Journal of Applied Sports Science
December 2019, Volume 9, No. 1
www.jass.alexu.edu.eg

Following Up the Effect of Rowing Sport on the Activity Level of Creatine Phosphokinaze Enzyme (C.P.K), Lactate Dehydrogenizes (L.D.H), Creatine and Creatinine in Blood Serum

Moustafa Abdel-Rahman Abdel-Azim Saif[1]

[1] **Lecturer at Aquatic Sports Training Department - Faculty of Sport Education - Alexandria University**

Abstract

This study aims to identify the effect of the rowing sport on the activity level of creatine phosphokinaze enzyme (C.P.K), lactate dehydrogenizes (L.D.H), creatine and creatinine in blood serum. Researcher used the experimental method on a sample consisted of ''10'' players from rowing players from ''Egyptian hunting club'' under ''18'' eighteen years old were chosen by the malicious way from rowing players at Alexandria region. This study results resulted that there is a significant increasing in ''creatine'' and ''creatinine'' level, also increasing of "L.D.H" enzyme and "C.P.K" enzyme activity level after the competition by "4"four hours was higher than from it's before or after the competition directly. Researcher recommends studying the rest enzymes activities in different sports ,to follow it's role and standing on the training status of players, so evaluating the training plans and building the training programs at the rowing sport field on a scientific base contributes in rising the performance level of rowing players especially during competitions ,and different sports players in general.

Introduction

Rowing sport is characterized by the muscular continual work that rises in its hardness whenever we reach to the competition ending.

This demands spending more physical effort from players, so rowing player must be on a high Physiological and biochemical efficiency level, any defect occurs leads to decreasing the rowing player performance as well as it reflects on the competition.

For that who are standing on the training process should have the completely knowledge about what occurs from biochemical variables before and after the competition, also it may be advantage at the scientific and the applied field of the rowing sport.

Athlete needs during the muscular work to a high amount of oxygen suits with the effort and the practiced sport nature.

When the received oxygen amount to the athlete body systems decreases the prepared lactic acid would goes through blood to the liver, in which it transforms into glycogen that is by it's role transforms to glycogen that is by it's role breaks into glucose , that is carried again to muscles and transforms to glycogen.

When physical effort is over the muscle reaches to the shrinkage degree, this shrinkage prevents the blood follow, in this case "biofeed

Acid" transforms to lactic acid that disappears after that, when blood circulation returns back to it, s normal state.

(shneider and Karpovich: 1995).

During highly hard muscular effort energy is supplied from:

1-Adinosine triphosphate A.T.P.

2-phosphato creatine P.C.

3-Suppled energy from analyzing glucose, glycolysis citric acid cyele (C.A.C).

4-Energy resulted from the continual oxidation process inside cells (C.A.C._B_Oxidation).

(langley, telford and others: 2006).

Athlete necessary energy differentiates according to the different spent effort, there is effort takes minutes and other takes hours.

It's known that the necessary energy amount to the body suits with the effort nature and the spent taken period.

Unfortunately the process of energy production in the cell stops when lactic acid accumulates locally; as result of it muscles fatigue causing cremps.

For that only the modern training programs was planned to increase the amount of the necessary enzymes to analyze Glucose aerobically, also increasing the amount of certain equivalent materials and other enzymes that loosen the accumulation of lactic acid and helps to get rid of it from the blood.

(Getchall: 1983)- (Chaffers and Evauk: 2003).

(Barnard and Illman: 2004)(Thomas: 2008).

Enzymes have the ability to accelerate chemical interactions in the vital systems, helps in the occurring of some interactions in the metabolic processes that provides us by energy too.

In which its activity increases by the continual physical trainings.

This what many scientists in this field confirmed, in which they referred to, that when player trains by a regular way this will be attached by storing the energy sources (P.C and A.T.P) , increases from oxygen consumption and the body ability to endurance.

(chaffers and Evauk:2003)(Barnard and Illman:2004)(Tancred and Tancred(2014).

Rowing sport is one from sports that demands a high fitness during competitions and rowing races, for this there should be a good planning for a wide range training program includes fitness elements and the skill side to achieve the most physical success in rowing sport.

Creatinine percentage differentiate in its value in plasma that it is between 0.7-1.1 and the amount of creatine in blood serum is small, in which it was found between 0.1-0.6 ml%.

However creatinine is basically in lever, it's percentage in Striated muscle is from 350-400 gram from creatine to every 100 gram and about 98% from creatine in the body is found in Voluntary muscles in the form of "P.C".

