The effect of Therapeutic exercises and plus whey protein in hamstring tear treatment of volley ball players

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ABSTRACT

The purpose of the study was to determine the role of rehabitaion exercises and whey protein in hamstring tear treatment of volley ball players injured with hamstring minor tears , they were diagnosed and divided to two equal groups (14volley ball players), Age between (18 : 23Y) ,group 1 treated with rehabitaion exercises and group 2 treated with rehabitaion exercises plus whey protein (30 grams) , twice daily, healing time , AST,ALT,UREA, creatinine concentrations, CPK, SOD, cortisol, together with isotonic leg muscle strength and pain scale were performed before and after rehabitaion exercises and exercises plus whey protein was detected . Blood sample (5 ml) was drawn for biochemiecal tests ,muscle strength was evaluated using dynamometer, pain test was evaluated, rehabitaion exercises were executed in three phases , one week each, the first stage was in negative rest and in positive rest during the other two stages after the suggestion of specialists insport medicine, whey protein capsules (30gr,twice/daily), were ingested daily for three weeks. results revealed a reduction of protein metabolites in the two groups with a further decline after whey protein ingestions in case of muscle strength , there was a significant increase after whey protein ingestion plus exercises compared to rehabitaion exercises , also decreased creatine phosphokinase (CPK), aspartate, alanine transamilnase (AST,ALT) .

In conclusion , whey protein administration induced faster healing time and a higher muscle strength together with lower pain test , it is recommended to use a supplement as whey protein for the process of muscle healing together with the rehabitaion exercises.

key words, whey protein: hamstring tears , volley ball players , muscle healing time .

Introduction:

Many athletes are using supplements to improve athletic performance , body build and to increase the quality of life and health .

Milk protein is mostly composed of whey protein (WP) and casein, about 20% and 80%, respectively. During cheese manufacturing, WP is generated as a by-product of casein precipitation. WP is the most popular protein supplement sold in powder format. It contains valuable food ingredients because of its nutritional value and functional bioactivity. WP contains β-lactoglobulin, α-lactalbumin, immunoglobulins, bovine serum albumin, lactoferrin, lactoperoxidase, phospholipoprotein, bioactive factors, and enzymes in order of abundance. The biological components of WP and its isolates have been reported to benefit antioxidation and regulation of lipid metabolism and have antifatigue and antidiabetic properties.

Whey Protein isolates contain enriched essential amino acids, including branched chain amino acids, which the body needs for tissue synthesis, energy, and health. The high leucine content (50%–75% more than other protein sources), one of the branched chain amino acids, in WP could explain its ability to stimulate muscle protein synthesis

Whey protein is one of the most usable supplement used by athletes specially power ones , it has some important nutritional advantages as it enhances the production of superoxide dismutase which is one of the body's most important , powerful natural antioxidants , also it contains high level of branched chain amino acids , it may boost immunity , also , whey protein is absorbed very fast through the intestines , whey protein build muscle and increase muscle mass and reduce body fat , and increase lean muscle mass and stimulate growth hormones and decrease cortisol hormone which is a muscle depleting substance [Howley and Franks , 1992 , Hatfield 2013 , Zaed, 2017]

Sport medicine is a specialization which is used to affect the physical activity in general and sport in specific . the classic medicine is used to the recovery of a person from disease but in case of sport medicine it may help the athlete to return to the field and his sport in full health and condition .

The sport medicine is classified to :

a) Biological sport medicine : which is included in the use of physiology , biology , biochemistry for preventive and healing
b) Field injuries and natural cure injuries which affect the foot or any organ of the body such as the arms , including the skeletal muscles , the bones and the tendons also the blood vessels and the nervous system and nerve endings , also to use the natural care to enhance athletic participation . [Stanish and Evans 2006,Oxford text book , 1996] .

Rehabitaion exercises are efficient methods in the treatment of different injuries including muscle tears as it helps healing of injured tissues and get rid of swelling and decreasing bleeding and leading to restoration of the injured muscles to their normal fumction in the least possible duration , after strenuous exercises , including eccentric contraction .

Athletes may be subjected to muscle injuries after high tensions produced by the muscle as in ease of volley ball training or in competition which resulted in tearing of the myofibrils and disturbances in their metabolic functions due to soreness of the muscles after acidity accumulation , which in turn led to released proteolytic enzymes and degradation of muscle protein structures .

