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Water Loss and Physical Performance in Judo in Hot Atmosphere Climate: The Case of Congo – Brazzaville

Moussouami Simplice Innocent[1*], Tira Juslain Joel[2], Moukila Moukala Serge Aime[1], Tira Alfred Romain[4], Laure Nguetet Synedia[2], Mabika Nzaka Prince[3] and Mbemba François[1]

[1]The effort Laboratory of Physiology, Biomechanics and Nutrition, Superior Institute of Physical Education, University Marien NGOUABI, Brazzaville, Congo
[2]Interdisciplinary Laboratory " Companies, Sport, Health and Development, National School of Administration and Magistracy, University Marien NGOUABI, Brazzaville, Congo
[3]Department of Physical Education and Sports
[4]Laboratory of Physical Planning and Organization of Space

Corresponding author

KEYWORDS

Dehydration, warm climate, judoka, performance, Congo.

A B S T R A C T

The objective was to assess the impact of dehydration on performance judokas exposed to hot environments. This is an experimental prospective study included 20 judokas a club Brazzaville. After informed consent, weight measurements, height, heart rate during exercise and the number of repetition and time to completion techniques and have been taken. These subjects were divided into two groups: non-hydrated subjects did not consume water during training sessions and topics hydrated (consuming water during training sessions). At the end of the session the beneficiaries lost a lot of weight subjects are those non-hydrated while those consuming water have hardly recorded weight losses. Heart rate increased significantly (up to 180bpm) in subjects not hydrated compared to post exercise values. It is the same for the central core temperature (7.90%). The study suggests that dehydration at a temperature of 31°C reduces physical performance outdoor practiced judo. We found significant decreases in body weight in subjects not hydrated, severe elevations in temperature and heart rate during exercise. Our results suggest that these variations are probably responsible prevalence of lower performance in non hydrated subjects.

Introduction

Today, sport is in societies a phenomenon that brings an undeniable part in human activities. Worldwide, several sports have taken magnitude of which is high on judo. Judo is an intensive combat sport on a background request endurance qualities of

strength and speed, but also practice room or the temperature and humidity of the ambient air have higher values and causes huge water losses. Usually done in water that constitutes 65% of our body varies. Physiological obligations intense exercise cause of real water losses. When temperatures and humidity are high, losses may be greater. The training is the set of methods used to improve quality: physical, technical, tactical ... to achieve in a given time the best performance. In particular, physical performance is the maximum capacity of an athlete to achieve the best result. It is due to the gradual increase in training load.

During exercise, evaporation is usually the main mechanism of heat dissipation. [1]

If the water balance of the body is not maintained, homeostasis is thereby broken. Thus, the major functions of the body are disrupted and physical performance as well as mental capabilities [2, 3].

Several studies have shown that changes in some sports have significantly increased physiological loads practitioners [4].

Located in Central Africa, Congo has a left humid tropical climate in four seasons: the great rainy season (October-December) dry small season (January-February) the small rainy season (March-May) and long dry season (June-September), with an average temperature of 30 ° C. The Congolese climate characterized by significantly lower temperatures, exercise outdoors promotes high heat and the body has to adjust its losses (depending on ambient conditions).

Several researchers have devoted themselves to the study of the impact of water loss on performance. However, Congo - Brazzaville few authors have discussed the aspect of the influence of water loss on physical performance of judokas.

Judo in a hot environment causes significant sweat losses causing changes in weight and physical performance. The purpose of this study was to assess the effects of dehydration on performance judokas exposed to hot environments.

Materials and Methods

Type of study, study framework and population

This is an experimental prospective study in the population of judokas from the city of Brazzaville. The choice of subjects was performed by the probabilistic method and according to simple random technique (draw). Only judokas being regularly enrolled in judo club, with regular training sessions and have given written informed consent participated in the survey. The city of Brazzaville is the first and most populous city (political capital) of the Republic of Congo. This study was conducted in 2015 on a 3-month period, from 26 April to 31 July 2014 in the club " gothia " Mfilou town of the city of Brazzaville. In our survey of measurements were performed before, during and after training. Weight was measured using a calibrated and verified balance, size was measured with a height gauge. A body mass index was calculated as a ratio of weight (in kilograms) by height squared (in meters). The registration of the arterial cardiac frequency by means of an electronic apparatus of the mark frequency meter. Dehydration was assessed using the scale of Casa [5].

Investigators have received prior training and the survey was conducted by direct interview between investigators and the people included in the study.

Sampling

The sample size was based on the number of judokas that we found in this club during our descent. So we conducted a sampling probaliste with draw. Thus, our sample consisted of 20 judokas.

