CARDIAC DEMAND IN PROFESSIONAL WIND INSTRUMENT PLAYERS

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Very few studies have analysed HR with respect to music playing and scarce evidences are controversial. The purpose of this study was to analyse the HR response in professional musicians during their real activity. Twenty-four voluntary professional musicians (20 men, 4 women), were considered playing wind instruments. HR was recorded by means of Sport Tester PE4000 (Polar®, Finland) pulsometers. Musicians wore the pulsometer and a recording of their HR was obtained, while playing in real situations, i.e. rehearsals or study and public concerts. The 220-years age formula was used to obtain the MTHR (Maximal Theoretical Heart Rate) values. An exercise test was made on 7 of the musicians in order to evaluate the real maximal heart rate and the correlation with the MTHR. In our study we have recorded what really happens while the professional musician plays, with the only intervention linked to wearing the device. We have found a similar HR response in similar conditions. The HR drawings corresponding to the same musician playing in repeated concerts (with the same programme) at the same time were similar. The statistical analysis showed no significant differences between the concert 1 / concert 2 situations. Throughout the HR recordings, we have observed that musicians present a heightened HR while they do their work (maximal HR in soloists from 67,67 to 98%MTHR), much greater than that expected of a supposed sedentary activity, and it could be similar to the HR corresponding to moderate exercise (60-79 %MTHR), heavy work (80-89 %MTHR), or even very heavy work (>90 %MTHR) in those musical pieces for soloist players. After our results we can conclude that cardiac demand for a professional wind instrument player is higher than previously described, ranging from a moderate to heavy intensity level of the activity. Cardiac demand is significantly higher in concerts than in rehearsals for the same musical piece.

Keywords: Cardiac demand, heart rate, musicians.

SPIROMETRIC FORMULAE FOR AQUATIC SPORTS ATHLETES

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INTRODUCTION

Aquatic athletes have higher forced spirometric values than other athletes or general population. Presence of asthma or bronchial hiperreactivity is usual in those athletes as the swimming practice is one of the best exercises for asthmatics and because of this it is recommended. Values just under the normal range could indicate, in elite swimmers with clinical history of asthma, an agudization of its illness and can be undiagnosed. A previous formula was edited and a revision had to be done.

OBJECTIVE

Obtain the forced spirometric reference formula for athletes practising aquatic sports.

METHODOLOGY

Values from athletes of Spanish teams who came to our Dept were selected. Swimming (151) Synchronised swimming (9), and waterpolo (42), Men (103) and women (100). Standard forced spirometry is usually done before every effort test under the indications of the Spanish Respiratory Society (based on the ATS).

RESULTS

Mean values for men were higher related to spanish general population reference values (FVC =111 %, FEV1=109% and PEFR =111 %), while mean values for women were very closed to the mentioned reference. As we considered in this study a short range of ages, it happened to be not useful to discriminate the values as in other epidemiological formula. In our study the predictive formula for basic respiratory values in elite aquatic athletes were as follows:

CONCLUSION

These formulae can be useful to evaluate and discriminate those aquatic athletes who suffer from bronchial hyperresponsiveness.

Key words: Swimming, asthma, hyperres-ponsiveness.

Women:	FVC	0.05327H+0.00711W-4.94509	Men	FVC	0.01365H+0.05711W-0.55874
	FEV1	0.05041H+0.00302W-4.75150		FEV1	0.026H+0.02906W-1.7398
	PEFR	0.08850H+0.00055W-6.71342		PEFR	0.00643H+0.11234W+1.56909

nature and clinical significance of low post-exercise plasma levels of cTnI.

Key words: cardiac troponin I, subclinical myocardial damage, long-term exercise, cycling.

	before	Immediately after	24 hours after
CK (U/L)*	79±58 (17-328)	160±121 (40-569)	245±165 (48-548)
CK-MB/CK (>6%)τ	3/38 (8%)	23/38 (60,5%)	10/38 (26%)
TnI (>0,05µg/l) τ	0/38	13/38 (34%)	9/38 (24%)
CRP (mg/dl)*	all<0,70	0,73±0,14 (0,7-1,52)	1,86±1,47 (0,7-7,1)
Leucocytes (G/L)*	6,74±1,51 (4,0-10,4)	17,35±4,3 (7,5-33,3)	8,25±2,66 (4,6-18,4)

* Values presented as mean ± SD (range) τValues presented as number of positive observations/total obserbvations

TABLE I.- Biochemical markers before and after competition before immediately after 24 hours after.