Building creatinine process in voluntary muscles is by little percentage.

(Harper: 2005)(Thompson and King: 2005).

(Data and Ottaway: 2008)(Bohmer2009).

(Kleiner and Orten: 2010)(Moran Camp Bell and Dickinson Morrison: 2018) www.ncbi.nlm.nih.gov

Creatinine produces the energy that is used immediately in muscle contraction during the muscular effort.

In spite of that creatine reflects the training case, as it, s tests takes long time, also muscle includes a lot of amounts of creatine phosphate P.C and amounts of C.P.K enzyme that helps in the transformation between'' A.T.P and P.C".

$$\text{Creatine+A.T.P} \xleftrightarrow{\text{C.P.K}} \text{P.C+A.D.P}$$

, during the recovery stage after the Muscular effort A.T.P is reformatted and part of it interaction with creatine forms the *P.C*

Blood Plasma includes too a lot from L.D.H enzyme that organizes the transformation for each of pyruvic acid and lactic acid the normal percentage of L.D.H in blood serum is from 200-680 unite/100 ml.

(Howald and POORTMAN: 1995)(Doll Freidurg: 1998)(Harper: 2005)(Goldstein: 2007)

(Bell and Emslie_Smith and et al: 2008)

(Harper and Rodwell and et al: 2016)(Bell and Davidson and et al: 2017)(Gornall: 2017)(Oser: 2018) www.rowperfect.co.uk www.britishrowing,org .

Scientists at the recent days Persistent on studding the enzymes activities in blood serum (L.D.H and C.P.K) before, after and during the sport training.

In which the regular control of the activated *C.P.K* enzyme is considered as an important and efficient way to observe the interactions and the changes that occurs to athlete after the training and during returning back to the normal status ,and after the enzyme activity returns back to it's normal rate.

(KeulP2005)(Bohmer: 2009)(Nowacki and Kustener and et al: 2015).

Within the limits of the researcher knowledge the biochemical variables are considered from the important indicators that refers to objectivity real of the athlete case in his specialize field and continuing the physical activity.

Biochemical researches are used too as a measure to evaluate athletes ability and standing on the hardness and the continual physical activity.

Also we still lack in informations related by biochemical variables occurred in athletes body before, after and

during competitions, which gives an idea and an indicator about the efficiency of the human system.

In the view of the study results, the insufficiency sides in the followed and applied plans can be explored, especially if we known that almost sports still modest by comparing it with the international levels.

This what stimulated the researcher to procedure this study hoping to explore some biochemical variables in which we can get benefit from it in the training field and it's reflection on players performance,

Also to help them to continue rowing competitions and races till its end by the same sufficiency of the beginning, thus the improvement of the rowing performance to the highest levels, as the biochemical variables are considered as a clear indicator about the players training status.

Research objective:

According to the above we can determine the following objective:

-Identify the follow of rowing sport effect on the creatine phosphokinaze enzyme activity level, lactate dehydrogenize (L.D.H) enzyme, creatine and creatinine in blood serum.

Research hypothesis:

-creatine level may increases in blood serum after the competition by *4* four hours more than of it before and after and during the competition directly.

-creatinine level may increases in blood serum after the competition by*4* four hour more than of it before and after the competition directly.

- Lactate dehydrogenize (L.D.H) enzyme in blood serum activity level may increases in blood serum after the competition by*4* four hours more than it before and after the competition directly.

- Creatine phosphokinaze enzyme activity (C.P.K) in blood serum after the competition by*4* four hours more than before and after the competition directly.

Research procedures:

Used methodology:

Experimental methodology was used to a unique group the pre and post measurements were conducted on it (before the experiment conducting and after applying and conducting the experiment)-2 kilo meter competition conducted, blood sample was taken before and after the competition directly and after the competition by*4* hours.

Research sample:

Study was conducted on a sample from rowing players from*Egyptian hunting club *consisted of *10*players under *18* eighteen years old, divided on number*5* five 2 paddled boats.

Sample was chosen by the intentional way from Alexandria region rowing players.

All the medical examination was conducted on the study sample individuals to ensure from the safety of the functional systems.

Researcher put some conditions in choosing study sample.

-player should be registered in Egyptian Rowing Fedepercentagen

-*3* three seasons should be passed by the player and participated in the nearest republic championship.

-player should be at under *18*eighteen years old stage and still practice rowing sport.

