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THE EFFECTS OF THE APPLICATION OF GLYCEROL AND FATIQUE IN ACUTE EXERCISE AND ACID-BASE EGUILIBRIUM AND BLOOD GASES

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ABSTRACT

Objective: The aim of the research is to investigate the effect of the applied glycerol reinforcement in the accute exercise on the level of PH, PCO_2, PO_2, HCO_3, TCO_2, BEB and O_2S of the sportsmen and sedanter individuals.

Material: 10 healthy sportsmen, in their avarage age 18.20 ± 0.61, their avarage height 178.20 ± 1.78 cm and avarage body weight 65.17 ± 2.04 kg, intersted in athletism in an elite level and 10 healthy sedanter men, in their ages 19.70 ± 0.47, their avarage height 169.10 ± 2.21 cm and avarage body weight 71.09 ± 1.87 kg as a control group, that's to say, 20 people have participated in this research as tested people.

Method: <In the first day, the examples of blood have been taken from S and C's elbow veins before and after the shuttle run test. After 1 day break, in the 3rd day, before 2 hours of the same exercise test (GET), solution has been applied to both 2 groups by mixing it with 1 gr/kg glycerol water and the same test has been applied again. Before and almost after the applicated ET and GET throughout 2 days, the qualified parameter levels of taken blood examples have been determined.

Result: It has appeared the important differences ($p< 0.005$) in the levels of PH, PO_2, HCO_3, TCO_2, BEB of S and C before and after ET and GET, between 2 groups after ET, the important differences ($p< 0.05$) of the levels of HCO_3, BEB and TCO_2, but the losing of these differences after GET, between S and K in both 2 days after the applied ET and GET, the absence of these differences in the levels of PH, PCO_2, PO_2, the similarity of the levels of PCO_2 of S inside group, the absence of differences of ET in C, but after GET, the level of PCO_2 has decreased in an important level and after GET and ET of C group, the increase of the level of O_2S in an important level ($p<0.05$), after ET, the same increase in S after ET ($p<0.05$), but after GET, the absence of the important difference. Between S and C, there have been no important differences in the levels of O_2S. After and before ET and GET of S and C groups, it has appeared the decrease of the level of BEB ($p<0.05$) in an important level, but the absence of difference between groups.

Discussion and conclusion: In conclusion, it can be said that in the submaximal execise it has appeared metabolic asidosis in both 2 groups, but the applicated glycerol reinforcement together with this exercise protocol has no important effect in this quantity and period at least.

Key Words: Exercise, Glycerol, Blood Gases.

Introductıon

By increasing the intake of glycerol, it has been stated that the time of exercise tolarance will be able to be increased up to approxiamately % 24 percent. (R.A. Robergs and S.E. Griffin 1998, P. Montner, D.M. Stork, M.L. Ricdesel et al 1996). In addition, after the intake of glycerol, the rate of heartbeat has been decreased substantially during the exercise .(R.A. Robergs and S.E. Griffin 1998, P.Montner, D.M. Stork, M.L. Ricdesel et al 1996). Altough it is obvious that glyceol has increased stability. There is no study that its energy substrate function has caused the important develeopment in the exercise. It is interesting that glycerol supplemetation of athleths has been approved by Olympic Commitee in USA in 1997 after collected Works published by Robergs and Griffin (D.R.Robergs and S.E. Griffin 1998).

In the studies about glycerol, it has been suggested that the glycerol should be taken before 60-120 minutes out of competition and race according to environmental condition and this should be given by mixing 1 gr glycerol with 1.5 lt. water according to per kg of each body weight. However, thereis no risk about the intake of glycerol in terms of the health (D.R. Wagner 1999).

Human cells and organs can work in the existence of stabile inner medium, the supply of inner medium means homeostasis. Acids- bases have been continuously ordered for the phylaxis of their normal Ph. For the stabile fixation of its Ph, the essential regulations mean ph homeostatic. The dynamic regulation of ph is provided with the relationship between lungs, kidneys and tampon systems. Lungs and kidneys try to fixate the acid-base balance in the blood. The first task of tampon systems is also to prevent the important changes in blood ph in acid-base defect.