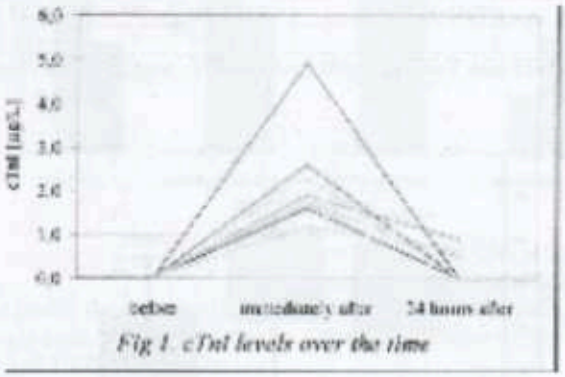

Fig 1. cTnI levels over the time

SHORT-TERM EFFECTS OF AN ULTRAMARATHON ON THE LEVEL OF HAEMATOCRIT IN AMATEUR CYCLISTS

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PURPOSE

Knowledge is sparse about the extent of potential dehydration coming up with prolonged strenuous cyclig and its haematological acute effects on the haematocrit (Hct) in study populations credibly not taking any kind of doping (e.g. Neuhaus & Gaehtgens 1994; Zbigniew 1990). With increasing training load the level of haematocrit (Hct) decreases as a long-term consequence of expanding plasma volume (PV). On a short-term basis, however counteracting dehydration potentially brought about by endurance exercise may cause a rise in Hct bringing competitive cyclists into conflict with the current condition regulations and Hct cut-off of 50% set by the International Cycling Union (UCI) in its fight against erythropoietin (rhEPO) doping. Adequate fluid substitution, however is substantial for successful endurance performances and should prevent any pronounced Hct rises. To study the haematological acute effects of prolonged strenuous cycling we measured Hct Hb, red blood cell (RBC) count and plasma protein in a reliably clean population of 38 well-trained male amateur cyclists before, immediately after and one day after an extraordinary ultramarathon.

METHODS

The Ötztaler Radmarathon is an extremely challenging one-day cycling race in the Alps with a workload (total distance of 230 km; altitude difference of 5500 m) comparable to that of the hardest mountain stages of the Tour de France.

RESULTS

All study participants (mean age 35 years) were free of diseases and finished the ultramarathon successfully. The pre-race levels of Hct, Hb and RBC count were placed in the lower range of normal distribution and well below the Hct cut-off limit of the UCI. Immediately post-exercise the mean levels of Hct, Hb. RBC count and protein remained unchanged. One day after race however the level of Hct did significantly drop by 3% from a mean pre-race value of 0.44 to 0.41 post-race (fig.). The level of Hb, RBC count and protein fell by 6.7%. 6.5%, 9.9% respectively (p<0,001).These decreases 24 hours after competition indicate significant post-exercise PV expansion calculated to be 11,9%. No evidence for co-

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existing exercise-induced haemolysis was found. All parameters investigated are illustrated in the table.

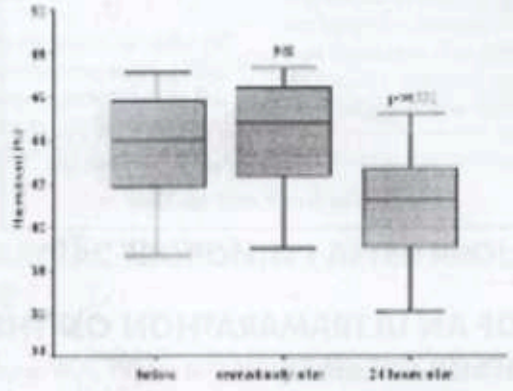
CONCLUSION

Our study shows that in "clean, rhEPO-free" amateur cyclists who involve in strenuous marathon cycling the haematological short-term effects of extraordinary marathon cycling consist in considerable PV expansion making Hct values fall on the following day. The findings - gained from amateurs though - suggest that despite all its disadvantages the UCI Hct cut-off represents an appropriate means to discourage from excessive rhEPO doping at least as long as the available direct methods for detecting this kind of misuse are not yet applied by the international sports federations.

