33 - ANALYSIS OF PHYSIOLOGICAL AND ENVIRONMENTAL VARIABLES DURING AN ADVENTURE RACE

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INTRODUCTION

Created during the 80´s, in New Zealand, adventure race is a competition that objectives a pre-determined distance and a diversity of sports practices such as mountain bike, trekking, canoeing, vertical techniques, horse riding, roller skating and others (TOWNES, 2005). Teams are usually composed by 4 athletes, being one from the opposite sex (TOWNES, 2005). The winner team is the first one to arrive, keeping the group together, through longer distances in all programmed route, passing the control points established by the organization (ASHLEY et al., 2006; LUCAS et al., 2008).

The premises of the competition are available few weeks before the event is held, making the preparation slightly more difficult.

The physiological demands during the competition are extreme, leading to much quitting and abandonment (FODHAM et al., 2004; ZALCMAN et al., 2007). Adventure race has become a popular sport and up-to-date literature does not contemplate the physiological and environmental characteristics of the race during competition. This information flaw is probably due to the sport´s recent development, to remote premises in which the competition is accomplished, lack of knowledge regarding the routes and limitations associated with data collection in the field (LUCAS et al., 2008).

MATERIAL AND METHODS

Sample

Four male and two female individuals, with over three years of experience, and aged an average of 30±3,1 years old, height 1,69±7,0 (m) and weight 66,40±10,6 (kg) were selected.

Instruments

A cardiac frequency meter (MFC), Polar ® AXN 500, was used to register cardiac frequency every 60 seconds.

To verify body mass, a scale brand Sanitas, model SBG 20 with 150 kg capacity and 0,1 kg graduation was used. Height was obtained from a 3 meters measuring tape Tramontina, with 1 cm graduation, model 43150/303, being the volunteer standing supported by the wall. Nine skinfolds were assessed according to Jackson e Pollock (1985) with a Cescorf plicometer with 1mm graduation.

Environmental thermal conditions were assessed through a thermal stress monitor (Metrosonic Hs3700). This equipment measures dry, humid and global temperature, and permits the calculation of Wet, Dry and Global Bulb Index (IBUTG). Local competition temperature was measured every hour of the day.

In a transition area, each athlete reported what had been ingested, food, or liquids. In order to calculate total calorie ingestion Diet Pro® 4.0 - software was used, and the ingested liquids were calculated by the difference between initial volume in a graduated reservoir (Camelback®) and the spare liquid.

Statistical Analysis

Statistical Analysis was descriptive, characterizing the sample according to the selected variables. The results are presented through graphics, tables and text.

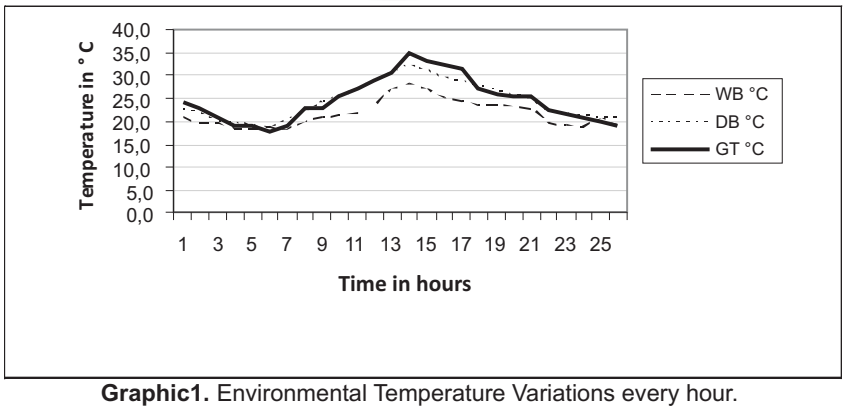
Ethic Care

Volunteers were informed about the objectives and procedures of the research and signed an agreement term. The principles of anonymity and volunteering will be fully respected throughout the research.

RESULTS

Six athletes concluded the whole course (approximately 200 km) of the competition. Athletes 1, 2, 3, and 4, from the same team, spent 24 hours and 43 minutes; athletes 5 and 6 completed in 19 hours and 32 minutes and 28 hours and 20 minutes, respectively.

