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FLUID INTAKE PROFILE OF ELITE RHYTHMIC GYMNASTS

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SUMMARY

In rhythmic gymnastics (RG), due to aesthetic concern, gymnasts may not achieve adequate fluid intake and/or may use extreme body weight loss methods. The purpose of this research is to investigate the hydration habits of elite rhythmic gymnasts. Ten elite rhythmic gymnasts (15.5±1.0 yrs old, 159.2±6.4 cm body height, 42.8±5.9 kg body weight, 16.3±1.3 kg/m^2 BMI, 12.6±1.7% body fat ratio, 8.7±1.7 training yrs, 27.4±9.9 hr/wk training, as means ± SD) were evaluated in the study. Physical and some anthropometric characteristics of the gymnasts were determined, and a hydration habits questionnaire was filled. During a six-day training camp at sea level prior to competition, body weight changes were recorded at the pre- and post-training period, and fluid consumed was measured. Descriptive statistics ($\overline{X}$ and SD) were obtained through the SPSS v15.0 program, and frequency rates were calculated. According to the hydration habits questionnaire, it was observed that 30% of the gymnasts had consumed adequate water and the remaining 70% had consumed slightly inadequate water (1240 ml/day of fluids). In addition, it was determined on a 5-hr intensive pre-competition training day, two days prior to the competition that gymnasts had lost $\overline{X}$ 1050 g of their body weight, and that their water intake was $\overline{X}$ 562 ml in the senior category. Data analysis indicated that this category had relatively the highest weight loss variance compared with the junior category, both for the six days camp and for the 5-hr intensive pre-competition training day. Gymnasts need to individualize hydration protocols to achieve optimal hydration strategy in training and pre-competition days, especially in the senior category.

Key words: Rhythmic gymnastics, fluid replacement, dehydration, rehydration strategies

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ÖZET

ELİT RİTMİK JİMNASTİKÇİLERİN SIVI ALIM PROFİLLERİ

Ritmik jimnastikte sporcular estetik kaygılarla yeterli sıvı almayabilir, veya aşırı kilo verme yöntemleri kullanabilirler. Bu çalışmanın amacı elit ritmik jimnastikçilerin hidrasyon alışkanlıklarını araştırmaktır. On elit ritmik jimnastikçi (Ort.±SD olarak 15.5±1.0 yaş, 159.2±6.4 cm boy, 42.8±5.9 kg vücut ağırlığı, 16.3±1.3 kg/m² VKİ, %12.6±1.7 VYO, 8.7±1.7 yıl antrenman yaşı, 27.4±9.9 saat/hf antrenman) değerlendirildi. Fiziksel ve bazı antropometrik özellikleri belirlenip bir sıvı alma alışkanlıkları anketi uygulandı. Yarışma öncesi deniz seviyesindeki altı günlük antrenman evresinde vücut ağırlığı değişiklikleri ve sıvı tüketimleri kaydedildi. Betimleyici istatistik ($\overline{X}$ ve SD) SPSS v15.0 paket programla elde edildi ve frekanslar saptandı. Anket sonucunda %30 jimnastikçinin yeterli sıvı aldığı, %70'inin ise biraz yetersiz sıvı aldığı belirlendi (1240 ml/gün). Ayrıca, yarışmanın iki gün öncesi beş saatlik yoğun antrenmanda yetişkin sporcuların $\overline{X}$ 1050 g ağırlık kaybettikleri, sıvı alımlarının ise $\overline{X}$ 562 ml olduğu belirlendi. Analiz sonucunda yetişkin kategorisinde kilo kaybı varyansının gerek altı günlük evrede, gerekse yarışma öncesi beş saatlik yoğun antrenmanda gençlere oranla yüksek olduğu gözlendi. Jimnastikçilerin optimal hidrasyon stratejisi için, özellikle yetişkin kategorisinde gerek antrenmanda, gerekse yarışma öncesi evrede sıvı alım protokollerini kişiselleştirmeleri gerekmektedir.

Anahtar sözcükler: *Ritmik jimnastik, sıvı replasmanı, dehidratasyon, rehidratasyon stratejileri*

INTRODUCTION

The term "euhydration" refers to "normal" body water content, while the terms "hypohydration" and "hyperhydration" refer to body water content deficits and excesses beyond the normal fluctuation in body water content, respectively. The term "dehydration" refers to the loss of body water. The purpose of drinking during exercise is to prevent excessive dehydration (>2% body weight loss from water deficit) and changes in electrolyte balance to avert compromised performance (1).

Participation in physical activity exposes individuals to a variety of factors (duration and intensity of exercise, environmental conditions and type of clothing/equipment worn) that influence sweat losses (1). Individual characteristics, such as body weight (4), genetic predisposition, heat acclimatization state (21) and metabolic efficiency (economy in undertaking a specific exercise task) influence sweat rates for a given activity (1). Hypohydration is known to impair performance and increase

the risk of heat injury (15). A net fluid loss of as little as 1% of the body weight increases plasma osmolality, while a 2% loss negatively affects exercise performance (7).