Brief Description of environmental conditions The training environment (outdoors) judokas indicates that they are exposed to all permanent weather for generating the thermoregulatory mechanisms (fight against the heat).

Specific exercises

After the measurements of rest, a 10 minutes of heating was conducted and followed by specific judo exercises (Ippon soei nage, Morote soei nage, O-goshi and Harai goshi) gradually accelerated were made by each subject on the mat. During these exercises, the group of hydrated subjects consumed 50cl of water after the completion of each technique.

Statistical analysis

The recorded data were processed with Statistica software Stat Soft Inc (5.97 Version). Descriptive statistics: mean, standard deviation was calculated for each variable. The Kolmogorov-smirnov allowed seeking normality. When normality was verified, the t-test was used to compare variables between the two groups. If normality was not verified, the U Mann withney was used to make the comparison between the two groups. The level of significance was set at $p < 0.05$.

Results and Discussion

Comparing the weight of the subjects before and after each training session rose variations in weight loss after each training session in both groups of judokas: losses in the non-hydrated judokas are between -2.75 and 19.06% and those of the anhydrate between 0.49 and 1.11% (table 1).

The central temperature in subjects not hydrate is averaging 36.70 ± 0.48 ° C, it is 36.90 ± 0.31 ° C in the hydrated at the start and end of the training it is 39.60 ± 0.51 ° C in non-hydrates and: 36.90 ± 0.32 ° C in non-hydrated: central core temperature was significantly increased in the judokas who have not consumed water (table 2).

The change in heart rate before and after the 4 training sessions and depending on the group of judokas. Indeed, in subjects not hydrated, heart rate increased severely reaching 180bpm by cons in hydrated subjects, it only reached 140bpm (Figure 1).

At all training sessions it was observed that the hydrated judokas made an average of 30.42 ± 11.42 uchi komi while non-hydrated have realized that on average 30.42 ± 11.42 uchi komi: hydrated judokas appeared more efficient than non-hydrated (Table 3).

The time averages performed during the execution of each observed technique in unhydrated subjects (between 36 and 38.35) in the hydrated subjects (42.15 and 43.47). It follows from this observation that the judokas hydrated achieve the best technical execution time (in uchi-komi) for the duration of our experiment (Figure 2).

The objective of this study was to assess the effects of dehydration on performance judokas practicing this outdoor activity in a warm climate atmosphere.

The ten (20) competitors in this study had a mean age of 22.00 ± 4.98 years. It is clear from our results that the dehydrated judokas

lost more weight than subjects hydrated at the end of each training session. This difference in weight loss is explained by the fact that dehydrated subjects induces weight reduction by sweating is a struggle against the heat mechanism. In fact, it prevents the continued elevation of core temperature during exercise and is through evaporation of sweat. However, the amount of water distributed in this way depends on the air breathed water saturation judokas and their time commitment largest motor of greater labor intensity in a session.

Regarding the temperature variation among hydrated judokas who participated in this study, significant increases in temperature and heart rate were observed at the end of each training session compared to non-hydrated. These results are not surprising and are due to a well-known phenomenon. Indeed, the warm climate and exposure to heat during workouts promote the elevation of core temperature.

Moreover, judo is a sport which contributes most to hyperthermia due to the holding of practice (judogi), his practice time and intensity. Indeed, the long sleeve of judogi is solid cotton production causes the rise in internal temperature. Then, its last and its intensity considerably raise the core body temperature.

The results recorded in this study are consistent with those of the study of Montain *et al* (1992). These authors have shown that a mild state of dehydration causes an increase in the internal heat of the heart rate and sweat reduction. [6]

This may be due to high heat of muscular exercise which therefore has a tendency to create hyperthermia, triggering hence, the involvement of thermoregulatory processes. The increase in muscle temperature and that of the central core are parallel to each other and directly proportional to the intensity of the activity. This temperature increase is in itself a factor in muscle activity as it speeds up the kinetics of enzymatic reactions liberating energy. [7]

Furthermore, a first purely physical mechanism that is increasing the thermal radiation from the skin surface which can be intense than if there's a large temperature difference between the skin temperature and of the environment [8]. If the ambient temperature rises much, radiation can be reversed and contribute to the rise of temperature of the body.

A physiological mechanism supporting a second physical mechanism: the physiological increased sweating promotes evaporation from the skin surface and that said evaporation from said heat. The physiological mechanism is triggered from the start of the effort from internal receivers. Observation shows us that whatever the outside temperature, the sports sweat.