Key words: haematocrit, long-term exercise, erythropoietin doping, plasma volume.

	Before race	Immediately after	One day after
Hct (40-52%)	0,44 (0,22)	0,44 (0,22) ^{NS}	0,14 (0,02)*
Hb (13,3-17,7g/dL)	14,9 (0,8)	14,9 (0,8) ^{NS}	13,9 (0,8)*
RBC (4,4-5,9 T/L)	4.89 (0,27)	4.89 (0,27) ^{NS}	4,57 (0,25)*
Protein (6,3-8,2g/dL)	8,07 (0,39)	8,07 (0,46) ^{NS}	7,27 (0,34)*
%ΔPV		-1,5 (6,22) ^{NS}	+11,9 (9.33)τ

*p<0,001 (Wilcoxon signed-rank Test), τ p<0,001 (one sample r_it-test), NS= non significant



HEART RATE RESPONSE TO EXTREME LONG-TERM CYCLING IN AMATEUR CYCLISTS

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PURPOSE

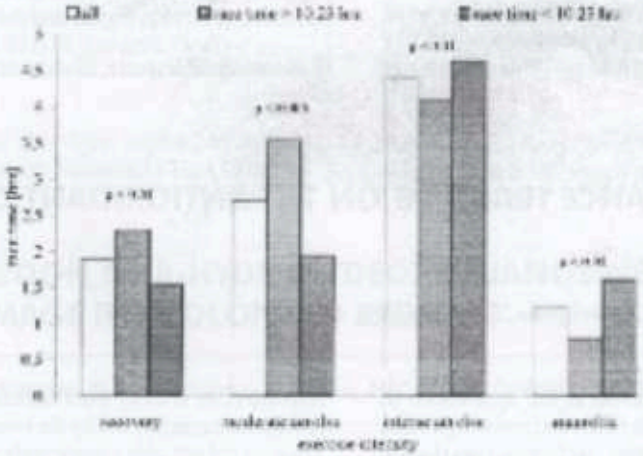
The heart rate (HR) response of amateur athletes to extraordinary long-term exercise is poorly investigated. A clear description of the cardiac demands is crucial not only for the quantification of exercise intensity but also for weighing up potential health hazards in the less-trained athlete. It was the aim of the present study to describe and to analyze the exercise intensities of amateur cyclists by monitoring their HR response during the Ötztal Radmarathon 1999, an extremely challenging 1-day cycling race in the Alps of Tirol (total distance of 230 km; altitude difference of 5500 m).

METHODS

HR monitoting was performed in 14 male well-trained amateur cyclists by the use of Polar Vantage. NV telemeters. Four different exercise intensities were defined as percentages of the age-predicted maximal HR (PMHR), 220 - age, as follows: "recovery" HR (HRre) = <70% of PMHR; "moderate aerobic" HR (HRma) = 70-80% "intense aerobic" HR (HRia) = 80-90%: and "anaerobic" HR (HRan) = >90%.

All athletes finished the ultramarathon successfully. The average racing time was 10.23 hours. The distribution of the different exercise intensities in % (hours) is illustrated in the table.

	HRre	HRma	HRia	Hran
Mean value	18,6 (1,90)	26,5 (2,71)	42,9 (4,39)	12,0 (1,23)
SD	10,8 (1,10)	17,5 (1,79)	18,5 (1,89)	10,1 (1,03)



RESULTS

Probably due to the tough course profile the amount of high exercise intensity was impressingly high, obvious by HRia and HRan of 54.9% (5.62 hrs) and HRmean/PMHRmean ratio of 0.79 - being nearly the same as described for similar stages of professional cycling (e.g. Lucia& Hoyos 1999). The energy expenditure observed showed that the vast majority of exercise was done under "aerobic conditions" (HRre+HRma+HRia=88%) with the classical aerobic range (HRma+HRia) amouting to 7.1 hours or 69.4% of total time. HRs declined significantly by an extent of 10% in the course of the race. According to the race time we found faster athletes to have increased percentages of higher exercise intensities. The endurace HRia and HRan of 47.7 and 16.5% versus 38.2 and 7.5% in the slower competitors (figure). This correlation between race time and energy expenditure suggests that better race performances may be achieved predominantly through an enhanced part of high exercise intensities.

