152 - BEHAVIOR OF PHYSIOLOGICAL VARIABLE DURING THE HIDROGIMNASTIC CLASS

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INTRODUCTION

Physical exercises done in liquid environment bring many benefits to physical form (PÖYHÖNEN et al., 2002; CARDOSO et al., 2003; TAKESHIMA et al. 2002; AVELLINI et al. 1983) and each time more, physical education teachers, physicians and physiotherapists are advising this practice. Considering the amount of exercises that can be developed in this kind of environment, hidrogymnastic is one of the more used ones, not only for leisure, maintenance or acquisition of physical conditioning, but also as writ of prevention and recovery of injuries (MORAES et al., 2002). Because of theses characteristics, this kind of exercise has been chosen not only by women, but also by men who wish to improve or maintain health.

Recognizing water as an environment used for the practice of physical exercises, it must be considered that alterations occur in the human organism when emerging in it. (PAULA & PAULA, 1998). These physiological reactions occur because of hidrostatic pressure (ARBORELIUS et al., 1972; GLEIM & NICHOLAS, 1989), thermodynamics (CRAIG & DVORAK, 1966) and hydrostatic weight (ALBERTON et al., 2002) and they can vary according to the different temperatures of the water (GLEIM & NICHOLAS, 1989; HALL et al., 1998), depths of immersion (KRUEL et al., 2001; WHITLEY & SCHOENE, 1987; KRUEL et al., 2002) and initial heart rate (HR) of the individual(COERTJENS et al., 1997). In order to adequate a program of exercises to this reality, it is necessary to have knowledge about the possibilities of working in water, as well as a deep investigation of the liquid environment and its physiological influences (PAULA & PAULA, 1998).

LEITE (1984) says that the measurement of oxygen consumption (VO_2) is accepted as the best physiological parameter to evaluate the oxidative metabolic capacity during muscular works above of the basal metabolism. In relation to HR, it is one of the most cardiovascular parameters most affected by the exercise and it is also the most often studied. When an individual is submitted to a cyclic physical exercise, for example, HR increases linearly with the intensity of the physical effort and with VO_2 raise (ARAÚJO, 1986 e BROOKS & FAHEY, 1984). For these same authors, this variable can also suffer modifications with the immersion of the individual in liquid environment.

It should be salient that the few studies that were done with hidrogymnastic exercises present different methodology, and, probably because of this, they show different results for HR and VO_2 behavior. These works have been realized in isolated exercises, and they do not portray a real class situation, comparing distinct speeds of movements (ALBERTON et al. 2004; CASSADY e NIELSEN, 1992), the aquatic and terrestrial way (CASSADY e NIELSEN, 1992; KRUEL et al. 2001; ALBERTON et al. 2004) and different exercises (JOHNSON et al., 1977; CASSADY E NIELSEN 1992; KRUEL et al. 2001; ALBERTON et al. 2004; OLKOSKI et al. 2005). When these results are applied to our reality, it is possible to question if these variables are going to have the same behaviors showed in these studies in a real class situation.

Aiming to contribute for a safer pedagogical practice, giving subsides for the planning and lapsing of hidrogymnastic lessons, the purpose of this study was to analyze the behavior of HR and VO_2 during the aerobic phase of a hidrogymnastic lesson.

METHODOLOGY

Twelve men, undergraduate students with age of 23,43±4,08, stature of 174,75±6,47 cm, who were used to hidrogymnastic practice, had no physical problems, were taking no drugs that could influence in the studies variables were the group of analysis of this study. The individuals reported themselves voluntarily to data collection in two days: in the first (Stage 1) a cardiorespiratory evaluation was done and in the second (Stage 2) was made the corporal evaluation and the lesson of hidrogymnastic. After being conscious of the procedures of the study, the individuals attended the *Laboratório de Fisiologia do Exercício e Performance Humana do Centro de Educação Física e Desportos* of Universidade Federal de Santa Maria CEFD/UFSM in pre-established dates, sites and timetable. In this opportunity, each person signed an Informed Consent and Enlightned Term, providing necessary information to fulfil the counter of Individual data, collect of the data of stature (wooden toll with resolution of 0,5 cm), corporal mass (Welmy scale, with resolution of 0,100 kg) and to the accomplishment of the Test of Maximum Effort in ergometric mat (INBRAMED ATL 10200). The protocol used for the effort test was written by Mader and contributors, which consists in stages of five minutes, with fix inclination of 1% and the speed was increased in 1.8 $km.^{h-1}$ in the end of each stage. During the test, HR was gotten to each minute (Polar mark, *Acurex Plus* model), and VO_2 was measured to each 20 seconds, according to the capacity of the gas analyst AeroSport TEEM 100. In the end of this stage a timetable was booked to realize Stage 2. The break between the stages had at least 72 hours, and the individuals were tested in both stages at the same time and day shift.