[Cordova et al 2004 , Macintyre et al , 1993, Armstrong , 1990]

Skeletal muscle is the largest tissue in the body , it makes up 40-45% of total body weight . indirect , (intrinsic) and direct (extrinsic) injuries are quite common both in competitive and recreational physical activities . these injuries may also lead to complications like muscle hernia . indirect trauma may happen during a concentric contraction the resisting load is less than the force generated by the muscle , then muscle shortens , if the resisting force is greater than that generated by the muscle, the muscle lengthens which is referred to eccentric contraction . this type of contraction help to absorb kinetic energy and protect joints as in the case of landing from a jump , the quadriceps the muscle contracts, protecting the knee .

The factors contributing to the muscle strain can be due to inadequate flexibility , or strength or endurance , sufficient warm up or inadequate rehabilitation from previous injury [Elkhoury et al 1996, Malone et al , 1996] .

The purpose of the study was to examine the effect of rehabitaion exercises and whey protein supplement in hamstring tear treatment.

It is hypothized that rehabitaion exercises or with whey protein supplementation would quick enhance the healing of hamstring tears and the return to games for the favour of the Rehabitaion exercises with whey protein supplementation .

The research sample : 14 volley ball players , , Age between (18 : 23Y) ,group 1 treated with rehabitaion exercises and group 2 treated with rehabitaion exercises plus whey protein (30 grams) , twice daily affected with minor injuries of hamstring , they were diagnosed by specialist and divided to two equal groups .

The study procedures :

Research curriculum : the experimental method was used in the study of pre-post design due to its suitability to the study of two groups . the first group using rehabitaion exercises [n=7] , the second group using rehabitaion exercises and whey protein (30gr) , twice daily until healing time [n=7] .

Table (1)

Mean, standard deviation and Skewness in Basic variables of the sample

N=14

Variables	Group (1)			Group (2)		
	Mean	S D	Skewness	Mean	S D	Skewness
Age(years)	21.8	0.43	0.492	21.2	0.489	0.651
Weight(kg)	81.3	1.03	0.33	81.5	0.922	0.007
Height(cm)	182.2	0.641	-0.597	182.3	1.081	0.194
Isotonic muscle strength(k)	٧٧,٨	1.25	-0.29	٧٧,١	1.77	-0.297
Pain scale (degree)	٨,٣	٠,٢٥٤	-٠,٦٤٧	٨,٣٧	٠,٢٣٦	٠,١٦٣-
Healing time (days)	-	-	-	-	-	-
Urea (mg/de)	42.52	0.23	-0.428	42.45	0.23	-0.12
Creatinine (mg/de)	1.32	0.01	0.121	1.31	0.02	0.63
CPK (IU/L)	44.2	0.22	0.424	44.2	0.29	0.05
AST (IU/L)	35.8	1.62	0.026	35.7	1.97	0.00
ALT (IU/L)	41.7	2.47	0.570	42.28	2.56	0.305
SOD (mg/de)	43.	0.21	0.25	43.17	0.228	1.07
Cortisol (mg/de)	93.3	0.330	0.55	93.4	0.244	0.572

Table(1) indicated that skewness (±3) of different variables meaning homogeinity of the sample of the variables, the matter that shows sample homogeneity in all variables under consideration.

Table (2)

Equivalence of the two groups in the variables under study

N1=N2=7

Variables	Group (1)		Group (2)		U Valu	Sig
	Mean Rank.	Sum of Ranks	Mean Rank.	Sum of Ranks		
Age(years)	5.71	40.00	9.29	65.00	12.00	0.109
Weight(kg)	7.50	52.50	7.50	52.50	24.50	1.00
Height(cm)	7.93	55.50	7.07	49.50	٧,٣٥	0.701
Isotonic muscle	7.36	51.50	7.64	5.350	23.500	0894
Pain scale (degree)	٧,١٤	٥٠,٠٠	٧,٨٦	٥٥,٠٠	٢٢,٠٠	٠,٧٤٨
Healing time (days)	-	-	-	-	-	-
Urea (mg/de)	8.21	57.50	6.79	47.50	19.50	0.517
Creatinine (mg/de)	8.36	58.50	6.64	46.50	18.50	0.437
CPK (IU/L)	7.21	50.50	7.79	54.50	22.50	0.795
AST (IU/L)	7.71	54.00	7.29	51.00	23.00	0.845
ALT (IU/L)	6.14	43.00	8.86	62.00	15.00	0.221
SOD (mg/de)	7.71	54.00	7.29	51.00	23.00	0.846
Cortisol (mg/de)	7.29	51.00	7.71	54.00	23.00	0.847

Table (2) shows that there are no statistically significant differences between the experimental groups, the matter that shows Equivalence of the two groups.