CONCLUSION

Based on the HR response, our findings confirm that the energy demands during an ultramarathon are predominantly met by the aerobic metabolism. The described amounts of intese aerobic and anaerobic exercise borne by amateur cyclists are high and do not significantly differ from those observed in professionals.

Key words: heart rate response, amateur cycling, long-term exercise.

DAY-TIME DEPENDENCE OF SWIMMWERS PERFORMANCE

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INTRODUCTION

Many physiological variables show periodic variations along the day. Many investigators reported that some of the performance indicator parameters could also register daily fluctuations.

POURPOSE

This experiment was designed to study the performance differences in a group of swimmwers at two different hours of the day in order to stabilsh the time of the day in which they show better results.

MATERIAL AND METHODS

A group of 7 swimmwers aged 12 – 14 years old were trained at 9 and 20 hours. Before and after the work sessions body temperature and heart rate were meassured and a urine sample was collected to determine the pH value. After the training session blood lactate level was determined. Also, the timing of a 300 meters trial was recorded. Results were analized usin non parametric statistic tests (Wilcoxon).

RESULTS

Body temperature after exercise is lower in the afternoon

(p<0.05). Preexercise heart rate is lower in the afternoon, but they were no differences after exercise session. The increase in heart rate is significantly higher in the afternoon (p<0.04). Urine pH doesn't modificate when indivuduals exercise in the morning, when they exercise in the afternoon an almost significant cecrease is shown (p<0.06). Blood lactate levels increase less in the afternoon than in the morning (p<0.01). Time score in the 300 meters trial is better in the afternoon (5 out of 7 individuals).

CONCLUSSIONS

Our results shown that sport performance of the group of swimmwrs studied is better in the afternoon than in the morning as blood lactate levels shown lower increments, the heart rate reserve is higher and the time score is better.

Key words: Herat rate, blodd lactate, urine pH, swimmers.

EFFECTS OF ENDURANCE TRAINING ON THE ANTIOXIDANT CAPACITY OF RAT MYOCARDIUM

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Oxidative stress has been involved in the appearance of muscular fatigue and in the origin of several pathologies like diabetes, Alzheimer, or cardiac ischemia-reperfusion syndrome. Several authors have proposed that endurance training couid increase the production of oxygen-derived free radicals. Therefore, this type of exercise could cause oxidetive stress, with the resulting cellular damage and antioxidant systems response. The proposal of the present investigation was the study of the effects of long term endurance training on the antioxidant capacity from rat myocardium. 20 male Wistar rats ware divided into a sedentary (S) and a trained (T) group. Animals from the T group were treadmill trained for 24 weeks, at 25 m/min, 5 days/week, and 45-60 min/day. Once the training period was finished, and after 48h from the last training session, animals were anestethized, and sacrified. Training efficacy was confirmed by the increase in cytrate sinthase (CS) activity from skeletal muscle, the increase in endurance capacity, and by the lower heart rate in T animals. Training did not alter significantly neither lipid peroxidation levels (TBARs), nor protein and nonprotein thiols content in heart homogenates. Antioxidant activities glutathion reductase (GR), glutathion peroxidase (GPx), and catalase (CAT) did not show alterations in response to exercise training. Nonetheless, total superoxide dismutase (SODt), and mitochondrial superoxide dismutase (SODm) increased significantly in trained hearts, in which also a marked increase (315%) in the heat shock protein 72 (HSP-72) levels was detected. In conclusion, the training paradigm employed in the present study doss not lead to oxidative stress in rat heart, and induces adaptations in antioxidant defence system in this organ.