Stage 2 was realized at Laboratório de Cineantropometria of CEFD/UFSM. Initially the individual was submitted to corporal evaluation where skin folds, (scientific compass, Cescorf™ mark, resolution of 0,1 mm), bones diameter (bars metal with precision of 0,01 mm) and circumferences (metric ribbon Cardiomed with precision of 1mm). Immediately after, the individual was monitored to the realization of the class, which was realized in a tank 1,71m of diameter and 1,50m depth,that presents possibilities of temperature and depth water control. The temperature was monitored with the help of a chemical termometer with resolution of $0,1^{o}C$ between 32 and 33°C, as this temperature is considered neutral for the realization of exercises in liquid environment (McARDLE et al., 1976). The depth established was according to xifoid process, which has been quoted in the literature (ALBERTON et al., 2004, OLKOSKI et al., 2005).

The hidrogymnastic class studied was based on the methodology used by the Porting Association of UFSM. This class contains 3 phases: Initial phase: is composed by elongations and jointed heatings, and it takes 5 minutes; Main phase: 35 minutes of aerobic exercises, composed by movements of the upper members realized at the same time as the movements of the low members which has 6 Blocks in the following order of intensity (determined by the movements of the low members): lower, average, high, high, average and lower from 1 to 6, respectively; and Final phase: elongations in the last 5 minutes of the class.

During the class, HR and VO_2 were collected each 20 seconds with the same equipments described in Stage 1. A *compact disc digital áudio* stereo, Toshiba mark, was also used to play 135bpm songs during the class as a way of motivating the individuals. The same sequence of songs was played for all of them.

For the analysis, the variables considered were those obtained during the 35 minutes of the main phase, using for this the descriptive statistics [average, shunting line standard (DP) and percentage].

RESULTS AND DISCUSSION

Aiming to analyze the behavior of physiological variable (HR and VO_2) during the aerobic phase of a hidrogymnastic class,

were studied 12 undergraduate students, whose characteristics are presented in table1.

Table 1. Caracterization of the studied group according to age, corporal mass (MC), stature and percentage of corporal fat (%GC).

Variables	Average	Shunting line standard (DP)
Age	23,42	4,08
MC (kg)	73,28	8,36
stature (cm)	174,75	16,47
%GC	12,42	4,09

In order to get referential values, an ergoespirometric test was done, establishing the results of VO_2peak and HRmax, what enabled the analysis of the results obtained during the aerobic phase of the class, in percentile terms, in relation to those obtained in the effort test. These results are presented in table 2.

Table 2. Averages and DP of the physiological variable (HR, VO_2) of the hidrogymnastic class compared to the gotten maximum values in the test of maximum effort.

	HR (bpm)			VO_2 (ml/kg.min)		
	Class	Max	%Max	Class	Max	%Max
Average	134,54	195	68,52	27,92	53,75	53,14
DP	12,68	10,53	5,87	5,28	7,42	12,86

According to ACSM (2003) the intensity advised range to the improvement of the cardiorespiratory aptitude is of 65-90% considering HRmax and of 50-85% considering the VO_2máx. Analyzing table 2, it can be observed that the results of the study are, in average, accorded to the advised range (68,52% of the HRmax and 53,14% of VO_2peak), supposing that the regular practice of the studied class could improve cardiorespiratory aptitude.

However, analyzing the DP showed in table 2, elevated values can be observed for the variable presented. Considering that the average values obtained are presented in the low limit of the advised range, some of the studied individuals do not fit in it. Analyzing individual data, it was observed that 67% of the individuals presented an average of 60,12% of VO_2peak and 75% of the individuals presented an average of 70,88% of HRmax, what fits them in the intensity range advised by ACSM (2003). This was not possible for only 37% of the studied individuals, who presented an VO_2peak average of 39,12% and the others 25% presented an HRmax average of 61,44%.

