therefore, when used researcher wanted to find raw scores on the performance of muscle strength exercises. In order to access the researcher to whom aim the objectives of this thesis, and by converting the findings of the ore grades to standard grades, as crude grades must be converted to standard scores can even evaluate their results and their interpretation .

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[2] Thomas R. Baechle, Roger W. Earle, editors: Ibid . pp.339.

[1] Thomas D. Fahey, Ed.D: Weight Training Basics.2005.pp.63.

Decision:

TABLE (1)

4-1: Presentation & Discussion of T-Test, between agonist muscles and antagonist muscle a bending and extending the arms exercise karl in front of body, For variables device EMG Top, RMS, Area, Time.

Var.	Mean	Std.Deviation	Std.Error Mean	T.Test	T. Test	df	Result
Top	**223.80**	**14.71**	**2.68**	**83.29**	**1.69**	**30-1=29**	**Moral**
RMS	**192.70**	**19.17**	**3.50**	**55.05**			**Moral**
Area	**126.86**	**13.43**	**2.45**	**51.74**			**Moral**
Time	**0.023**	**0.10**	**0.01**	**1.20**			

Under the degree of 30-1 = 29 and the proportion of error 0.05 = 1.69 .

The table no. (1) refer to existence of a statistically significant difference at the level less than (0.05) between the mean study sample in the value of the contractions of muscle between the major muscle and muscle anti for variables device and exercise bending and extending your arms in front of the body, where researcher noted disparity in the amount where the value of the variables in the above mentioned are, TOP 83.29, RMS 55.05, Area 51.74 .

The reason for this attribute to the difference in mathematical circles for each of these variables as the arithmetic mean value of each is : TOP 223.80, RMS 192.70, Area 126.86 .

In addition to that this result is consistent on what he referred (Neder et. al.) in the importance of the impact of the activity and its kind on the values of the maximum torque of the power muscle.[1]

While the fourth variable which is the time it was the value is not statistically

[1] *Neder, A. Nery, L.; Shinzato, G.; Andrade, M. ;and et-al,Reference values for concentric knee isokinetic strength and power in nonathletic men and women from 20 to 80 years old. Journal of Orthopedic and Sports Physical Therapy.1999. ;29 (2):pp.116-126.*

significant The researcher finds it a matter of course in the reading device EMG for a time be not fixed amount, and this is also due to the nature of directives nerve and the nature of work the muscles more
accurately and how to receive the signal nerve and after transition while for muscle contraction. Where the value (T.test) (1.20), the smallest of the value (T.test) spreadsheet, which was (1.69) and at the level less than (0.05) and under the degree of freedom (n-1).

Make maximum power against resistance requires a certain time period the player takes to achieve Cramp appropriate and which in turn achieves so much power, has been observed at the time of isometric work of the holding muscles where the elbow joint could be up to (1.6 sec.) to achieve the maximum constriction, but for the time in maximum constriction of the muscles holding the Leg be longest.

That this delay to reach the muscles to the maximum constriction due to the fact that there are several processes that must take place before the arrival of the muscle for this level of contraction and these processes are:

1. All muscle fiber of the muscles must be involved excited to work with the utmost and highest.
2. Muscle and praises must be in a state of tension before a crunch to take advantage of the power enjoyed by rubber, and the time in many of sports renderings be have the time available to make relatively short power. (1)

(1) *Atha J. Strength trning muscle .In miller D. (ed) Exercise and sport science Reviews , Franblin institute press, philad alpha. 1981.*

Table (2)

4-2 : Presentation and discussion T. Test Between agonist muscles and antagonist muscle an exercise bending and extending the arms behind the head For variables device EMG : Top, RMS, Area, Time.

Var.	Mean	Std. Deviation	Std. Error Mean	T. Test	T. Test	df	Result
Top	321.55	16.62	17.45	18.41	1.69	30-1=29	Moral
RMS	190.90	16.36	11.21	17.02			Moral
Area	316.00	16.01	15.70	20.12			Moral
Time	0.017	0.053	0.009	1.73			Moral

Under the freedom degree of 30-1 = 29 and the proportion of error 0.05 = 1.69 .

The table no. (2) refer to the existence of a statistically significant difference (at the level less than (0.05) between the mean study sample in the value of the contractions of muscle between the major muscle and muscle anti for variables device EMG and exercise bending and extending your arms behind the head, where he noted researcher disparity in where the value of the amount (T.test) of the above mentioned variables are, TOP 18.41, RMS 17.02, Area 20.12.