Key words: Heart; superoxide dismutase; TBARs

ARE THE FIELD TESTS AN OBJECTIVE METHOD FOR EVALUATION OF AEROBIC CAPACITY IN SOCCER PLAYERS?

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The modern soccer is a sport with maximal loads and demands of both aerobic and anaerobic metabolism. Therefore, the physical condition and particularly the aerobic capacity is an important factor for high performance in soccer players. The purpose of the study was the comparative evaluation of two tests in the field in order to determine the maximal oxygen uptake (VO2max) with two different protocols of exercise in the treadmill that were applied in the laboratory. Thirty-five elite young soccer players were studied (mean age 18±1 yr and years of training 8±2) during the playing season. All the players performed two maximal tests in the field, the YO – YO endurance test for the estimation of VO2max according to nomogram values (T1) and the YO – YO intermittent endurance test (T2) by using portable telemetric ergospirometry (Cosmed K2). In the laboratory, the players performed two maximal exercise tests on the treadmill, one with progressive increase of intensity (T3) and a second one with intermittent protocol (T4). Furthermore, the concentration of blood lactate was determined at rest and in the 4th min of recovery. The main results of all tests are presented in the following table:

	VO2max(ml/kg/min)	Lactate (mmol/l)
(T1)	56.3±2.7	9.9±1.7
(T2)	62.9±3.8*, #	10.8±1.9*
(T3)	63.6±4.7*, $	10.3±2.0
(T4)	65.0±4.8*	11.3±1.7*

*:p<0.05 vsT1, # :p<0.05 T2vsT4, $:p<0.05 T3vsT4.

The VO2max values of the three ergospirometry tests presented high degree of cross correlation (T2)vs(T3), r=0.47, p<0.004 (T2)vs(T4), r=0.59, p<0.001, (T3)vs(T4), r=0.796, p<0.001).

In conclusion, the determination of aerobic capacity in soccer players by telemetric method in field is reliable in competition to laboratory methods. On the contrary, the result of the YO – YO endurance test was found to be overestimated. However, this method is useful as a guideline in the training program during the season.

Key words: soccer, aerobic capacity, field test, laboratory method, maximal oxygen uptake.

URINARY EXCRETION OF 8-HYDROXYDEOXYGUANOSINE AS A MARKER OF OXIDATIVE DAMAGE IN PROLONGED EXERCISE

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AIMS

The energy demand during physical exercise causes an increased oxygen uptake and supply to active tissues, which may increase the rate of reactive oxygen species production and lead to lipid peroxidation and oxidetive modifications of proteins and DNA: Oxidative damage to DNA is generally measured by levels of 8-oxo-7,8-dihydro-2-deoxy-guanosine (8-OHdG) and excretion of 8-OHdG reflects the integrated rate of oxidative DNA damage and the repair of DNA in the whole body. Data obtained by different authors suggest that oxidative stress induced by prolonged exercise does nor consistently increase oxidative DNA damage. Discrepancies may arise from poor optimisation of analytical procedures or the use of creatinine as a reference marker. In the present study we have determined the urinary 8-OhdG levels of 8 professional cyclists during a 5-day and a 3-week stage races.

METHODS

Field testing was conducted in the Vuelta Ciclista a España (3-week) and in a local 5-day race. The urinary concentration of 8-OHdG was measured by high performance liquid chromatography using an electrochemical detector and the creatinine concentration in urine was analyzed by an alkaline picrate method using a Hitachi 704 Autoanalyzer.

RESULT

The daily urinary excretion of 8-OHdG expressed as a function of body weight increased significantly during the first week (+121%) of the 3-week race and the first day (+47%) of the 5-day competition and did nor show further increases thereafter. No significant changes in 8-OHdG were detected when levels in spot urine samples were corrected by creatinine excretion. Although the urinary excretion of 8-OHdG expressed per kg body weight and the ratio of 8-OHdG to creatinine in spot urine samples were significantly related, correlation was rather poor when levels increased. Creatinine excretion was elevated by 83% in the first week of the 3-week competition and by 33%, in the first day of the 5-day race. Values remained significantly increased at any of the following sampling periods.