There is special concern for adolescent athletes when it comes to dieting, in some sports (24). Weight is a prevailing theme in gymnastics, regardless of the discipline. Gymnasts are sensitive to the strength-to-weight ratio both from the appearance and performance standpoints. Many young gymnasts may try to achieve low weight through unhealthy methods. Due to the maximal efforts and the short duration, gymnastics is categorized as a high-intensity, anaerobic sport (5). However, gymnasts practice approximately for 4-6 hrs on a regular training day. Therefore, their fluid intake must be observed.

In this study, fluid intake habits of gymnasts were evaluated with a questionnaire. Average pre- and post training body weight differences throughout six days, weight loss during a 5-hr intense training, and average fluid intake during training were investigated. This study may provide some information about the precautions concerning hydration, depending on body weight loss in pre-competition intense training.

MATERIAL and METHODS

Ten elite rhythmic gymnasts in their age groups (15.5±1.0 yr old, of 159.2±6.4 cm height, 42.8±5.9 kg body weight, 16.3±1.3 kg/m^2 BMI, 12.6±1.7% body fat ratio, with 8.7±1.7 training yrs and 27.4±9.9 hr/wk training, as means ± SD) were evaluated in the national camp in İzmir. During the six days preparation period, all gymnasts practiced twice daily on the 1st, 3rd and 5th days, and once daily on the 2nd, 4th and 6th days (each training lasting 5 hrs) before the competition. They had ballet exercise for 2 hrs and then rehearsed their apparatus competition exercises.

Anthropometric measurement sites and techniques have been set out by ISAK (Int. Soc. for the Advancement of Kinanthropometry) (16). Body weight (BW) was measured through a 0.1 kg-sensitive electronic scale. Stature was measured using a wall-mounted stadiometer. Body mass index (BMI) was determined using the body weight/(stature)^2 (kg/m^2) formula. Body fat ratio was assessed using Slaughter et al. (23)'s equation. All gymnasts who participated in the study had primary amenorrhea.

During the camp days, gymnasts were asked to fill out a simple questionnaire about their general hydration status. During six training days at a sports camp before competition, body weight changes were

followed at the pre- and post-training periods. Furthermore, for 5 hrs on a training day at sea level, their body weight changes, fluids consumed were recorded at 20.2ºC air temperature, 59% mean humidity. Gymnasts were allowed to consume water ad libitum. Descriptive statistics ($\overline{X}$ and SD) were assessed, using the SPSS v15.0 program and frequency ratios were calculated from the questionnaire. Written informed consent was obtained from all gymnasts or their parents.

RESULTS

Physical characteristics of the gymnasts are given in Tables 1-3, as means and SD. Controlled weight loss variances of the gymnasts for the six days training period before competition are given in Table 4; those for the 5-hrs daily training two days prior the competition, in Table 5.

Table 1. Physical characteristics of the gymnasts for the senior category

Senior category, n=4	Min	Max	Mean	SD
Age (yr)	16.0	17.0	16.5	0.6
Training year (yr)	8.0	11.0	9.5	1.3
Training hours/wk	24.0	50.0	32.0	12.3
Starting age (yr)	5.0	9.0	7.0	1.6
Body weight (kg)	36.5	50.0	44.5	5.7
Stature (cm)	152.0	166.0	160.8	6.4
BMI (kg/m^2)	15.2	18.4	16.8	1.3
BF (%)	10.5	15.6	12.1	2.4

Table 2. Physical characteristics of the gymnasts for the junior category

Junior category, n=6	Min	Max	Mean	SD
Age (yr)	13.0	15.0	14.8	0.4
Training year (yr)	5.0	10.0	8.2	1.8
Training hours/wk	18.0	34.0	24.3	7.5
Starting age (yr)	5.0	10.0	6.3	1.9
Body weight (kg)	31.8	48.5	41.6	6.2
Stature (cm)	148.5	165.5	158.2	6.8
BMI (kg/m^2)	14.4	18.0	16.6	1.5
BF (%)	10.8	14.5	13.0	1.3

Daily hydration status rate was observed as 6.2±1.6 cup of water (~1240ml/d), and daily coffee and tea intakes, and urine color were found within normal limits from questionnaire results. Data analysis indicated

that the senior category had relatively the highest weight loss variances compared with the junior category, both for the six days controlled, and the 5-hr intensive pre-competition training day.