Environmental temperature assessed each hour through a humid bulb(WB), dry bulb (DB) and global temperature (GT) thermometer are presented in graphic 1.



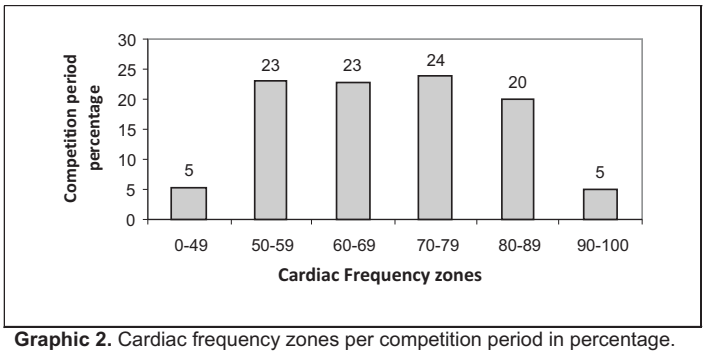
Graphic1. Environmental Temperature Variations every hour.

Antropometric features are represented in Table 1.

Table 1. Physical features from volunteers (n=6).

Athletes	Gender	Age (years)	Height (m)	Body Mass (kg)	Skinfold Sum (mm)	VO_2 ($ml.min^{-1}.kg^{-1}$)
1	M	33	1,73	71,0	70	53,8
2	F	28	1,58	49,0	70	51,1
3	F	29	1,62	55,0	94	47,8
4	M	32	1,71	70,0	84	55,5
5	M	29	1,75	75,0	83	56,5
6	M	26	1,78	78,0	62	55,4
Average	**-**	**31**	**1,69**	**66,4**	**77**	**53,3**
Deviation	**-**	**3**	**0,80**	**12,0**	**11,8**	**3,3**

Graphic 2 represents the competition time percentage in which participants remained at a determined cardiac frequency effort zone according to levels instituted by the Polar Pro Trainer 5 ® software.



Graphic 2. Cardiac frequency zones per competition period in percentage.

In average, 5651 kcal were ingested during total route of the competition, whereas 80% obtained from carbohydrates, 6% from proteins and 14% from fat, being observed with more details in Table 2.

Table 2.
Calories and macronutrient percentage ingested during the competition.

Athletes	Kcal ingested	% CHO	% PTN	% LIP
1	6624	86	4	10
2	3834	81	6	13
3	5355	76	6	18
4	7021	79	7	14
5	5792	74	7	19
6	5281	81	7	12
Average	**5651**	**80**	**6**	**14**
Deviation	**1129**	**4**	**1**	**4**

All six athletes had caloric expenditure superior to ingested calories during the competition, creating a 7597 kcal deficit. The average ingestion was of 43% from total expenditure. This information can be visualized in Graphic 3.

Graphic 3. Kcal ingested and kcal spent for each athlete.

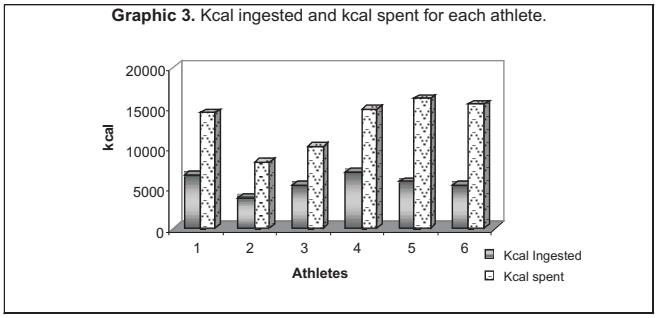
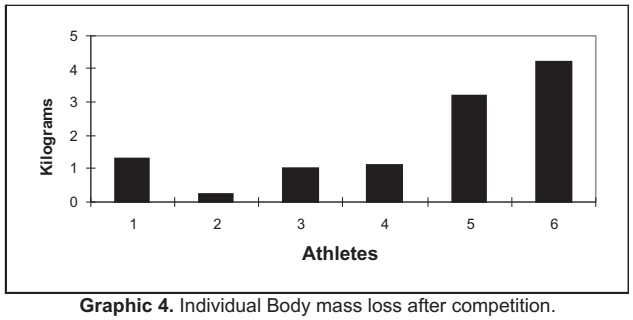


Table 3 describes ingested liquid quantities by each athlete and graphic 4, the body mass loss at the end of the

competition.