CONCLUSION

We conclude that the correction procedure using the amount of creatinine excreted should not be used when studying effects of exercise on urinary 8-OHdG.

Key words: 8-hydroxydeoxyguanosine, exercise, DNA damage

D.N.A. OXIDATIVE DAMAGE DURING A MULTY-DAY STAGE CYCLIST RACE

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AIMS

Our study was aimed to investigate changes in the urinary excretion of 8-hydroxydeoxyguanosine (8-OHdG), a marker of DNA oxidetive damage, in professional cyclists participation in a multi-day stage race and its relationship to duration of exercise and intensity of effort quantifiet1 by telemetric heart rate.

METHODS

The subjects of this study were 8 professional road cyclists. Field testing was conducted in the 1999 Vuelta Ciclista a España race. During each day's racing subjects wore a Polar Sports Tester heart rate monitor for the determination of field heart rate. Data were used lo establish the following intensities of exercise: Anaerobic=AN (around 90% of V02max), Intense Aerobic=LA (between 60-90% of VO2max) and Moderate Aerobic=MA (under 60% VO2max). The urinary concentration of 8-OHdG was measured by high performance liquid chromatography using an electrochemical detector. The amount aldehydic products was quantified in plasma by the thiobarbituric acid reaction (TBARS).

RESULTS

The excretion of 8-OHdG based on the body weight of subjects increased signilicantly on the first week of race and did not show further increases thereafter. Oxidative damage could be related to the increased intensity of exercise when compared to the pre-race periods, as shown by the increased amount of time spent in the AN heart rate zone and its relative contribution during these stages. Serum TBARS concentration did not change significantly at any point during the 3-week race and g1utathione concentration was maintained. Serum creatine kinase activity increased progressively for the first two weeks and decreased thereafter.

CONCLUSIONS

Road cycling courses with an oxidative damage to DNA that is sustained as long as the exercise is repeated. Both adaptation of antioxidant defenses and a decreased capacity to maintain a high intensity of effort may contribute to explain absence of progressive increases in 8-OHdG excretion. The results of this study also indicate that in prolonged exercise urinary 8-OHdG is a more sensitive marker of oxidative stress than TBARS.

Key words: cyclism, DNA oxidation, 8-hydroxydeoxyguanosine.

EFFECT OF LEG EXERCISE ON OXYGENATION IN INACTIVE FOREARM SKELETAL MUSCLE

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We know that sympathetic nerve activity (SNA) becomes active when exercise intensity is increased above a certain level. Increased SNA causes peripheral vascular constriction. In active skeletal muscle, it is thought that sympathotic vasoconstriction is overridden by contraction-induced metabolites, causing the vasodilation (Delp et al. 1998). In inactive skeletal muscle, on the other hand, it is thought that sympatheric vasoconstriction occurs and causes a decrease in blood flow because there are no contraction-induced metabolites. This decrease in blood flow leads to a decrease in oxygen supply. In muscle in which the amount of oxygen consumption is constant, the change in oxygen supply is estimated by the oxygenated hemoglobin concentration (HbO2), which is measured by using near-infrared spectrometry (NIRS). Thus, the purpose of this study was to determine the exercise intensity level at which HbO2 in inactive forearm muscle decreases during leg exercise.

Six subjects performed incremental leg cycling exercise (ILE) in the upright position. The ramp slope was 10Wmin-1. The forearm of each subject was kept in a resting position on a board that was adjusted slightly below heart height. A NIRS probe was fixed to the forearm muscle, and HbO2 change was recorded continuously. Arterial blood pressure was measured using a pneumatic cuff fixed to the left upper arm. Oxygen uptake (VO2) and heart rate (HR) were measured continuously.

The changes in HbO2 and mean arterial blood pressure (MBP) duringn ILE in a representative ubject are illustrated

in Fig. 1. Both HbO2 and MBP tended to level off or slightly decrease until abour 80 W, and then they increased with increasing power output. However, although MBP tended to increase until peak power output, HbO2 showed a sudden drop from about 160 W. This flexion point was observed at around 80% of peak work rate. The amount of tissue blood flow, which determines the amount of oxygen supply, is controlled by the blood pressure and degree of constliction ofresistance vessels. Thus, it is thought that after 70% of VO2 peak pre. constriction level of resistance vessels exceeds the increasing level of blood pressure.