Research conducted was applied in the rowing international water way at Alnozha airport in Alexandria region.

Blood drawn from the vain by rate 3 cm^3 blood in each stage to each player (before the competition starting, after warming up, after the competition ending directly and after the competition by *4* four hours, this for standing on the probably biochemical variables in the rowing player body and following this during the competition time period.

Then measuring after the competition ending by *4* four hours because*4*four hours is not a short time and enough for the appearance of any changes than before *the competition effort or before the experiment conduction and after the competition effort or after the experiment procedure*.

-Blood was drawn by *5*five lab technicians a technician for each compound.

-Compensatory drinks were given to players after drawing the blood directly.

-This study was conducted at the beginning of the training season 2019, during this period rowing players of the research sample were prepared physically and functionally to run this competition.

-Attached in it the applied training program on the research sample.

Research ways:

*** "Fundamental of Clinocal Chemistry editet", by Narbart, W., Tietz, Wendel, T., Pub., by Saunder, Phi. London, Taronto. Copy at, 1976.

Creatine and Creatinin, P. 994. " L.D.H., " P., 660., "C.P.k., P.682.

***This encyclopedia the scientific and practical process was done through it, also the used equipments to measure all variables under considepercentagen.

Research sample characteristics:

Table (1) that is specialized by the statistical significance of the research sample in the basic variables before 2 kilometer competition directly shows that the data for the overall research sample are moderate, non dispersed and Characterized by the Normal distribution of the sample.

In which standard deviation value ranged between (-0.91 to0.02) which confirms the modepercentagen of specialized research sample data at the basic variables before 2 kilo meter competition directly.

Table (2) that the specialized research sample statistical significance in research variables before 2 kilometer competition directly shows that the overall research sample data are moderate, non dispersed and Characterized by the Normal distribution of the sample.

In which standard deviation value ranged between (-1.34 to 0.18) which confirms the modepercentagen of research sample data at the variables under considepercentagen before the experiment.

Statistical treatments:

Statistical treatments were found by using SPSS version 2020 program in the following:-

-Mean.

Standard deviation

-Median

-Skewness.

-Kurtosis.

-Repeated Measures ANOVA test.

-Effect size ETA².

-LSD0.05 0.05.

-Rate change%.

Results representation:

Table (3)

Analyzing the variance of the repeated measures ANOVA in research sample.

variables \ Statistical significance		total squares(three measurements)	Free degree	Squares average	Value(f)	Significance level	Effect size (ETA²)
creatine	Effect between measurements	6.021	1	6.021	1580.807*	0.000	0.994
	Error of coefficient between measurements	0.034	9	0.004			
	Effects inside measurements	0.228	2	0.114	112.811*	0.000	0.926
	Error of coefficient inside measurements	0.018	18	0.001			

F tabulated value at 0.05 level between measures =5.12.

F tabulated value at 0.05 level inside measures =3.55.

Table number (3) shows that there are statistically significant differences between the repeated measures in the research sample in which (F) calculated value is bigger than tabulated (F) at 0.05 level = (5.12).

Also shows that there are statistically significant differences inside the repeated measures in which (F) calculated value is bigger than tabulated (F) value at 0.05 level= (3.55).

Table (3) shows that the effect size (ETA²) value to the independent experimental variable reached (0.93) as it is bigger than 0.05 which refers that the effect of the independent experimental variable under considepercentagen was high.

Table (4)
The lowest significant value deference (L.S.D) at 0.05 levels between measures means with the research sample.

variable	measure	mean	Before 2km competition directly	After 2km competition directly	After competition by four hours
creatine	Before 2km competition directly	0.325		0.176*	0.193*
	After 2km competition directly	0.501			0.017
	After competition by four hours	0.518			

Table (4) that is specialized by the deference between repeated means measures shows and table(5) that is specialized by the change percentage :- that there are differences within statistical significance between the measure before 2 kilometer competition directly , measure after 2 kilometer directly and after the competition by four hours.

It shows also that there are no differences within statistical significance between 2 kilometer competition measure directly and after the competition measure by four hours.

Table (6)
Analyzing the variance of the repeated measures (ANOVA) within the research sample.

variables / Statistical significance		total squares(three measurements)	Free degree	Squares average	Value(f)	Significance level	Effect size (ETA^2)
creatinine	Effect between measurements	73.947	1	73.947	508.162*	0.000	0.983
	Error of coefficient between measurements	1.310	9	0.146			
	Effects inside measurements	4.722	2	2.361	45.631*	0.000	0.835
	Error of coefficient inside measurements	0.931	18	0.052			

F tabulated value at 0.05 level between measures=512.
F tabulated value at 0.05level inside measures=3.55.