In the free H+, small changes can cause life-threatening results. Negative logarithm of

concentration is ph. There is an adverse relationship between the amount of H+ and ph. When the level of H+ increases, ph decreases and when the level of H+ decreases, ph increases. The organism tries to fixate between 7.30 and 7.45 of the ph of tissues and circulatory system, lungs and kidneys with plasm. When the level of ph is 7.40, the amount of H+ is 40 nmol/L. Normal serum sodium concentration is 140 meq /L, it is one millionfold of this amount. (J.C.M. Chan and R.H.K. Mak 2004).

The agents having the capacity of the release of H+ ion have been known as acid. They mix with blood after free H+ releases from chemical agents. The more the amount and quality of acids are, the more the level of H+ is in the solution. There are different acids in the blood and they are free H+ resources, all resources releasing to the solution do not remain freely. Most H+ has relationship with other chemical agents. Chemical agents, being able to combine with H+ mean base. Blood ph is determined according to the balance between acids and bases. When this sensitive balance is destroyed, there is also the defect of acid-base balance.(L.A. Greenboun 2004). While chronic and small defects cause more definite levels of the results, acute and important changes can be fatal. The borders of life- threatening blood ph has been determined as < 6.85 and> 7.70.

In one day, avarage 15.000 milimal carbondioxyde has arised. It cause carbonic acid (H2CO3) by mixing CO2 with water. Free H+ ion arises with the dissolution of H2CO3. CO2 is a potential acid (R.M. Kliegman, R.E. Behman, H.B. Jenson 2007).

The decrease in the level of plasm HCO3 or the increase in the level of CO2 causes acidose, the increase in the level of HCO3 or the decrease in the level of CO2 causes alcolasis. The buffering of the extracellular fluid with bicarbonate, carbonic acid can be evaluated with measurementof blood ph, PCO2, HCO3 or total CO2 clinically. Free H+ or ph is related with the rate of PCO2 and HCO3. This relationship is normal ph's protection mechanism. If the first defect is the decrease in the level of serum bicarbonate, the subject is metabolic acidose. In this situation the increase in alveolar ventiltion compensation and the level of plasm CO2 decreases. Because of this compensation, blood ph is approached to the normal level, but it cannot remain in the normal level.(p<7.30)

If the first defect is the increase in the level of serum bicarbonate, the subject is metabolic alcalosis. In this situation, the decrease in alveolar ventilation happens as compensatris and the level of plasm increases. Because of this compensation, blood ph is approached to the normal level, but again it never remain in the normal level (p<7.45). If the first defect is the increase in the level of blood CO2, the subject is respiratory acidose. If the situation lasts more than 48-72hours (chronic respiratory acidose)the synthesis of bicarbonate in the kidneys increases as compensatris blood ph is approached to the normal level, but it cannot remain in the normal level. If the first defect is the decrease in the level of blood CO2, the subject is respiratory alcalosis. If this situation lasts more than 48–72 hours (chronic respiratory alcalosis), the synthesis of bicarbonate decreases in the kidneys as compensatris and blood ph is approached to the normal level, sometimes it can reach to the normal level.

Results

Table. C and S Groups of Values Before and After Exercise

		B.S		**A.S**	
	G	***Rest*** Mean±SE	***Exhaustion*** Mean±SE	***Rest*** Mean±SE	***Exhaustion*** Mean±SE
PH	C	7,39±0,005 **a**	7,28±0,024 **b**	7,38±0,009 **a**	7,32±0,011**b**
	S	7,40±0,008 **a**	7,31±0,015 **b**	7,41±0,031 **a**	7,32±0,019 **b**
PCO_2(mmHg)	C	46,02±1,22 **ab**	39,84±3,09 **b**	48,27±2,04 **a**	41,04±2,10 **b**
	S	46,17±0,92	43,34±2,10	45,76±2,09	40,91±3,00
PO_2(mmHg)	C	28,15±1,72 **b**	50,58±4,50 **a**	31,68±2,16 **b**	45,62±5,41**a**
	S	27,47±1,87 **b**	39,87±2,52 **a**	28,84±1,33 **b**	41,31±4,52 **a**
O_2 Sat(%)	C	52,04±3,65 **b**	74,68±5,23 **a**	58,04±4,40 **b**	72,21±6,56 **a**
	S	52,90±4,45**b**	64,60±4,41**a**	54,84±3,82**ab**	67,72±7,24**a**
TCO_2 (mmol/L)	C	29,27±0,63 **a**	**B** 19,60±0,75 **c**	29,74±0,68 **a**	22,52±0,84 **b**
	S	29,91±0,48 **a**	**A** 24,85±1,37 **b**	30,10±0,97 **a**	22,10±0,91**b**
BEB(mmol/L)	C	2,27±0,45 **a**	**B** -7,77±0,72 **c**	2,31±0,30 **a**	-4,44±0,62 **b**
	S	3,01±0,50 **a**	**A** -2,44±1,26 **b**	3,32±1,45 **a**	-4,85±0,69 **b**
HCO3(mmol/L)	C	27,84±0,59 **a**	**B** 18,38±0,68 **c**	28,25±0,60 **a**	21,24±0,79 **b**
	S	28,48±0,48 **a**	**A** 23,14±1,34 **b**	28,68±0,99 **a**	20,84±0,83 **b**