Key word: oxygen supply, blood pressure, vasoconstriction, NIRS.

ANÁLISIS OF THE PHYSIOLOGICAL PARAMETERS OF SWIMMING AND TOWING IN A SEA RESCUE IN ADVERSE SEA CONDITIONS

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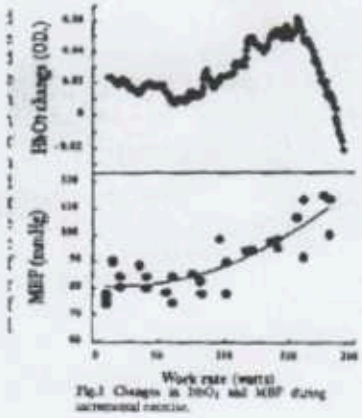
The efficiency of a sea rescue in adverse sea condition has been studied by means of the obtention of the energetic consumpion and the swimming and towing time in a simulated rescue action. Seven life-savers participated in a simulation, where they were asked to swim a certain distance of 55 m until reaching a supposed victim, which they had to tow up to the starting point. Two tests were made; in one of them, a float named 'torpedo buoy' was used as auxiliary material, and in the other no auxiliary material was used. The rescue action was performed in an ergometric swimming pool with waves of 1.7 m high, located in the Integral Sea Safety Center 'Jovellanos' (Gijón). Besides the time used, the lactate was analysed, that is the heart frequency during the test, index of effort perception (Borg scale) and personal inquiry. A few days later, an effort test in laboratory on rolling carpet was performed, obtaining the Fc/VO2 relation, which was used to obtain the VO2 used in the rescue simulation.

It is observed that the average energetic cost in a rescue, in swell condition, is 3278ml.min-1 with torpedo buoy and 3361 ml.min-1 without this material, this supposing 84% and 86.1% of the maximum VO2, respectively, maintaining a heart frequency of 175 and 178 p.p.min-1 (90.4% with material and 91.7% without it, with respect to the maximum Fc). The average time used until reaching the victim was 53.9 sec with buoy and 45.8 without it. The total time is 153.0/157.7 sec, and therefore, the towing time has been 12 seconds shorter with material than without it.

No significant differences were observed in the energetic expense with or without supporting material, but it was certainly observed in the rescue time. We take the conclusion that the torpedo buoy represents an inconvenient for the swimming up to the victim and that, on the opposite, it means a benefit in its towing, in an equal time. It would mean more energetic expense with material in swimming and less expense in the towing. It is important to biomechanically analyse a design of the supporting material that offers a minimum resistance (volume) to the water on approaching the victim and one that can be activated in the towing, since some seconds can be essential to save someone's life.

It is also concluded that, given so an intense cardiovascular requirement maintained, required for the rescue action, and the high energetic cost, a physical preparation is very important for the development of this job, and this should be done training the metabolic transition zone aerobic-anaerobic due to the heart frequency average during the rescue is in the limit of the anaerobic threshold.

Key words: Physiology, Sea Rescue, Torpedo Buoy, Sea.



EVOLUTION OF THE HEART RATE AND BLOOD LACTATE ACCUMULATION IN ROLLER HOCKEY PLAYERS IN COMPETITION AND DURING A PROGRESSIVE RECTANGULAR PROTOCOL

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PURSOPE

To establish the relationship between heart rate and lactacidemy in competition and during the test, and the possible differences in function of the exercise type (competition intermittent exercise – Test continuous exercise).

MATERIALS AND METHODS

Five roller hockey of First Division were valued in competition and in a progressive rectangular test carried out five days after the match. The heart rate was registered with a pulsometer POLAR Acurex plus (Polar electro Oy, Finland), memorizing the registrations every 5 seconds. Data were transferred to a personal computer by means of the Polar Advantage Interface and the software Polar Training Advisor V 1.05.016 (Polar electro Oy, Finland). The blood lactate concentration was determined with the analysing Analox micro-stat, P-LM4 model (Analox Instruments LTD, England).