Table (6) shows that there are statistical significant differences between repeated measures (ANOVA) with research sample.

In which calculated (F) value is bigger than tabulated (F) value at 0.05= (5.12), also appear statistical significant differences inside repeated measures in which calculated (F) value is bigger than tabulated (F) value at 0.05 level = (3.55).

Table (6) shows that the effect size (ETA^2) value to the independent experimental variable reached (0.84) as it is bigger than 0.50 which refers that the effect of the independent experimental variable under considepercentagen was high.

Table (7)
The lowest significant value deference (L.S.D) at 0.05 levels between measures means in the research sample.

variable	measure	mean	Before 2km competition directly	After 2km competition directly	After competition by four hours
creatinine	Before 2km competition directly	1.010		0.810*	0.870*
	After 2km competition directly	1.820			0.060
	After competition by four hours	1.880			

Table (7) that is specialized by the repeated means difference shows and table (8)that is specialized by the change rate: that there are differences within statistical significant between the measure before 2 kilometer competition directly, the measure after 2 kilometer directly and after the competition by four hours.

Also it shows that there are no differences within statistical significance between 2 kilometer competition measures directly and after the competition measure by four hours.

Table (9)

Analyzing the variance of the repeated measures (ANOVA) with the research sample.

variables / Statistical significance		total squares(three measurements)	Free degree	Squares average	Value(f)	Significance level	Effect size (ETA²)
Lactate dehydrogenises	Effect between measurements	2056177.200	1	2056177.200	*1632.059	0.000	0.995
	Error of coefficient between measurements	11338.800	9	1259.867			
	Effects inside measurements	4872.800	2	2436.400	*8.872	0.002	0.496
	Error of coefficient inside measurements	4943.200	18	274.622			

F tabulated value at 0.05 level between measures=512.

F tabulated value at 0.05level inside measures=3.55.

Table (9) shows that there are statistical significant differences between repeated measures (ANOVA) with research sample.

In which calculated (F) value is bigger than tabulated (F) value at 0.05= (5.12), also there are statistical significant differences inside repeated measures in which calculated (F)was bigger than tabulated (F) value at 0.05 level = (3.55).

Table (9) shows that the effect size (ETA²) value to the independent experimental variable reached (0.50) which refers that the effect of the independent experimental variable under considepercentagen was above average.

Table (10)

The lowest significant value deference (L.S.D) at 0.05 levels between measures means of the research sample.

variable	measure	mean	Before 2km competition directly	After 2km competition directly	After competition by four hours
lactate dehydrogenises	Before 2km competition directly	243.800		27.800*	26.200*
	After 2km competition directly	271.600			1.600
	After competition by four hours	270.000			

Table (10) that are specialized by the repeated means difference shows and table (11) specialized by change rate: that there are differences within statistical significant between measurement before 2 kilometer competition directly, measurements after 2 kilometer directly and after the competition by four hours.

Also it shows that there are no differences within statistical significance between 2 kilometer competition measures directly and after the competition measure by four hours.

Table (12)

Analyzing the variance of the repeated measures (ANOVA) with the research sample.

variables / Statistical significance		total squares(three measurements)	Free degree	Squares average	Value(f)	Significance level	Effect size (ETA²)
Creatine phosphokinaze	Effect between measurements	28892.033	1	28892.033	583.503*	0.000	0.985
	Error of coefficient between measurements	445.633	9	49.515			
	Effects inside measurements	2663.267	2	1331.633	73.063*	0.000	0.890
	Error of coefficient inside measurements	328.067	18	18.226			

F tabulated value at 0.05 level between measures=512.

F tabulated value at 0.05level inside measures=3.55.

Table (12) shows that there are statistical significant differences between repeated measures within research sample.

In which calculated (F) value is bigger than tabulated (F) value at 0.05= (5.12), also shows a statistical significant

differences inside repeated measures in which calculated (F) is bigger than tabulated (F) value at 0.05 level = (3.55).

Table (12) shows that the effect size (ETA^2) value to the independent experimental variable reached (0.89) and it is bigger than 0.05 which refers that the effect of the independent experimental variable under considepercentagen was high.