Table 3. Ingested Liquid Quantities

Athlete	Liquid Ingested (L)
1	14
2	9,5
3	14,5
4	15
5	12
6	8
Average	**12**



Graphic 4. Individual Body mass loss after competition.

DISCUSSION

This is the first field study done in Brazil, analyzing the physiological and environmental variables during a real adventure race. The main findings from this study are as following: approximately 50% of total exercise time was performed with 70% maximum cardiac frequency intensity, though environmental thermal conditions were not extreme. The athletes presented during the race weight loss from less than 1 kg to 4,5 kg approximately, and the caloric ingestion was not enough to supply spent calories.

It was observed from the cardiac frequency measurements that the average effort was below 80% maximum during 75% of the time, these same findings were shown by LUCAS et al., 2008. A justification would be the incapacity of maintaining high intensity exercise during long hours of continuing activity.

Temperature during the race was measured and probable interference could be noticed in the body liquid loss due to maintenance of body temperature and body mass. The athlete with higher body mass loss was the one with less liquid ingestion and which took longer in completing the race, among the studied athletes.

Researches about ultra-resistance activities report high body mass loss during competitions (MURRAY, 1996; KAO et al., 2008). Although no specific data about body mass loss during adventure races has been reported, the present study showed similarities in this aspect, with losses up to 4,5 kg from body mass.

The ingestion of nutrients during the race was 5651 kcal in average, and the expenditure reached 13248 kcal, generating a 7597kcal or 43% deficit, which relates to ZIMBERG et al. (2008), where in similar conditions, participants had a 40% deficit in calorie ingestion.

The antropometric profile was similar to existing studies, characterizing an heterogeneous group of competitors in adventure racing (LUCAS et al., 2008).

This was a difficult work to be executed due to logistic complicacies of the race. Hard access plots and routes revealed only hours before the competition started made the planning of sample collection even more challenging.

CONCLUSION

New studies must be done to subsidize with data and scientific information physical activity professionals and dieticians who work directly with adventure race, since results show high physiological demand required from this activity.

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ANALYSIS OF PHYSIOLOGICAL AND ENVIRONMENTAL VARIABLES DURING AN ADVENTURE RACE

The objective of the study was to analyze the cardiac frequency, the caloric expense, the loss of corporal mass, ingest alimentary and to measure thermal stress during a test of adventure race. Four men and Two women had been selected; they had been competitors for more than 3 years, with average of age of 30±3,1 years, stature 1,69±7,0 and weight 66,40±10,6 kg. Approximately 50% of the total time of exercise was carried through in intensity above of 70% of the maximum cardiac frequency, the participants had had a loss of corporal mass up to 4,5 kg, the average caloric ingested was of 5651 Kcal and 13248 Kcal of energy expense creating a deficit of 7597Kcal where 80% was ingested in form of carbohydrates. The average of the temperature of dry bulb was 21,5±2,9, humid bulb 24,3±4,0 and globe 24,6±4,9. New studies must be carried through to subsidize of data and scientific information the professionals of physical education and nutritionists who work directly with adventure race, once that the results prove the high physiological requirement of this type of activity.

KEY WORDS: adventure race, physiological stress, thermal stress.