The reason for this attribute to the difference in mathematical circles for each of these variables as the arithmetic mean value of each TOP 321.55, RMS 190.90, Area 316.00

The value of was (T.test) for each of these variables is smaller than the value of (T.test) to exercise which preceded, and agree this result with what he referred to (Hahn) and others in the presence of statistically significant differences between the values of the maximum

contraction muscle between the players and according to the nature and type of sports activity.[1]

As well as consistent with the study of Bahiya El-Baden et. Al., conclusions of body, as well as with the study of Gilliam and others and what conclude it from the results of which showed that the value of the

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[1] Hahn – T; Foldspang ,A .; and Ingemann, H.: Dynamic strength of the quadriceps muscle and sports activity. Br – J Sports –Med,1999 Apr; 33 (2) :pp. 117-120.

muscle contractions vary depending on the type of activity and the age of the player.[2]

This result is inconsistent with the results of a study Zakas, which indicated that there was no statistically significant difference in the value of muscle contractions between the players according to the type of activity.[3]

While variable fourth which is the time it was the value (T.test) function statistically have researcher finds it a matter of course in the reading device EMG for a time be not fixed amount, and this is also due to the nature of directives nerve and the nature of work the muscles more accurately and how to receive the signal nerve and then transition while for muscle contraction, where the value (T.test) (1.73) which is greater than the value of (T.test) spreadsheet, which was (1.69) and at the level less than (0.05) and under the degree of freedom (n-1) and the arithmetic mean of this variable is (0.017).

So the researcher finds that the first hypothesis in the study Significant differences for variables device EMG between the major muscle and anti-muscle in the proposed exercises had been achieved and this is main objective of the researcher.

4-2 Display, Analyze and Discuss the antagonist Muscle forearms in the Proposed Exercises Under Study for EMG device variables .

Table (3)

Shows the percentage of antagonist muscle an exercise bending and extending forearms in front of the body (Karl), for variables device EMG under study :Top, RMS, Area, Time

T	TOP	RMS	Area	Time
1	47.66416	42.04057	42.38095	100

(2) El Baden, B.; Hassan, A.; and Reisman, M.: The effect of peer presence on strength test scores of Bahraini male athletes. The Bulletin of The High Institute of Public Health, Alexandria, Eqypt, July 1994, Vol. 24, No. 3, pp.659-674.

(3) Zakas – A; Mandrouks,k . ;Vamvakoudis ,E.; and et.al : Peak torque of quadriceps and hamstring muscles in basketball and soccervplayers of different divisions. J-Sports. Med-phys– Fitness, 1995.

2	51.38573	40.70568	39.51691	100
3	47.80305	41.37542	34.18803	100.5
4	49.00044	44.35061	38.57143	104.5455
5	52.52021	50.08331	40	100.4762
6	48.86099	45.3102	44.27861	87.55187
7	47.66416	42.04057	42.38095	100
8	51.38573	40.70568	39.51691	100
9	47.80305	41.37542	34.18803	100.5
10	49.00044	44.35061	38.57143	104.5455
11	52.52021	50.08331	40	100.4762
12	48.86099	42.36989	44.27861	95.47511
13	47.66416	42.04057	42.38095	100
14	51.38573	40.70568	39.51691	100
15	47.80305	41.37542	34.18803	100.5
16	49.00044	41.43856	38.57143	104.5455
17	52.52021	46.75108	40	100.4762
18	48.86099	42.36989	44.27861	87.55187
19	47.66416	42.04057	42.38095	100
20	51.38573	37.83706	39.51691	100
21	47.80305	38.55693	34.18803	100.5
22	49.00044	41.43856	38.57143	104.5455
23	52.52021	46.75108	40	100.4762
24	48.86099	42.36989	44.27861	87.55187
25	47.66416	42.04057	42.38095	100
26	51.38573	40.70568	39.51691	100
27	47.80305	38.55693	34.18803	100.5
28	49.00044	41.43856	38.57143	95.83333
29	52.52021	46.75108	40	100.4762
30	48.86099	42.36989	44.27861	95.47511
Title/6	1486.173	1280.329	1194.68	2972.502
the percentage	49.5391	42.67764	39.82266	99.0834