Application of the study:

(14) volley ball players injured with firstgrade tears (hamstring) were selected , the Search Experiment was in 8/10/2017 to 11/2/2018. the prestudy measurements were performed individually upon injured , they were subjected to medical examination and blood sample was drawn after 8 hours of fasting .

They were divided to two groups .Rehabitaion exercises (group ١), Rehabitaion exercises plus whey protien (group 2).

The program was designed after references and scientific studies of the previous programs , and specialist suggestion of physical education and sport medicine :

the rehabitaion exercises were performed in 3 week [composed of three phases].

Exercises were performed 4 units per week , total 12 exercises units , duration of unit 45 minute, the second group added to the exercises plus whey protein (30gr) twice daily , blood samples were collected after 8 hours fasting in the morning of pre-post experiment .

The measured parameters included :

healing time , SOD , cortisol , urea , creatinine , CPK,AST,ALT using spectrophotometer for biochemical variable , as for SOD and cortisol levels elisa tecknique was used , muscle strength using dynamometer pain , test was also examined using pain scale .

Statistical analysis

non parametric test was evaluated , differences of the two group . were compared using mann whitney (u) test .

for comparison of the pre-post treatment using Wilcoxon rank sum , paired test statistical significant differences was of $p< 0.05$

Table (3)
isotonic muscle strength , pain scale, healing time before and after rehabitaion exercises for group (1) (N=7)

Variables	N		Mean Rank		Sum of Ranks		Mean before	Mean after	(z) Valu	valu P
	-	+	-	+	-	+				
Isotonic muscle strength(k)	٧	٠	٤,٠٠	٠,٠٠	٢٨,٠٠	٠,٠٠	77.8	87.3	-٢,٢٣٢	٠,٠٢٦
Pain scale (degree)	٠	٧	٠,٠٠	٤,٠٠	٠,٠٠	٢٨,٠٠	8.4	3.2	-٢,٣٥٧	٠,١٨
Healing time (days)	٧	٠	٤,٠٠	٠,٠٠	٢٨,٠٠	٠,٠٠	-	16.6	-٢,٠٣٧	٠,١٨

The Wilkson scale value (Z) = 4 at statistical significance level (0.05)

Table (4)
isotonic muscle strength , pain scale, healing time before and after rehabitaion exercises. Plus whey protein for group (2) (N=7)

Variables	N		Mean Rank		Sum of Ranks		Mean before	Mean after	(z) Valu	valu P
	-	+	-	+	-	+				
Isotonic muscle strength(k)	٠	٠	٣,٥٠	٠,٠٠	٢٨,٠٠	٠,٠٠	78.3	89.4	-٢,٢٣٢	٠,٠٢٦
Pain scale (degree)	٠	٧	٠,٠٠	٤,٠٠	٠,٠٠	٢٨,٠٠	8.6	2.1	-٢,٣٧٩	٠,٠١٧
Healing time (days)	٧	٠	٤,٠٠	٠,٠٠	٢٨,٠٠	٠,٠٠	-	14.2	-٢,٣٧٥	٠,٠١٨

The Wilkson scale value (Z) = 4 at statistical significance level (0.05)

Table (5)
isotonic muscle strength , pain scale, healing time after rehabitaion or rehabitaion Plus whey protein(N1= N2=7)