Table 3. Physical characteristics for all gymnasts

Gymnasts, n=10	Min	Max	Mean	SD
Age (yr)	13.0	17.0	15.5	1.0
Training year (yr)	5.0	11.0	8.7	1.7
Training hours/wk	18.0	50.0	27.4	9.9
Starting age (yr)	5.0	10.0	6.6	1.7
Body weight (kg)	31.8	50.0	42.8	5.9
Stature (cm)	148.5	166.0	159.2	6.4
BMI (kg/m^2)	14.4	18.4	16.7	1.3
BF (%)	10.5	15.6	12.6	1.7

Table 4. Body weight changes during a six-day training prior to competition

Conditions: 21.8ºC air temperature, 53% mean humidity (in the sports hall)	Junior category n=6	Senior category n=4
Weight loss, pre- and post-training (g)	328	600
Body weight loss ratio (%)	0.9	1.3

Table 5. Intensive training day body weight changes

Conditions: 20.2ºC air temperature, 59% mean humidity (in the sports hall)	Junior category n=6	Senior category n=4
Weight loss, pre- and post-5 hr training (g)	300	1050
Body weight loss ratio (%)	0.7	2.4

DISCUSSION

RG exercises are of a complex nature, as they involve coordinating different body parts with the apparatus (rope, hoop, ball, clubs, ribbon). Naturally, this complex coordination makes RG difficult to master. The gymnast must in general combine two motor tasks. Developing technique is a very long and difficult process. (14). Cognitive and mental performance, where concentration, skilled tasks and tactical issues are involved is important, and may be degraded by dehydration and hyperthermia (10). In this study, fluid intake habits of gymnasts were evaluated, as well as the six days' training and the 5-hr intense training period's average fluid intakes were investigated.

Total body water (TBW) is tightly regulated within ~0.2% of body weight each day (2). Water balance is achieved and maintained by matching bodily water input and output. The ad libitum consumption of drinking water, water in foods and beverages, and metabolic water production contribute to water input, and output occurs in urine, stool, sweat, and insensible respiration and perspiration (18,19). TBW averages ~60% of body mass, with a range of approximately 45-75%. These differences are mainly due to body composition. Fat-free mass is ~70-80% water, while adipose tissue is ~10% water. Water content relationships are independent of age, sex and race (13).

Individual sweat rates can be estimated by measuring body weight before and following exercise. This approach assumes that 1 ml of sweat loss represents 1 g loss in body weight (1). Also bioelectrical impedance analysis (BIA) is useful to assess body fluid balance (6). Many indices have been investigated to establish their potential as markers of hydration status. Body mass changes, blood and urine indices, and BIA have been widely investigated (22). Detailed test protocols were not applied to the gymnasts, in order not to cause any pre-competition disturbances.

At the RG World Championships in MIE-2009, especially furosemide use as a diuretic was emphasized to coaches by the FIG (Fédération Internationale de Gymnastique) Medical and Anti-doping Commission (8).

Well-hydrated athletes are less prone to fatigue and improve overall performance comparing with the dehydrated athletes. Dehydrated athletes are prone not only to energy deficits, but also to overuse injuries. Injuries tend to occur later in a workout, when the athlete is most dehydrated. Adequate hydration and continued access to water intake reduce this significantly (12). In RG, most skills necessary for successful competitive compositions take a long time to learn and master (14). Each movement and combination requires many repetitions and gymnasts may become prone to overuse injuries.

Dehydration has an inevitably negative impact regarding maintenance of physiological homeostasis and athletic performance (15). Under resting conditions, hypohydration is normally balanced and is prevented by thirst-driven drinking increase that adequately stimulates fluid intake (9). During exercise, however, human thirst mechanism may be insufficient (20). Despite free access to fluids, exercising subjects replace voluntarily only 66-75% of their net water losses (11). A decrease in body water provokes changes in metabolic, cardiovascular, thermoregulatory, and central nervous functions that progressively increase as dehydration

worsens. Similarly, performance impairment often reported with modest dehydration (~2% body mass) is also exacerbated by higher fluid loss (17).

General guidelines for athletes involved in sports that include intermittent periods of high-intensity work are to consume a 6-7 % carbohydrate sport solution, to drink 600-1.200 ml/hr of fluids depending on environmental temperature, humidity and predisposition to sweating, to consume approximately 1.5 l/kg of body weight lost during the activity. Gymnasts, because of the time spent in training and competition, may need to develop their own strategies to obtain energy and fluids during the activity (5). In this study, daily hydration status rate was assessed as 6.2±1.6 cup of water (~1240 ml/d) from the result of questionnaire.

Responses to the questionnaires revealed that all the gymnasts who participated in the study had not normal menstrual function. To the extent of normal menstrual function, positive water balance may lead to body water retention.

Hydration issues remain a concern for young athletes. Compared with adults, they have lower sweat rates, produce more heat per body weight, experience a faster rise in core body temperature, are predisposed to voluntary dehydration, and acclimatize relatively slower in warm environments (3). Junior gymnasts' body weight losses were lower than those of the seniors, who had relatively higher body weight loss variances for both the 6-day training period (1.3%), and the 5-hrs daily training at the pre-competition period (2.4%). To conclude, gymnasts were found to be at a slight risk of fluid intake in training. Improved education of rhythmic gymnasts about the guidelines of fluid intake is required. Parents, coaches should pay attention to their fluid intake habits.

KAYNAKLAR

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