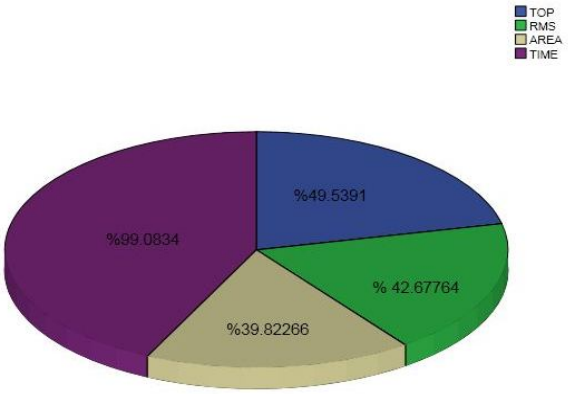

Figure 5 the percentage of antagonist muscle an exercise bending and extending forearms in front of the body (Karl), for variables device EMG under study :Top, RMS, Area, Time.

Table (3) and figure (5), show the ratio of anti-muscle among a study sample in exercise bending and extending your arms in front of the body and variables device EMG, has ranged between (39.82 - 49.54), has noted researcher that all ratios muscle anti were higher (60%) which is indicated on the imbalance between major muscle and muscle anti analogy to this percentage and shared in the work of this exercise, but acceptable for this sample. Where the researcher finds that he must not be less than this percentage (60%) because they cause lack of balance in the joint or part of the body that are working on these muscles and thus injury. And also due researcher cause of the low percentage to (39%) that the sample does not have any training program for muscle power during the period of the study, and this is consistent with the discretion of Bennell and others, on the weakness of training programs for raising the level of muscle strength may be the causes of decline antagonist muscle ratio when you do the sports work.[7]

As for the variable time is of the variables that have high proportions when making major anti muscle or to the fact that the mechanism or the nature of the work of the muscles are determined by the time while doing the exercise, and this deems researcher.

Table (4)

Shows the percentage of antagonist muscle an exercise bending and extending forearms behind head, for variables device EMG under study :Top, RMS, Area, Time.

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[7] Bennell, k .; Wajswelner, H.; Lew, P.; Schall, R.; and et.al: Isokinetic strength testing does not predict hamstring injury in Australian Footbalers. ,B.J.Sports,Med, 1998, Dec, 32 (4), pp.309-314.

T	TOP	RMS	Area	Time
1	29.73191	32.0962	22.69841	100
2	37.57848	52.29328	43.4466	100
3	51.02998	33.505	29.92519	100
4	35.36642	55.92473	28.39506	100
5	56.41814	63.26802	46.31579	100
6	55.30829	41.0565	36.36364	100
7	29.73191	32.0962	22.69841	100
8	37.57848	52.29328	43.4466	100
9	51.02998	33.505	29.92519	100
10	35.36642	55.92473	28.39506	100
11	56.41814	63.26802	46.31579	100
12	55.30829	41.0565	36.36364	100
13	29.73191	32.0962	22.69841	100
14	37.57848	52.29328	43.4466	100
15	51.02998	33.505	29.92519	100
16	35.36642	55.92473	28.39506	100
17	56.41814	63.26802	46.31579	100
18	55.30829	41.0565	36.36364	100
19	29.73191	32.0962	22.69841	100
20	37.57848	52.29328	43.4466	100
21	51.02998	33.505	29.92519	100
22	35.36642	55.92473	28.39506	100
23	56.41814	63.26802	46.31579	100
24	55.30829	41.0565	36.36364	100
25	29.73191	32.0962	22.69841	100
26	37.57848	52.29328	43.4466	100
27	51.02998	33.505	29.92519	100
28	35.36642	55.92473	28.39506	100
29	56.41814	63.26802	46.31579	100
30	55.30829	41.0565	36.36364	100
Title/6	1327.166	1390.719	1035.723	3000
the percentage	44.23887	46.35729	34.52411	100