Variables	Group (1)		Mean before	Mean after	Group (2)		Mean before	Mean after	U Valu	Sig
	Mean Rank.	Sum of Ranks			Mean Rank.	Sum of Ranks				
Isotonic muscle (k)	٤,٠٠	٢٨,٠٠	77.8	87.3	١١,٠٠	٧٧,٠٠	78.3	89.4	٠,٠٠٠	٠,٠٠١
Pain scale (degree)	٤,٠٠	٢٨,٠٠	8.4	3.2	١١,٠٠	٧٧,٠٠	8.6	2.1	٠,٠٠٠	٠,٠٠١
Healing time (days)	٤,٠٠	٢٨,٠٠	-	16.6	١١,٠٠	٧٧,٠٠	-	14.2	٠,٠٠٠	٠,٠٠١

P < 0.05

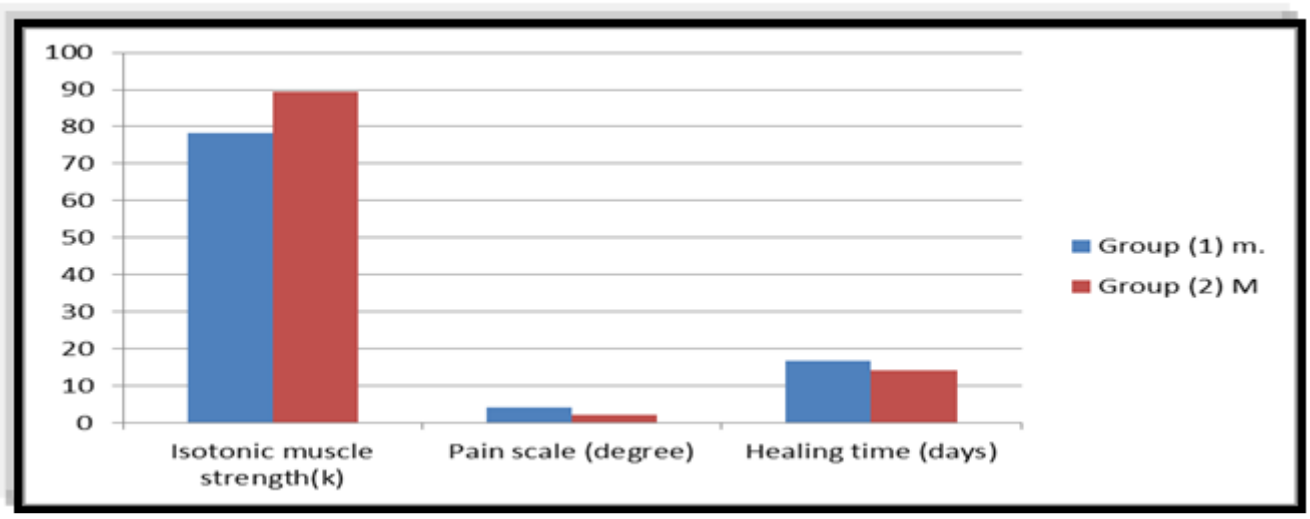


Fig (1)

Table (6)
concentration of biochemical variables before and after rehabitaion exercises for for group (1)

(N=7)

Variables	N		Mean Rank		Sum of Ranks		Mean before	Mean after	(z) Valu	valu P
	-	+	-	+	-	+				
Urea (mg/de)	٠	٧	٠,٠٠	٤,٠٠	٠,٠٠	٢٨,٠٠	42.3	39.1	٢,٣٧١-	٠,٠١٨
Creatinine (mg/de)	٠	٦	٠,٠٠	٣,٥٠	٠,٠٠	٢١,٠٠	1.33	1.24	٢,٢٠٧-	٠,٠٢٧
CPK (IU/L)	٠	٧	٠,٠٠	٤,٠٠	٠,٠٠	٢٨,٠٠	44.2	12.6	٢,٣٧٥-	٠,٠١٨
AST (IU/L)	٠	٧	٠,٠٠	٤,٠٠	٠,٠٠	٢٨,٠٠	35	13.4	٢,٣٧١-	٠,٠١٨
ALT (IU/L)	٠	٧	٠,٠٠	٤,٠٠	٠,٠٠	٢٨,٠٠	40	22	٢,٣٦٦-	٠,٠١٨

The Wilkson scale value (Z) = 4 at statistical significance level (0.05)

Table (7)
concentration of biochemical parameters before and after rehabitaion exercises, plus whey for group (2) (N=7)