The sportsmen played the match with the pulsometer and they were carried out two lactate takings, one during the first half, and another during second half. The heart rate was analysed for the 4 previous minutes to the taking of blood lactate concentration. The progressive test consisted in five exercise periods with 3 minutes of continuous exercise and 1 minute of recovery. The initial speed was of 13 Km/h, being increased in 1 Km/h in every period. The blood lactate concentration was analysed at the end of every period and was related with the heart rate (stable heart rate, corresponding to the average heart rate in the last 30 seconds of the period).

RESULTS

The average heart rate in competition was of 176,6±6,88 beats min. corresponding to 87,6% of the max. H.R. (201,6±7,27 beats min.). The blood lactate concentration was of 4,42± 0,80 mmol/l. (first half) and 4,64± 0,58 mmol/l. (second half) and the heart rate of the 4 previous minutes to the taking of lactate it was of 188,0±6,20 beats min. (93,3% Max. H.R.) and 186,6 2,88 beats min. (92,6% Max. H.R.). During the test the Max. heart rate was of 195,2± 5,72 beats min. (96,8% Max. H.R. obtained in competition) and the maximum blood lactate concentration was of 10,72± 2,02 mmol/l. very superior to the one detected in the match in spite of be working with similar heart rates to those of the competition.

CONCLUSIONS

The high heart rate and the relatively low blood lactate concentrations observed in the match they are propitiated by the intermittent character (a-cyclic) of the team games. The recovery phases and low intensity allow a release in the blood lactate accumulation. On the other hand, the constant accelerations, changings of directions, sprints, decelerations, static muscle contractions etc. maintains very high the heart rate in relation to the continuous exercise.

Key Words: Heart rate, Lactacidemy, Roller Hockey.

MODIFICATION OF HEMATOLOGICAL AND ERITROPOYETICOS PARAMETERS DURING PROFESIONAL CYCLIST TOURS OF 22 DAYS

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PURPOSE

Facing the fact of that physical exercise of aerobic resistance induces significant changes in hormonal and hematological parameters, we seeked to analyze the possible modifications of such parameters during aerobic extreme resistance efforts for elite cyclists during Vuelta España 2001, which lasted for 22 days.

METHOD

Three samples of blood were taken from eight cyclists of the same professional team (26±0.59 years, 70±1.54 kg, 180±1.61cm, witch 13±3 years of continuous practice), who were in a good state of health and with a certain performance in functional tests, between 9:00 and 9:30 a.m.: tA (control before competition), tI (in the middle of competition) and tD

(the last day of competition). The hematologic analysis were carried out with a Coulter 20 min after the extraction, for hormonal analysis, serum was obtained in tubes with EDTA and froze to -20° C in aliquotes. The hormonal levels of testosterone and cortisol were determined by radioinmunoensayo and those of eritropoyetine hormone by quimioluminiscencia by means of inmunometric essay (Diagnostic Products, Los Angeles, CA).

RESULTS

All results were in a range of normality and were exprtessed (X SD), = $p<0.05$ concerning the tA: eritrocitos (5.37 ± 0.18; 4.87 ± 0.31; 4.65 ± 0.52*), hemoglobin (16.37 ± 0.58; 15.48 ± 0.38*; 14.07 ± 1.04*), hemotocrito (48.35 ± 2.18; 45.22 ± 0.87*; 43.03 ± 3.60*); eritropoyetina (4.98 ± 2.09; 8.23 ± 2.52*; 4.91 ± 3.24); testosterone (3.81 ± 0.8; 5.79 ± 1.10*; 3.52 ± 0.8); cortisol (17.70 ± 1.73, 21.26 ± 2.63*; 11.28 ± 3.51*) respectively tA, tI and tD.

CONCLUSIONS

1.-The endurance physical exercise causes a significant decrease of hematological parameter during competition, which is not overcome by a significative increase in eritropoyetine hormone at the middle of the competition period, but they in are kept in a normality range of health. 2.-Eritropoyesis is reduced at the end of competition, which is similar for testosterone and cortisol.

Keywords: cycling, hematological parameters, testosterone and eritropoyetine.