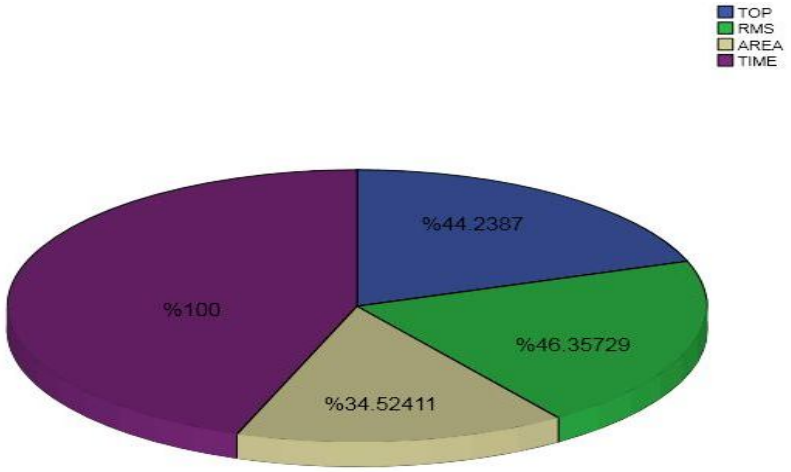

Figure 6 The percentage of antagonist muscle an exercise bending and extending forearms behind head, for variables device EMG under study :Top, RMS, Area, Time.

Table (4) and figure (6), the ratio of muscle anti among a sample study in exercise bending and extending your arms behind the head and variables device EMG, has ranged between (34.524-46.357), have noted researcher that all ratios muscle anti was less than (60%) which is indicated on the imbalance between major muscle and muscle anti analogy to this ratio and joint work in this exercise. Where the researcher finds that he must not be less than this percentage (60%) because they cause lack of balance in the joint or part of the body that are working on these muscles and thus injury.

It shown by the researcher that the percentage of these muscles in this exercise was close and close to the extent that could lead to injury or limit who can predict the occurrence of injury and variables device EMG under study, but the researcher does not see that this ratio may put inevitably player in the case expected to hit later in the muscles, and this is consistent with the study of Stafford and William, it was not necessary that the ratio of balance

muscle in normal limits to less injury, but the percentage rate that can help in reference to predict efficient functional muscles .[1]

As for the time it is a matter of course be a completely different time in any one of the sample and therefore is high in every reading. The researcher believes that the mechanism of the device and the nature of the exercise is that control in a record time to exercise and that variable.[2] Here, researcher finds that the second hypothesis:

The presences of appropriate and acceptable rates of muscle action counter to the work of major muscle. Has been achieved, which purports to researcher.

The time is variable and as a researcher at the saw discussed in the previous exercises.

Depending on the recent and previous studies , I have reached to the following results:

5-1 The Conclusions.:

1- Existence of differences in statistical sign at the level indication of (0.05) among the agonist muscles and the antagonist muscles in sport performance .
2- Existence of different and a accepted percentages for the antagonist muscles in comparison with the agonist muscles in sport performance .
3- The EMG helps to know the relation among the differences and the percentages of the agonist muscles and the antagonist muscles in sport performance.
4- The results of the proportions of the agonist muscles and the antagonist muscles can be considered as a good sign to predict the happening of injuries.

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[1] Stafford, M., and William A.: OP Cit Vol. 12, No. 3,pp. 209-211.

[2] Aagaard. P; Simonsen,E.;Beyer,N.;and et al.: Isokinetic muscle strength and capacity for muscular knee joint stabilization in elite sailors, Int. J- Sports – Med. 1997 Oct; 18(7): pp. 521-525.

5- The result of differences among the agonist muscles of football players and the antagonist muscles will help to assure the importance of nature and quality of the activity in reaching to the suitable muscular balance.
6- The time in the acting of muscles is unsteady in every exercise and in all the EMG variables apparatus .

5-2 The Recommendations:

Depending on the result of the study , the researcher offers many recommendations hoping to be useful to all the interested people in the health and safety of players especially ,and the athletes in general .

1- Stress on the understanding of muscular balance or the proportion of the muscular power among the agonist muscles and the antagonist muscles among the movement of stretching and bending of joint and the limbs of the human body , to all the interested persons in the sport medical filed , health of players ,coaches, specialists in physical therapy and doctors.

2-Interest in measurement of proportions of muscular balance amp among the agonist muscles and the antagonist muscles with the athletes in general, in regulated periods in condition that this proportion is not less than 60% especially with the football players .

3-Development of the muscular power among the fore muscles and the rear muscles of study especially with the football players.

4-Issuing local Iraq standards in regard to the proportion of muscular balance of the new and progressed players .

5- To keep the right and balance proportions among the agonist muscles and the antagonist muscles in sport performance to protect the players from injury.