Variables	N		Mean Rank		Sum of Ranks		Mean before	Mean after	Valu (z)	valu P
	-	+	-	+	-	+				
Urea (mg/de)	٠	٧	٠,٠٠	٤,٠٠	٠,٠٠	٢٨,٠٠	41.8	37.3	٢,٣٦٦-	٠,٠١٨
Creatinine (mg/de)	٠	٥	٠,٠٠	٣,٠٠	٠,٠٠	١٥,٠٠	1.36	1.11	٢,٠٢٣-	٠,٠٤٣
CPK (IU/L)	٠	٧	٠,٠٠	٤,٠٠	٠,٠٠	٢٨,٠٠	43	10.6	٢,٣٨٤-	٠,٠١٧
AST (IU/L)	٠	٧	٠,٠٠	٤,٠٠	٠,٠٠	٢٨,٠٠	34	10.2	٢,٣٦٦-	٠,٠١٨
ALT (IU/L)	٠	٧	٠,٠٠	٤,٠٠	٠,٠٠	٢٨,٠٠	41	8.4	٢,٣٦٦-	٠,٠١٨

The Wilkson scale value (Z) = 4 at statistical significance level (0.05)

Table (8)

concentration of biochemical variables after rehabitaion exercises, plus whey protein for both for group (1) and group(2)

(N1= N2=7)

Variables	Group (1)		Mean before	Mean after	Group (2)		Mean before	Mean after	Valu U	Sig
	Mean Rank.	Sum of Ranks			Mean Rank.	Sum of Ranks				
Urea (mg/de)	**11.00**	**77.00**	**42.3**	**39.1**	**4.00**	**28.00**	**41.8**	**37.3**	**0.00**	**0.001**
Creatinine (mg/de)	**11.00**	**77.00**	**1.33**	**1.24**	**4.00**	**28.00**	**1.36**	**1.11**	**0.00**	**0.002**
CPK (IU/L)	**11.00**	**77.00**	**44.2**	**12.6**	**4.00**	**28.00**	**43**	**10.6**	**0.00**	**0.002**
AST (IU/L)	**11.00**	**77.00**	**35**	**13.4**	**4.00**	**28.00**	**34**	**10.2**	**0.00**	**0.002**
ALT (IU/L)	**11.00**	**77.00**	**40**	**22**	**4.00**	**28.00**	**41**	**8.4**	**0.00**	**0.002**

P < 0.05

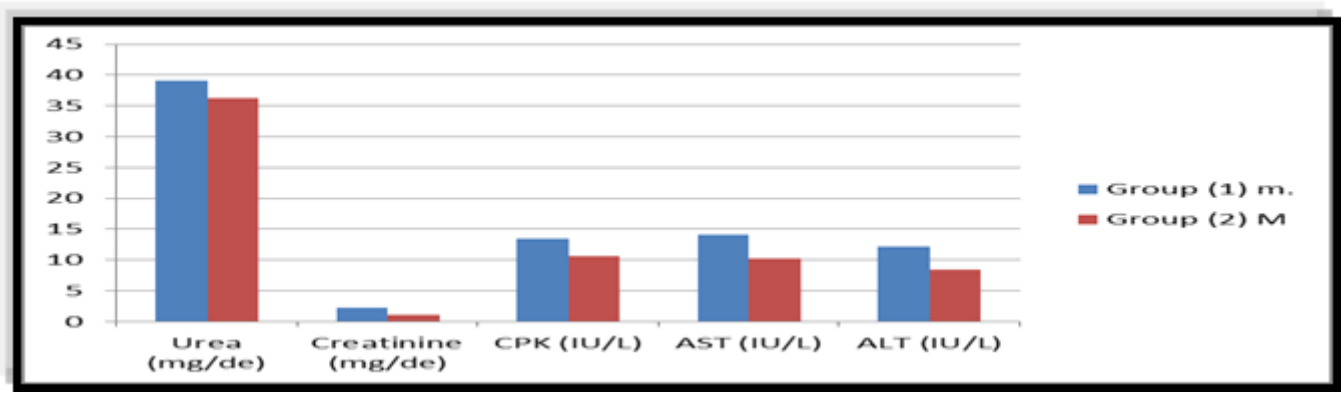


Fig (2)

Table (9)