AB: In the same column, the differences between avarage values are (p<0.05) important among the group carrying different letters.

abcd: In the same line, the differences between avarage values are ($p<0.05$) important within group carrying different letters.

C: Control group
S: Sportsman group
BS: Before supplementatıon
AS: After supplementatıon

It has appeared the important differences ($p< 0.005$) in the levels of PH, PO_2, HCO_3, TCO_2, BEB of S and C before and after ET and GET, between 2 groups after ET, the important differences ($p< 0.05$) of the levels of HCO_3, BEB and TCO_2, but the losing of these differences after GET, between S and K in both 2 days after the applied ET and GET, the absence of these differences in the levels of PH, PCO_2, PO_2, the similarity of the levels of PCO2 of S inside group, the absence of differences of ET in C, but after GET, the level of PCO_2 has decreased in an important level and after GET and ET of C group, the increase of the level of O_2S in an important level ($p<0.05$), after ET, the same increase in S after ET ($p<0.05$), but after GET, the absence of the important difference. Between S and C, there have been no important differences in the levels of O_2S. After and before ET and GET of S and C groups, it has appeared the decrease of the level of BEB ($p<0.05$) in an important level, but the absence of difference between groups.

Materıal

Total 10 sportsmen whose avarage ages are 18.20± 0.61 years, avarage heights are 178.20± 178 cm and body weights are 65.17±2.04kg and who are interested in the branch of athletism in the elite level and 10 healthy and sedentary men whose avarage ages are 19.70±0.47 years, avarage heights are 169.10± 2.21 cm and avarage body weights are 71.09± 187 kg as a control group, that's to say, 20 people have been participated in this study as experimentals.

Method

S: Sportsmen group (n:10)
C: Control Group (n:10)
ET: First day before exercise test
GET: Third day before exercise test

Before and after shuttle run test (ET) , in the first day S and C groups' blood samples have been taken from their elbow veins. After one day break in the third day before 2 hours out of the same exercise test (GET) they have been given to both 2 groups as solution by mixing 1 gr/kg glycerol with water and the same test has been applied again. Before and after ET and GET applied in every 2 day, the levels of bloof exemples (fatique) have been determined by using the device labelled with EIRMA point (USA) and CC cartridge.

Exercise Test

20 m mecic running test which applied to people being in experiment is multi-leveled test aiming getting tired of people and its first level is warming up tempo. People run first 20 m distance as coming and going. Running speed is controlled with a tape giving signal voice. People started running when they firstly heard signal voice and reached the line by second signal voice. When they heard second signal voice they were backed to starting line by turning back and the running went on with these signals.The people set their own tempos as being on the other side of the patch when they heard the signal. The running which was slow at the beginning is increased at ever 10 seconds. If a person can't reach the line before signal, but if she can reach other signal, person went on the test. If person can't reach 2 signals after and after, test is finished. The tiredness is formed on people with this way.

Statıstıcal Analysıses

Avarage values and Standard errors of parameters of all experimentals have been counted. Indepented 't' has been used in the importance determination of differences among groups. The repetead measurement has been applied by analyzing variancein the determination of differences in the in-group. Paired 't' has been applied in the determination of differences.