6- It is necessary to do another studies deal with muscles and another kinds of sport activity.

Reference

1. Aagaard. P; Simonsen,E.;Beyer,N.;and et al.: Isokinetic muscle strength and capacity for muscular knee joint stabilization in elite sailors, Int. J- Sports – Med. 1997 Oct; 18(7).

2. ---------- :A new concept of isokinetic hamstring:Quadriceps muscle strength ratio. American Journal of SportsMedicine. March, April, 1998; 26(2.
3. Ammar Abdul Rahman : sports medicine. House of Wisdom for printing, the University of Mosul, 1988.

4. Arthur C. Guyton, John E. Hall. : Textbook of medical physiology . 11th ed. 2006.
5. Atha J. Strength trning muscle .In miller D. (ed) Exercise and sport science Reviews , Franblin institute press, philad alpha. 1981.

6. Basmajian,J.V.and C.J.De Luca ,eds.1985.muscles Alive: Their Function Revealed by Electromyography ,5th ed.Williams and Wilkens ,Baltimore,

7. Bennell, k .; Wajswelner, H.; Lew, P.; Schall, R.; and et.al: Isokinetic strength testing does not predict hamstring injury in Australian Footbalers. ,B.J.Sports,Med, 1998, Dec, 32 (4).

8. Brian Sharkey:Fitness Illustrated. Human Kinetics.2010.
9. Cram,J.R.and G.S.Kasman..Introduction to Surface Electromyography .Aspen publishers,Inc,Gaithersburg,MD, 1998.

10. David Fearing, John C. Lincoln: Shoulder problems-are they due to muscular Imbalance or Repetitive type motion, American Journal of Sports Medicine Committee,1997.

11. El Baden, B.; Hassan, A.; and Reisman, M.: The effect of peer presence on strength test scores of Bahraini male athletes. The Bulletin of The High Institute of Public Health, Alexandria, Eqypt, July 1994, Vol. 24, No. 3.
12. Faleh Francis: Almaekerotoma when athletes in Iraq. Conference Althanilaeliat Journal of Physical Education, University of Basra, Alaa Press, 1986.

13. Hahn – T; Foldspang ,A .; and Ingemann, H.: Dynamic strength of the quadriceps muscle and sports activity. Br – J Sports –Med,1999 Apr; 33 (2) .

14. Hassan, Adel Ali: school sports injuries, Riyadh, Saudi Federation for Physical Education and Sports, Issue 7, 1419.

15. Jari Ylinen: Stretching therapy for sport and manual therapies. Edinburgh London New York Oxford Philadelphia ST Louis Sydney Toronto 2008.

16. Klaus Klausen ,Strength and Wight-training .physiology of sports ,2005.

17. Lionel Bender, and other: the facts on file illustrated guide to the human body skeletal and muscular systems ,2005.

18. Loeb,G.E.and C.Gans..Electromyography for Experimentalists .Universty of Chicago Press,Chicago, 1986.

19. Mohaned Hussien Al-bashtawi , Ahmed Mahmood Ismaeil , corporal training physiology, ed.1, 2006.

20. Neder, A. Nery, L.; Shinzato, G.; Andrade, M. ;and et-al,Reference values for concentric knee isokinetic strength and power in nonathletic men and women from 20 to 80 years old. Journal of Orthopedic and Sports Physical Therapy.1999.

21. Stafford, M., and William A.: Hamstring/quadriceps ratios in college football players: A high velocity evaluation. The American Journal of Sports Medicine, 1984, Vol. 12, No. 3.

22. T.Reilly, N. Secher, P. Snell and C . Williams: Physiology of sport ,2005.

23. Thomas R. Baechle, Roger W. Earle, Essentials of strength training and Conditioning -3rd Edition. Human Kinetics,2008.

24. Thomas D. Fahey, Ed.D: Weight Training Basics.2005.

25. Wahbi Al- Baytti : Studying Electric Activity "EMG" for LegsMuscles in Hop and Step phases and the Relation of some Biokinematics Variables for Triple Jump Performance.2009.

26. W. Larry Kenney, and others. Physiology of sport and exercise : 5th ed. Human kinetics ,2012.

27. Zakas – A; Mandrouks,k . ;Vamvakoudis ,E.; and et.al : Peak torque of quadriceps and hamstring muscles in basketball and soccervplayers of different divisions. J-Sports. Med- phys– Fitness, 1995.