ANALYSE DES VARIABLES PHYSIOLOGIQUES ET ENVIRONNEMENTALES LORS D'UNE COURSE D'AVENTURE

L'objectif de cette étude a été d'analyser la fréquence cardiaque, la dépense calorique, la perte de masse corporelle, l'ingesta alimentaire et de mesurer le stress thermique lors d'une course d'aventure. 4 hommes et 2 femmes ont été sélectionnés, compétiteurs depuis plus de 3 ans, d'un âge moyen de 30±3,1 ans, d'une taille moyenne de 1,69±7,0 et d'un poids moyen de 66,40±10,6 kg. Environ 50% du temps total d'exercices a été réalisé à une intensité supérieure à 70% de la fréquence cardiaque maximum, les participants ont eu une perte de masse corporelle de jusqu'à 4,5 kg, l'ingesta calorique moyen a été de 5651 Kcal et la dépense énergétique de 13248 Kcal, créant ainsi un déficit de 7597 Kcal où 80% a été ingéré sous forme de féculents. La moyenne de température du bulbe sec a été de 21,5±2,9, du bulbe humide de 24,3±4,0 et du globe, de 24,6±4,9. De nouvelles études doivent être réalisées, avec des données et des informations scientifiques, qui serviront d'aide aux professionnels d'éducation physique et aux nutritionnistes qui travaillent directement dans le milieu de la course d'aventure, étant donné que les résultats prouvent la haute exigence physiologique de ce type d'activité.

MOTS-CLÉS : course d'aventure, stress physiologique, stress thermique.

ANÁLISIS DE LAS VARIABLES AMBIENTALES Y FISIOLÓGICOS PARA UNA CARRERA DE AVENTURA

El objetivo de este estudio fue analizar la frecuencia cardíaca, gasto de calorías, la pérdida de peso corporal, la ingesta de alimentos y para medir el estrés térmico durante una prueba de las carreras de aventura. Hemos seleccionado a 4 hombres y 2 mujeres, que compiten por más de 3 años, edad media 30 ± 3,1 años, altura 1,69 ± 7,0 y el peso de 66,40 ± 10,6 kg. Aproximadamente el 50% del tiempo total del ejercicio se llevó a cabo a una intensidad superior al 70% de la frecuencia cardíaca máxima, los participantes tuvieron una pérdida de masa corporal en 4,5 kg, la ingesta calórica promedio fue de 5651 kcal de gasto energético y la creación de un 13.248 Kcal déficit de 7597 kcal con un 80% se ingiere en forma de hidratos de carbono. El promedio de temperatura de bulbo seco de 21,5 ± 2,9, de bulbo húmedo 24,3 ± 4,0 y 24,6 ± 4,9 mundo. Otros estudios deben llevarse a cabo para apoyar a los datos y los profesionales de la información científica en la educación física y los expertos en nutrición que trabajan directamente con las carreras de aventura, ya que los resultados indican la alta demanda de este tipo de actividad fisiológica.

PALABRAS CLAVE: carrera de aventura, el estrés fisiológico, el estrés térmico.

ANÁLISE DE VARIÁVEIS FISIOLÓGICAS E AMBIENTAIS DURANTE UMA CORRIDA DE AVENTURA

O objetivo do estudo foi analisar a freqüência cardíaca, o gasto calórico, a perda de massa corporal, ingesta alimentar e medir o estresse térmico durante uma prova de corrida de aventura. Foram selecionados 4 homens e 2 mulheres, competidores há mais de 3 anos, com média de idade de 30±3,1 anos, estatura 1,69±7,0 e peso 66,40±10,6 kg. Aproximadamente 50% do tempo total de exercício foi realizado numa intensidade acima de 70% da freqüência cardíaca máxima, os participantes tiveram uma perda de massa corpórea até 4,5 kg, a ingesta calórica média foi de 5651 Kcal e o gasto energético 13248 Kcal criando um déficit de 7597 Kcal onde 80% foi ingerido em forma de carboidratos. A média da temperatura de bulbo seco foi de 21,5±2,9, bulbo úmido 24,3±4,0 e de globo 24,6±4,9. Novos estudos devem ser realizados para subsidiar de dados e informações cientificas os profissionais de educação física e nutricionistas que trabalham diretamente com corrida de aventura, uma vez que os resultados comprovam a alta exigência fisiológica desse tipo de atividade.

PALAVRAS CHAVES: corrida de aventura, estresse fisiológico, estresse térmico.

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