Table (13)

The lowest significant value deference (L.S.D) at 0.05 levels between measures means (ANOVA) of the research sample.

variable	measure	mean	Before 2km competition directly	After 2km competition directly	After competition by four hours
Phosphokinaze creatine	Before 2km competition directly	17.800		18.500*	21.200*
	After 2km competition directly	36.300			2.700*
	After competition by four hours	39.000			

Table (13) that are specialized by the repeated means difference shows and table (14) specialized by change rate: that there are differences within statistical significant between the measure before 2 kilometer competition directly, measures after 2 kilometer directly and the measure after the competition by four hours.

Also it shows that there are differences within statistical significance between 2 kilometer competition measurements directly and after the competition measurement by four hours.

Table (15)

Correlation coefficients between research variables with research sample.

Correlation matrix		creatine			creatinine			lactate dehydrogenises			phosphokinaze creatine		
		Before 2km competition directly	After 2km competition directly	After the competition by 4 hours	Before 2km competition directly	After 2km competition directly	After the competition by 4 hours	Before 2km competition directly	After 2km competition directly	After the competition by 4 hours	Before 2km competition directly	After 2km competition directly	After the competition by 4 hours
creatine	Before 2km competition directly	1.000											
	After 2km competition directly	0.253	1.000										
	After 2km competition directly	0.400	0.772*	1.000									
creatinine	Before 2km competition directly	0.507	0.374	0.471	1.000								
	After 2km competition directly	0.411	0.246	0.319	0.112	1.000							
	After 2km competition directly	0.539*	0.304	0.558*	0.082	0.779*	1.000						
lactate dehydrogenises	Before 2km competition directly	0.256-	0.451	0.474	0.279	0.117	0.140	1.000					
	After 2km competition directly	0.018	0.055	0.216	0.116	0.061-	0.038-	0.407	1.000				
	After 2km competition directly	0.000	0.133	0.299	0.172	0.157-	0.041-	0.422	0.976*	1.000			
Creatine phospho kinaze	Before 2km competition directly	0.009	0.171-	0.208	0.473	0.028-	0.058	0.482	0.305	0.297	1.000		
	After 2km competition directly	0.643*	0.011	0.075	0.086-	0.639*	0.520	0.345-	0.264	0.144	0.192-	1.000	
	After 2km competition directly	0.641*	0.205-	0.134-	0.028-	0.484	0.354	0.429-	0.080	0.064-	0.043	0.885*	1.000

Tabulated R value at 0.05 level =0.521

Discussion of the results:

Tables (3), (4), (5) and the diagram figure no (1) results refers to the presence of increasing level in creatine level after 2 kilometer competition directly or after the competition by 4 four hours more than it before 2 kilometer competition directly, this for the breaking of the creatine phosphate*C.P* to creatinine to gain the needed energy for the muscular work.

(Howald and Poortmans :1995)(Harper:2007).

(Ennor and Morrison:2018)(Nwenson:2018).

A lot of scientists confirmed the presence of the increasing of creatine level in blood serum of individuals who are highly trained .

(Bohmer:2009) www.rowperfect.co.uk

www.britishrowing.org

Researcher sees that rowing sport competitions demand from it's players a great and continual physical effort ,this which demands high level in biochemical variables inside the athlete body and a rapid supplying of energy during competitions ,to be able to continue the champion till it's end.

It is observed that the untrained individuals or simply trained the amount of creatine is low and increases by an observed way within the high training and the high intensity effort, on the opposite individuals who are trained a good training, the amount of creatine is high.

(Howald and Poortman :1995)

(Castenfors and Mossfeldt and et al:2015).

www.rowperfect.co.uk www.britishrowing.org

Tables (6) (7) (8) and the diagram figure number (2) results shows the presence of increasing within significant significance at the creatinine level after 2 kilometer competition directly and after the competition by "4" hours, this for that the periodic time "4"hours is enough for the transformation of the creatinine that is not combined by phosphate to creatinine by erasing water from it. (Harper: 2007)

(Bohmer:2009)(castenfors and mossfeldt and et al:2015)(Ennor and Morrison:2018).

www.ncbi.nlm.nih.gov www.medicalnewstoday.com

A Lot of scientists confirmed that creatinine level increases according to the muscles size in the case of the individuals whom are not highly trained.