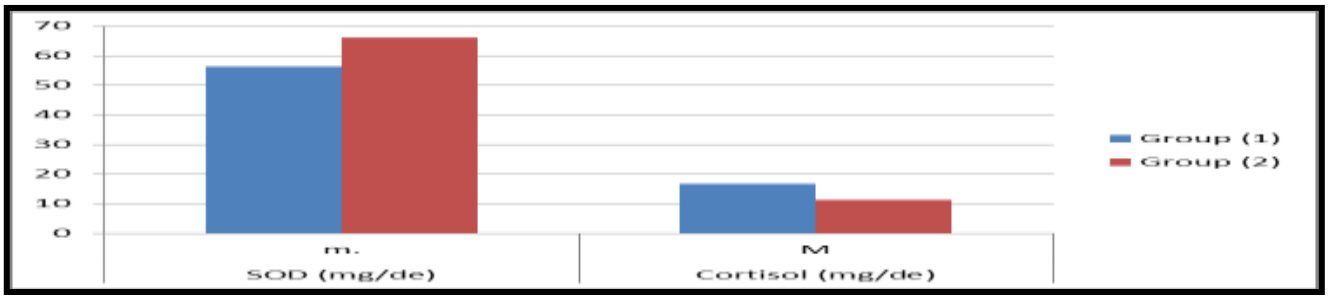
superoxide dismutase and cortisol concentrations

Pre-post treatments of group (1) , group (2) (N1= N2=7)

Variables	Group (1)		Mean before	Mean after	Group (2)		Mean before	Mean after	Group (1)	Group (2)
	Mean Rank.	Sum of Ranks			Mean Rank.	Sum of Ranks				
SOD (mg/de)	٤,٠٠	٢٨,٠٠	**43.**	٥٦,٢	١١,٠٠	٧٧,٠٠	**43.17**	٦٦	٠,٠٠٠	٠,٠٠٢
Cortisol (mg/de)	٤,٠٠	٢٨,٠٠	**93.3**	١٦,٧	١١,٠٠	٧٧,٠٠	**93.4**	١١,٢	٠,٠٠٠	٠,٠٠٢

P < 0.05

Fig (3)



Results :

Table (3) indicated that after the rehabitaion exercises , there was an increased muscle strength , decrease pain scale and the healing time reach more than 16 days .

Table (4) indicated that after the rehabitaion exercises plus whey protein , there was an increased muscle strength, decrease pain scale and the healing time reach around 14 days .

Table (5) indicated that after the rehabitaion exercises plus whey protein led to higher muscle strength , less pain scale and less duration for healing .

Table (6) revealed that rehabitaion exercises led to decreased biochemical products related to the study .

Table (7) revealed that rehabitaion exercises plus whey protein led to a further decrease of biochemical variables .

Table (8) revealed that whey protein adding variables indicated that there are more improvement in biochemistry .

Table (9) revealed a decreased cortisol level post treatment in both group (1),(2) but the decreased hormone level in case of exercise and whey protein led to a lower levels of cortisol compared to exercise only .

SOD concentration increased in group(1),(2) after treatment , while SOD was elevated in the second group compared to group (1) due to the effect of the whey protein which stimulated immunity .

Discussion :

whey protein used in this study is a supplement rich in all types of amino acid , essential and non essential , also whey contains some distinct nutritional advantages . as it enhances the production of SOD superoxidedismutase a natural antioxidants, also contains branched chain amino acids to boost immunity and immune system very fast to be absorbed and used by the body , which is important during exercise , recovery of exercise and specially after muscle injury , as whey protein has been proved clinically to build muscle after exercise and training and in case of injuries and tearing of the muscle [Newsholme , 2013] .as for cortisol concentration Johnson and Raven (2006) stated that injuries affect cortisol level greatly due to the effect as a stress factor , while the suppression of cortisol may be induced with the development of the healing process , the quicker the healing the lesser stress accompanied with decreased cortisol level.

Table (3,4,5) revealed muscle strength , pain scale , healing time after rehabitaion exercises , or rehabitaion exercises plus whey protein, there was a significant difference before and after both cases , while the improvement of muscle strength sensation of decreasing pain and healing time was for the sake of rehabitaion exercises plus whey protein , these benefits may be caused by the effects of the rehabitaion exercises and extra from the different constituents of whey protein as natural antioxidants , boosting immunity and affecting muscle repair this was also reported by (Malone et al, 1996, Walsh et al, 2006, Safaa Tewfik ,2007, Cordova ,2004, Fatma el zahraa, 2015 , Bounous, 2000) .