Dıscussıon and conclusıon

In this study, the decrease of PH, PCO2, HCO3 in the important rate below the normal level has shown the metabolic acidose ($p<0.05$). In addition, the important increase in PO2 and O2 sat after every 2 group and exercise has supported this idea. It has stated that glycerol supplementation applied with this exercise test also has shown no important effect.

(J.A. Zalods, A.J. Sergeant, J. Emmerich 1993) The important decrease in 4 marathon runners levels of PH, PHO3, BEB has been informed after applied exercise test in the elite level, in 5 –day run period by providing 2 min-break among periods and 6 min-period, 10 heartbeats in each period and it has shown that this decrease is much more in thelast period. J. Del Coso, N.Hamouti, R. Aguado Jiminez (2009). After 24 min-cycle exercise test applied to 10 trained cyclists and 10 untrained sedentary people in the low and high intensity, the levels of PH, HCO3 are similar in both groups, but after the high intense exercise , there is the decrease in the untrained sedentary people' levels of PH and HCO3, but there is no differences in the trained cylists. So stability exercises have been suggested to develop the

tolarance to the low PH level and for the exercises to tampon the metabolic acidose J.D.Coso, N.Hamouti, R.Augoda Jimenez (2009). After short (4.5 min), avarage (6 min), high (9 min) exercises applied to 11 trained sportsmen when analyzing the levels of ph , the important decrease of ph have been informed according to avarage and short execise after high exercise I.I. Douroudos, I.G. Fotourus, V. Gourgoulis et al (2006). It has been informed that the intake of sodium bicarbonate will be able to increase aneaerobic exercise performance and prevent acid-bese defect S. Rojos Vega, H.K. Strüden, B.U. Wahmann (2006). It has been informed that intensive exercise will be able to decrease the levels of PH,HCO3 and BEB, the intake of bicarbonate will be more effective than placebo supplementation. J.C. Siegler and K.Hirschen (2009) It has been put forward that sodium bicarbonate supplementation has increased the capacity of the buffering of the blood and increased the fist performance in amateur boxers before the competition and exercise. Thus, it has appeared that the application of glycerol has no important effect in this study. In addition, F.E. Marino, D.Kay, J.Cannon (2003).It has been informed that the intake of glycerol or placebo has no important effect on body heat or exercise performance. Moreover, L.R. McNaughton, S. Kenney, J.Siegler (2007) before exercise, the intake of 15 ml. Superoxygenated water, PO2 and PCO2 has no effect on submaximal and maximal exercise performance.

Studies mentioned above have shown that the similarities with this research. But, S. Tubek, M.Rekowek, S.Skubis (1999) it has been informed that before and after exercise applied to 8 healthy sedentary people in 2 different days and hours, there has no increase in PCO2 and PO2 and decrease in BEB and change in HCO3 and the study in different hours and days has not changed the results.

Researhes have shown that the exerxise's period, intensity and type cause the change in the acid-base balance. Especially, in the studies, it has been informed that long-dated and high intense exercise will cause metabolic acidose, because of the exercise, the ailments of acid-base balance will be able to be arranged, the supplementations such as placebo, glycerol has no important effect on the ailment of acid –base because of exercise, the intake of sodiun carbonate also will be effective to reinforce the system of the buffering of the blood to prevent acid-base ailments (J.A. Zolads, A.J. Sergeant, J.Emmerich 1993), (J.D.Coso, N.Haumouti, R.Aguado Jimenez 2009), (J.Del Cosa, N. Hamouti, R. Aguado-Jimenez 2009), (I.I.Douroudos, I.G.Foutouros, V.Gourgoulis et al 2006), (S.Rogos Vega, H.K. Strüder, B.U. Wahmann 2006), (F.E. Marino, D.Kay, J. Connon 2003).

In conclusion, in this study shuttle run test has cause fatique because it is a submaximal test. The important decrease in PH, PO2 and PO3 has signed metabolic acidose in both groups. The differences in TCO2,BEB and HCO3 between 2 groups can also result from that S group contains sportsmen and trained people, their recovery periods are short, lungs givequick answer to decreasing PH by increasing ventilation as compensatuar effect, the change in PCO2 is more important in control group. It has been stated this exercise protocol has no effect in this period and amount at least with applied glycerol supplementation.

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