(Howald and Poortmans:1995).

www.medialnewstoday.com

Tables (9),(10),(11)and diagram figure (3) results shows the presences of increasing within significant significance in the activity level of*L.D.H* enzyme after 2 kilometer competition directly and after the competition by 4 hours more than it before the competition ,this for that during the competition the*L.D.H* enzyme activity increases as by it's role leads to the increasing of the resulted energy and the increasing continue by the enzyme for a period of time after the ending of the competition.

In which athlete needs during the competition to more energy ,as by this the internal case inside the cell would be * aerobic * and the energy would be supplied from the increasing of the *L.H.D*enzyme activity.

(Edelman and Sehultz:1999)(Clarke and Clarke:2000)(Taylor and Landry:2000)(Kiessling and Pilatrom and et al.:2011)(Sehnohr and Grand and et al.,:2014).

www.ncbi.nih.gov www.recearchgate.net

Tables (12), (13), (14) and diagram figure (4) results shows the presences of increasing within significant significance in the activity level of*C.P.K* enzyme after 2 kilometer competition directly and after the competition by 4 hours more than it before the competition.

This for the enzyme activity increases to help in storing the new energy in the form of creatine phosphate *C.P*.

(Howald and Poortmans:1995)(Langley and Telford and et al:2006)(Harper :2007)(Schnolhr and Grand and et al:2014)(Nowacki and kustner and et al:2015)(Lott and Stang:2018).

www.ncbi.nlm.nih.gov www.hopkinslupus.org

From the research situation as trainer in rowing sport ,he observed that this sport is characterized by the hard muscular effort .

In which the breaking process of *A.T.P to A.D.P is continual to gain the needed energy during the competition ,as it leads to the energy depletion ,so rowing player is urgent need s to reformate A.T.P from the C.P.K enzyme activity.

Muscle contains great amounts of phosphocreatine*P.C*, great amounts of creatine phosphokinaze enzyme *C.P.K* creatine phosphokinaze that helps in the transformation between P.C and A.T.P.

$$\text{Creatine} + \text{A.T.P} \xleftarrow{\text{C.P.K}} \text{Creatine phosphate} + \text{A.D.P},$$

during recovery stage

After trainings A.T.P is reformed and part of it interacts with creatine and forms the *p.c* unlike the previous interaction.

(White and Handler and et al:2016)(Bell and Dovidson and et al:2017)(Goldstein,L.2017).

www.ncbi.nlm.nih.gov www.hopkinslupus.org

Table (15)refers to the presence of Significant correlation between *creatine * after the ending of the competition by 4 hours and after 2 kilometer competition directly .

There was correlation within Significant significance between *creatinine after the competition ending by *4*hours , and*creatinine *before 2 kilometer competition

directly ,and*creatinine*after the competition ending by 4 hours and after the 2 kilometer competition directly.

The previous was for the breaking of creatine phosphate*C.P* to creatine to gain the needed energy to continue rowing and the competition, this for producing energy from the increasing the L.D.H enzyme activity and *C.P.K* enzyme, also this for the numerously presence of creatine after the competition ending which makes it's transformation process to creatinine easier by erasing water from it to get rid of it.

(Howald and Poortman :1995)(Kiessling and Pilatrom:2011)(schnolhr and Grand and et al:2014)(Castenfors and Mossfeldt and et al:2015)(Harper and Rodwell and et al 2016)(Bell and Emsile –Smith :2017)(Ennor and Morrison:2018).

Correlation within Significant significance appeared between *L.D.H* enzyme after the competition ending by *4*hours ,and after 2 kilometer competition directly ,this may be for the increasing of this enzyme activity, as by it's role leads to the increasing of the produced energy and this increasing continue for a period of time after the competition by the enzyme.

(Howald and poortmans:1995)(Edelman and Sehultz:1999)(Schnolhr and Grand and et al:2014).

www.ncbi.nlm.nih.gov www.recearchgate.net

Also the presence of correlation within Significant significance between *C.P.K*after 2 kilometer competition directly and*creatine * before 2 kilometer competition directly, and *creatinine * after 2 kilometer competition directly.

There were correlation within Significant significance between *C.P.K* after 2 kilometer competition by 4 hours and *creatine * before 2 kilometer competition directly, and after 2 kilometer competition directly.

This may be for the increasing rate of storing the energy in the form of creatine phosphate*C.P* after the competition ending, also may be for the increasing of the activity of *C.P.K* enzyme after the competition as a result of the creatinine utilization presented before the competition.