As already mentioned, works that investigate exercises into the water present a large diversity of methodolgycal practices, despite the fact that all the accessed ones were realized with women, what restricts the possibility of relating the data here presented with the existent literature.

One of the most similar works in terms of structure, is Eckerson and Anderson´s (1992), which was realized with women who were also undergraduate students. In this work, the authors found values of 82% of the HRmax and 48% of the VO_2max, but they are not similar to the ones found in this study. This difference in the results can be occured because the water exercises were realized in a temperature of 26,3±2°C, and according to some authors, (GLEIM & NICHOLAS, 1989; HALL et al., 1998) physiological reactions in liquid environment can vary with the different temperatures of the water.

The analysis of the literature shows that other studies (OLSON et al., 1992; GRIER et al., 2002; ANGELIS et al. 1998), that used aerobic and non-cyclic exercises, accorded to the characteristics of the studied movements in this work, obtained results that are framed with the advised range by ACSM (2003), as in the present work, despite of the activities had been realized in land.

Another possibility of analysis of the results obtained in this investigation is to consider the blocks of the aerobic phase of the class, because the same was composed by 6 blocks with different characteristics. This analysis is justified because it can be proved, in practice, that there is a distinction of intensity among the blocks and that it follows the pre-established sequence (lower - average- high -high - average - lower).

When this analysis was realized, it was once more considered the division into two groups: the groups that presented averages below (GA) and the group that presented pertaining averages (GP) to the band recommended by ACSM. In the table below are presented the averages obtained and the DP found for physiological variables during each block of the class for GP.

Table 3. Average and shunting lines standard for HR and VO_2 during each block of the lesson for GP group.

Variable	Block1	Block2	Block3	Block4	Block5	Block6
HR (%)	61,07±7,04	64,73±5,26	78,15±6,52	80,77±3,85	74,89±4,94	69,04±4,35
VO_2 (%)	45,83±7,71	50,41±6,62	73,35±12,8	75,31±10,3	62,74±10,75	57,35±10,73

The results presented in table 3 show that the structure used in blocks 1 and 2 did not provide enough stimulus to frame HR responses into the band of percentage of the maximum stipulated for the ACSM (2003). The same happened with VO_2 results, but only in block 1.

Table 4. Average and shunting lines standard of HR and VO2 during each block of the lesson for group GA.

Variable	Block1	Block2	Block3	Block4	Block5	Block6
HR (%)	54,75±4,09	56,52±4,58	64,82±5,99	68,51±4,48	64,58±2,25	61,29±2,96
VO_2 (%)	38,38±5,35	37,03±1,96	56,25±5,95	59,03±6,96	43,55±8,95	37,45±3,49

Table 4 results show that despite of GA had presented a general average below of the band recommended by the above-mentioned literature, the structure of the class used as standard in this study was enough for the individuals present satisfactory values in the blocks with larger depth (3 and 4), indicating that for this particular group the intensity of the class should be larger in order to let them enjoy the benefits that the class provides.

In this point of view, the results presented by this study can suggest alternatives in the prescription of classes for groups with similar characteristics of the group studied. It is salient the necessity of caring the structure of the first two blocks when elaborating a class, because the analysis presented here is referred to the aerobic phase of the hidrogymnastic class, that should provide enough stimulation for benefic adaptations to the organism, what did not happen in these blocks.

Based on this, as well as in the data obtained, it would be possible to manipulate the blocks sequence according to the aim of each class. Considering the studied group, a sequence of exercises that is part of the blocks 5 and 6, is an example of a class with low intensities. Another alternative could be the predominance of exercises from blocks 3 and 4 with a larger intensity during the class, and the intensity could also be varied, alterning exercises of high and low intensity from other blocks.

CONCLUSION

Based on HR and VO_2 behavior during the aerobic phase of the hidrogymnastic class, it is concluded that the used structure in the present study will be able to provide the improvement of the cardiorespiratory aptitude of undergraduate students with similar characteristics.

Despite of that, the information that was obtained from the analysis of the different blocks provided alternatives for the prescription of hidrogymnastic classes which different purposes, helping in this way professionals of the area in their practice.