Clarsen , (2013) and Calles et al (1995) reported that muscle strains are classified as complete or partial according to severity .1 degree (mild) characterized by tear of few muscle fibres, mild swelling , pain , disability , muscle contraction may be strong and painful 2 degree (moderate) , cause disruption of more muscle fibres , moderate pain, swelling and disability , muscle contraction may be weak and painful . 3 degree (severe) , cause complete rupture of muscle – tendon unit , and may affect origin of muscle and tendon insertion ,

muscle contraction is weak and painful . they added that rehabitaion exercises are very important , to correct the weakness of injury , and rehabilitation aimed at restoring muscle strength , flexibility and endurance .

Clarson et al , (1992) , Bucci and Unlu (2000) Crib et al (2002) (2003) described the importance of protein , amino acids and whey in the process of rapid healing and remodeling of muscle structures and functions together with active muscle exercise in increasing speed of healing , through static exercise without load then with loads , limited dynamic exercise within active range of movement , followed by strength exercises and proprioceptive training .

Cynthia (2006) reported the importance to assess strength of the injured muscle using dynamometer or manually testing so as to return to full training and competitions presupposes that the strength has regained Rythm to near normal .

Mougious (2006) reported that urea is the main product of nitrogen metabolism in humans , urea concentration is affected by nutrition , intensity of exercise or injury of the skeletal muscle , if protein intake is low , urea concentration is also low , the same occur in case of the intensity of exercise and the degree of injury.

Thus , the measurement of serum urea act as a marker of protein exercises . the same extend as in ammonia , creatinine which are products of protein metabolism and creatine dehydration . creatinine is derived from tissue , specially muscle creatine , and creatine is converted to creatinine to be excreted and removed through the kidneys .

As for , aminotransferases (alanine aminotransferase , ALT, aspartate aminotransferase (AST) there concentrations are low in the blood unless the skeletal muscles are harmed , through exercise or injury , and serve as markers of the cases of the muscles , (Ganong,2000) .

Table (6,7,8) revealed that there are a significant differences of [urea,ereatinine,CPK,AST,ALT] before and after rehabitaion exercises, and another decrease in case of combination of rehabitaion exercises plus whey protein , as indicated in table (8,9) .

The decreased protein metabolism which are markers of the soundness and health of the skeletal muscle indicated the positive effect of the rehabitaion exercises or with the combination of the whey protein , It also revealed that protein supplementation is an advantage to the injured muscle . this is in accordance with many researchers that used supplements [Bucci and Unlu,2000,Crib et al, 2003].

The reported data indicated that the biochennical markers of the injured muscle decreased within time , the cause of using the preceeded variables in the study is they are directly related to the protein and any elevation of one or more of these variables (urea,creatinine,CPK,AST,ALT) .

CPK is one of the biochemical variables sensitive to any damage of the muscle , as athletes have higher CPK concentration than non athletes because of the regular strain imposed by the training . CPK is an indices of the damage or injured muscle as occurring due to eccentric exercise this is reported by [Ber et al, 2002,Nelson (2004).

Aminotransferases (ALT,AST) are normally low in theblood unless the muscle structure being harmed or damaged and injured , in this case the contacts of the damaged muscle cells leak in the blood and increased in concentratin as in case of the participants of the study , their aminotransferase (ALT,AST) increased after muscle injuries leading to increase their concentrations , than decreased after rehabitaion exercises and whey

protein administration and denoting lower levels . And a positive method of curing muscle injuries . it was also noted that aminotransferase increased in case of doping leading to damage of muscles or liver .(Poormans,2004), Tipton and Wolfe 2001, (Droge and Holme,1997) from the preceeded discussion the hypothis is of the study has been realized .

Conclusion:

Whey protein plus rehabitaion exercises Induced faster healing time , a higher muscle strength , and lower pain , together with a lower muscle damage markers of the injured muscle tears to return to play quikly of the volley ball players

It is recommended to use supplement with the classic rehabitaion exercises to help injured athletes to return sooner to the sportfields .

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