(Edelman and Sehultz:1999)(Langley and Telford and et al:2006)(Harper:2007)(Nowacki and Kustner and et al:2015)(Harper and Rodwell and et al:2016)(Lott and Stang:2018).

www.ncbi.nlm.nih.gov www.hopkinslupus.org

Appears from the discuss of the results of this study that muscles of those players have the ability to store the energy in the form of *A.T.P* and *C.P* ,so rowing player can use the energy easily during competitions.

This is considered too as an indicator of the high efficient of * L.D.H* and *C.P.K* enzymes to gain energy within those players.

Conclusions:

According to the above and within the limits of the study could be reached results , the following can be concluded:

-Creatine level increases after the competition by *4* hours more than it before or after the competition directly.

-Creatinine level increases after the competition by *4* hours more than it before or after the competition directly.

-L.D.H enzyme activity level increases after 2 kilometer competition directly more than it before 2 kilometer competition directly ,when ever it is a little bit decreases after the competition ending by *4* hours than of it directly .

-C.P.K enzyme activity level increases after the competition by 4 hours more than it before or after 2 kilometer competition directly.

-Correlation within Significant significance appeared between *creatinine after the competition ending by *4*hours and after 2 kilometer competition directly.

-There is correlation within Significant significance between *creatinine *after the competition ending by *4* hours, after 2 kilometer competition directly and creatine before 2 kilometer competition directly and after the competition ending by *4* hours.

-There was found a correlation within Significant between L.D.H enzyme after the competition ending by *4* hours and after 2 kilometer competition directly.

-Correlation within Significant significance appeared between* C.P.K* enzyme after 2 kilometer competition directly, and between *creatine* before 2 kilometer competition directly and between*creatinine* after 2 kilometer competition directly.

-Correlation within Significant significance was found between* C.P.K* enzyme after the competition ending by *4* hours, after 2 kilometer competition directly and between creatine before 2 kilometer competition directly.

-All over sample research data are moderate, not distracted and characterized by the normal distribution of the research sample.

This fulfills the hypotheses of this study.

Recommendations:

- Using the biochemical researches results as a measure to evaluate the ability and efficiency of the rowing players especially and the other sports players in general, this for standing on the hardness and the continual of the muscular effort and it's reflection on the training plans evaluation.

- Conducting more experiments and practical and scientific researches on the other enzymes activity level.

- Create a record for each player to record biochemical variables during the training season and competitions to evaluate the improvement level.

- Conducting more of these studies on the other rest sports, also doing experiments and periodical researches on the athletes blood serum in general and rowing players especially , this for standing on the training status and evaluate the training plans.

References:

I) Foreign references:

1- Barnard, C., and Illam, J. : The body machine, your health in Perspective, hamlyn, London. New York. Sudney. Toronto, 2004, pp.35-40.

2- Bell, G.H. Davidson, J.N., and Scarborough, H., : Textbook of Physiology and Biochemistry. 6th ed., E.& S.. London, 2017. pp. 810 – 815.

3- Bell. G.H., Emslie. D., and Patterrson, C.R. : Textbook of Physiology and Biochemistry, 9th ed., The Eng. Lan-Book Society, 2017. pp. 151 – 155.

4- Bohmer, B., Creatine, Creatinine, and C.P.K. in the Serum of Athletes, Frankfurt, 2009, pp. 222 – 229.

5- Castenfors, J., Mossfeldt, F. and Piscator, M. : Effect of Prolonged heavy exercise on renal function and urinary protein excretion, Acta Physiol. Scand, 2015, pp.68-72.

6- Cheffers, J. and Evaul, T. : Introduction to Physical Education, Concepts of Human Movement, New Jersey. 2003.,pp 58 – 61

7- Clarke, H.H., and Clarke, D.H. : Developmental and adapted Physical Education, 2nd ed., Jersey, 2000, pp, 67 – 70.

8- Datta, S.P., and Ottaway. J.H. : Concise Medical Textbooks Biochemistry, 2nd ed., London, 2008, pp,280 – 282.

9- Doll, J.E., and Freibur &, K. : Medicine and Sport Energy Metabolism of Human Muscle, Vol.7. Joh. Amb. Barth, 1998., pp.85 – 89.

10- Edelman, I.S., and Schultz, S.G. : Annual Review of Physiology, Vol.43. U.S.A., 1999., pp. 348 – 352.

11- Ennor. A.H. and Morrison, J.F. : Biochemistry of the Phosphagens and Related Guanidines, Physiol, Rev., 2018, pp . 33 -40.