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BEHAVIOR OF PHYSIOLOGICAL VARIABLE DURING THE HIDROGIMNASTIC CLASS

ABSTRACT

Hidrogymnastic practice has increased considerably, because it can be used to help rehabilitation as well as to increase physical conditioning. However, no works about physiological variables behavior are found in literature, becoming emergent to analyze HR and VO_2 behavior during aerobic phase of a hidrogymnastic class. 12 undergraduate students were studied (age of 23,43±4,08, stature of 174,75±6,47cm, 73,28±8,36kg and %GC of 12,42±4,09) in two different stages. In stage 1, an ergoespirometric test in rolling mat was done (Mader´s protocol) and in stage 2 was realized a corporal evaluation and also a hidrogymnastic class in the temperature of 32±0,5°C and the depth of the water was adequated to xifoid process. HR (oftener, Polar mark) and VO_2 (gas analyst Aerosport TEEM100) were gotten each 20 seconds. In accordance with the gotten results, 75% (in relation to HR) and 67% (in relation to VO_2) of the investigated people presented satisfactory values in general average during the aerobic phase of the class. The analysis of the different groups showed that for the first two, %HRmax average remained below of the

limit stipulated by literature, as well as to %VO_2peak during group 1 exercises. Groups 3, 4, 5 and 6 presented intensity results adjusted to the improvement of cardiorespiratory aptitude. It was concluded that the methodology applied in the studied class is enough to the improvement of undergraduate students´ cardiorespiratory aptitude. Despite that, the results from each group showed that is possible to project, through this methodology, different classes for this group of people, providing alternatives for hidrogymnastic, helping in this way professionals of the area in their practice.

Keyword: Hidrogimnastic Class, Heart Rate, Oxygen Consumption.

LE COMPORTEMENT DES VARIABLES PHYSIOLOGIQUES PENDANT UN COURS DE GYMNASTIQUE AQUATIQUE

RESUMÉ

La pratique de la gymnastique aquatique a considérablement augmenté car elle peut être utilisée aussi bien pour la réhabilitation que pour l'amélióration du conditionnement physique. Cependant la documentation ne presente pas de travauxe sur le comportement des variables physiologiques pendant un cours de gymnastique aquatique. Il a don fallu analyser le comportement de FC et VO_2 durant la phase aérobique d'um cours de gymnastique aquatique. Douze étudiants universitaires ont 'eté analysés (23,43±4,08ans, 174,75±6,47cm, 73,28±8,36kg e %GC12,42±09) en deuxe étapes distinctes. Dans la premiere étape a été réalisé le test ergospirométrique sur tapis roulant (Protocole de Mader) et dans la seconde étape ont éte faites l'évaluation corporelle et le cours de gymnastique aquatique à une température de 32°C et une profondeur d'eau à hauteur du processus xiphoïde-Les variables FC (fréquencemètre de marque Polar) et VO_2 (analyseur de gaz Aerosport TEEM100) ont été obtenues toutes les vingts secondes. Em prenant comme base les résultats obtenus 75% (par rapport à FC) et 67% (par rapport à VO_2) des sujets étudiés ont presenté des valeurs satisfaisantes em moyenne générale pendant la phase aérobique du cours. Pour ce qui est de l'analyse dans les différents blocs, on a pu observer que pour les deuxe premiers blocs la moyenne du %FCmáx est resté'au dessous de la limite stipule par la documentation ainsi que pour les %VO_2pointe pendant les exercices du bloc 1. Par contre, les blocs 3,4,5 e 6 présentèrent des résultats d'intensité adéquates pour l'amélioration de la capacité cardiorespiratoire. On a conclu que la méthodologie de la classe étudieé est suffisante pour une amélioration de la capacité cardiorespiratoire de sétudiants. De plus, les résultats de chaque groupe ont montré qu'il est possible d'apercevoir par cette méthodologie des cours différents pour ce groupe, offrant des choix dans la prescription de cours de gymnastique aquatique qui révèlent des objectifs différents, em aidant la pratique des professionnels du secteur.

Mot- clé: gymnastique aquatique, variables physiologiques, étudiants universitaires.