12- Getchell, B., : Physical Fitness : A Way of Life, Hohn Wiley and Sons, Inc., New York, London, 1983., pp. 210 – 212.

13- Goldstein, L. : Introduction of Comparative Physiology, Toronto, London, 2007., pp. 189 – 191.

14- Gornall, A.G. : Applied Biochemistry of Clinical disorders, New York, Phi. San Fra. London, 2017. pp. 30 – 33.

15- Harper, HA. : "Review of Physiological Chemistry" 15th ed., Los. Altos, California, 2005, pp.415 – 420 and 323 – 325 and 410 - 413 .

16- Harper, H.A., Rodwell. V.W. and Maves, P.A. : Review of Physiological Chemistry, 16th ed., Lange Med. Pub, 2016. pp. 45 – 47.

17- Harper, H.A. " Review of Physiological Chemistry " 17th ed., Lange Med. Pub, 2007, pp,654 – 656.

18- Howald, H. and Poortmans, I.R. : Metabolic adaptation to prolonged Physical Exercise, Birk - Verl., Basel. 1995, pp, 229 – 231.

19- Keul, J. : Muscle Metabolism during long lasting exercise. Fra, 2005, pp. 35 – 41.

20- Kiessling, K.H., Pilstron.L. Bylund, A.C., Saltin, B. and Piehl, K., : Morphometry and enzyme activities in skeletal Muscle from middle aged men after training and from alcoholics, 2011. pp. 384 – 387.

21- Kleiner, I.S., and orten, J.M. : Biochemistry, 7th ed., The C.V. Mosby com., Saint Louis, 2010, pp. 168 – 170.

22- Langley, L.L., Telford, I.R., and Christensen, J.B, : Dynamic anatomy and Physiology, 5th ed., Mc Graw-Hill book Com., 2006, pp.486 – 490 and 128 – 160.

23- Lott, J,A., and Stang, J.M. : Serum enzymes and isoenzymes in the diagnosis and differential diagnosis of myocardial ischemia and necrosis, Vol – 26, Cli – Chem, 2018, pp.1242 – 1244.

24- Moran Camplell, E.J., Dickinson, C.L. and Platt, R. : Clinical Physiology, Black Well, Oxford, 2010, pp. 286 – 290

25- Nowacki, P,E., Kustner, W., and Haag, H. : The influence of exhaustive efforts at high attitude (204 Om) on serum enzyme (C.P.K., C.P.K. act, L.D.H., SGOT, SGPT) in well trained athletes. 2015 pp. 78 – 84.

26- Oser, B.L. : Physiological Chemistry, 14th ed., com, 2018, pp. 78 – 83.

27- Schneider, E.C., and Karpovich, P.V. : Physiology of Muscular activity 1st ed., W.B. Sau. Com. Phi. London, 1995. pp. 19 – 25.

28- Schnohr, P., Grande, P., and Christiansen, C. : Enzyme activities in serum after extensive exercise with special reference to creatine Kinase MB. Asta Med-Scand., 2014., pp. 229 – 235.

29- Swenson, M.J. : Duke's Physiology of domestic animals, 8th ed., London, 2018, pp., 580 – 585.

30- Tancred, B., and Tancred, G. : Weight training for sport. London, Toronto, 2014., pp. 91 – 95 .

31- Taylor, A.W. and Landry. F. : The Scientific aspects of sports training Cha. C. Tho. Pub. Spr. Illinois, U.S.A., 2000, pp., 8 – 15.

32- Thomas. V., Exercise Physiology. Grosby Lockwood Staples. London., 2008, pp., 46 – 54 .

33- Thompson, R.H.S. and King, E.J. : Biochemical disorders in Human disease, 2nd ed., London, 2005, pp. 430 – 434 .

34- White, A., Handler, P., and Smith, E.L., : " Principles of Biochemistry, 5th. Ed., Mc. Com Pub., 2016, pp. 954 – 960.

35- Fundamental of Clinocal Chemistry editet", by Narbart, W., Tietz, Wendel, T., Pub., by Saunder, Phi., London, Toronto. Copy at, 1976.

36- Creatine and Creatinin, P. 994., " L.D.H., " P., 660., "C.P.k., P.682.

II) Websites

37- www.ncbi.nlm.nih.gov

38- www.rowperfect.co.uk

39- www.britishrowing,org

40- www.medicalnewstoday.com

41- www.recearchgate.net

42- www.hopkinslupus.org