COMPORTAMIENTO DE LAS VARIABLES FISIOLÓGICAS DURANTE LA CLASE DE HIDROGIMNASIA

RESUMEN

La práctica de hidrogimnasia ha aumentado considerablemente en función de poder ser utilizada tanto para la rehabilitación como para el aumento del acondicionamiento físico. Sin embargo, la literatura no presenta trabajos acerca del comportamiento de las variables fisiológicas durante una clase de hidrogimnasia, haciendo inminente analizar el comportamiento de del RC y VO_2 durante la fase aeróbica de una clase de hidrogimnasia. Fueron investigados 12 estudiantes universitarios (edad de 23,43±4,08 años, estatura de 174,75±6,47cm, 73,28±8,36kg y %GC de 12,42±4,09) en dos etapas diferentes. En la etapa 1, fue realizado el test ergoespirométrico en estera mecánica (Protocolo de Mader) y en la etapa 2 fueron hechas la evaluación corporal y la clase de hidrogimnasia con la temperatura de 32° C y profundidad del agua a la altura del proceso xifoides. Las variables FC (frecuencia de marca Polar) y VO_2 (analizador de gases Aerosport TEEM 100) fueron obtenidas a cada 20 segundo. Con base en los resultados obtenidos 75% (en relación a la FC) y 67% (en relación al VO_2) de los sujetos investigados presentaron valores satisfactorios en la media general durante la fase aeróbica de la clase. Con respecto al análisis en los diferentes bloques, se observó que para los 2 primeros bloques, la media del %FCmax permaneció bajo el límite estipulado por la literatura, así como para los %VO_2pico durante los ejercicios del bloque 1. Ya en los bloques 3, 4, 5 e 6 presentaron resultados de intensidades adecuadas para la mejora de la aptitud cardiorrespiratoria. Se concluye que la metodología de la clase estudiada es suficiente para la mejora de la aptitud cardiorrespiratoria de los estudiantes universitarios. Además, los resultados de cada bloque mostraron que es posible vislumbrar a través de la metodología, diferentes clases de hidrogimnasia que vislumbren diferentes objetivos, subsidiando la práctica de los profesionales del área.

Palabras-clave: Hidrogimnasia, Ritmo Cardíaco, Oxígeno de la Consumición.

COMPORTAMENTO DE VARIÁVEIS FISIOLÓGICAS DURANTE A AULA DE HIDROGINÁSTICA

RESUMO

A prática da hidroginástica tem aumentado consideravelmente, em função de poder ser utilizada tanto para reabilitação, quanto para o aumento do condicionamento físico. No entanto, a literatura não apresenta trabalhos acerca do comportamento das variáveis fisiológicas durante uma aula de hidroginástica, tornando-se emergente analisar o comportamento da FC e VO_2 durante a fase aeróbica de uma aula de hidroginástica. Foram investigados 12 universitários (idade de 23,43±4,08 anos, estatura de 174,75±6,47cm, 73,28±8,36kg e %GC de 12,42±4,09) em duas etapas distintas. Na etapa 1 foi realizado o teste ergoespirométrico em esteira rolante (protocolo de Mader) e na etapa 2 foram feitas a avaliação corporal e a aula de hidroginástica com a temperatura de 32°C e profundidade da água à altura do processo xifóide. As variáveis FC (frequêncímetro da marca Polar) e VO_2 (analisador de gases Aerosport TEEM100) foram obtidas a cada 20 segundos. Com base nos resultados obtidos 75% (com relação à FC) e 67% (com relação ao VO_2) dos sujeitos investigados apresentaram valores satisfatórios na média geral durante a fase aeróbica da aula. No que diz respeito à análise nos diferentes blocos, observou-se que para os 2 primeiros blocos, a média do %FCmáx permaneceu abaixo do limite estipulado pela literatura, assim como para os %VO_2pico durante os exercícios do bloco 1. Já os blocos 3, 4, 5 e 6 apresentaram resultados de intensidades adequadas para a melhora da aptidão cardiorrespiratória. Concluí-se que a metodologia de aula estudada é suficiente para a melhora da aptidão cardiorrespiratória de universitários. Além disso, os resultados de cada bloco mostraram que é possível vislumbrar através desta metodologia, diferentes aulas para este grupo, proporcionando alternativas na prescrição de aulas de hidroginástica que vislumbrem diferentes objetivos, subsidiando a prática de profissionais da área.

Palavras-chave: Hidroginástica, Freqüência Cardíaca, Consumo de Oxigênio.