A third physical mechanism, which is the convection, that is to say the movement of air in contact with the skin. This convection mechanism acts in two ways: on one hand the air stream by heating of oxygen and nitrogen molecules in contact with the skin takes heat, on the other hand the air stream promotes evaporation of sweating [9]. It is certain that all these physical mechanisms that are heat radiation, evaporation of sweat and convection, are favored by two concomitant physiological mechanisms whose second depends in part the first: vasodilation of the cutaneous vessels, the sweat gland activity. These results confirm that the internal temperature rises sharply in subjects compared to non-hydrated hydrated topics: hydration during exercise tends to stabilize the core temperature.

Table.1 Average initial weight, the weight after each training session

	Topics hydrated			subjects not hydrated		
	Pré	Post	%	Pré	Post	%
E_1	61.00 ±9.98	60.40 ±9.91	-0.98	62.10 ±11,09	60.10 ±11.27	-5.91
E_2	60.60 ±9.61	60.00 ±9.68	-0.99	61.90 ±10,59	50.10 ±10.41	-19.06
E_3	61.00 ±11.09	60.30 ±11.14	-1.11	61.80 ±10,39	60.10 ±10.54	-2.75
E_4	60.80 ±10.98	60.50 ±10.71	-0.49	62.40 ±10,70	60,20 ±10.90	-3.52

Table.2 Change in subjects' core temperature before and after each training session

	Topics hydrated			subjects not hydrated		
	Pré	Post	Pré	Post	Pré	Post
E_1	36.70 ± 0.48	39.60 ± 0.51	+7.90*	36.90 ± 0.31	37.60 ± 0.51	+1.89
E_2	36.60 ± 0.51	38.80 ± 0.42	+6.01*	36.30 ± 0.48	36.40 ± 0.51	+0.03
E_3	36.90 ± 0.31	39.40 ± 0.51	+6.77*	36.70 ± 0.48	36.90 ± 0.32	+0.05
E_4	36.90 ± 0.31	38.00 ± 0.01	+2.98	36.20 ± 0.42	36.80 ± 0.42	+1.65

*Significant difference ; E: Training Session

Table.3 Physical Performance judokas in terms of achievements of numbers (ushi Komi)

	Ushi komi	
Technical	JNH	JH
Ippon soei nage	32.15 ± 9.98	46.52 ±7.93*
Moroté soei nage	30.07 ± 11.91	46.80 ±8.32**
O-goshi	30.18 ± 9.90	45.52 ±7.96*
Harai goshi	30.42 ± 11.25	44.92 ±8.24*

*Significant difference; ** Very significant difference; JNH: judokas non-hydrated; JH: judokas hydrate

Fig.1 Comparison of the change in heart rate between judokas trained and untrained judokas

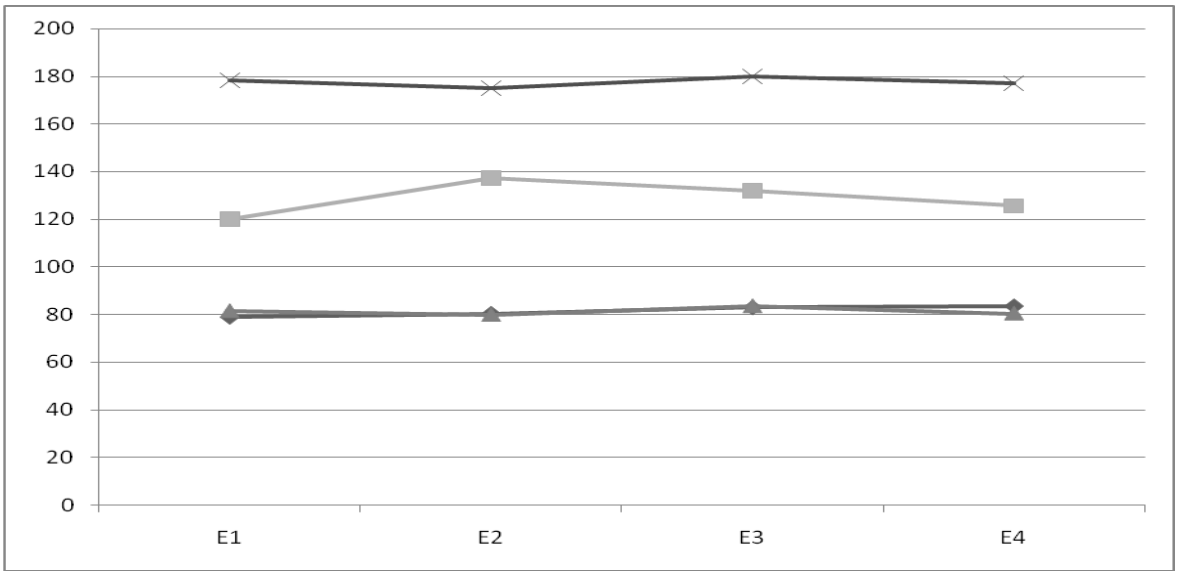
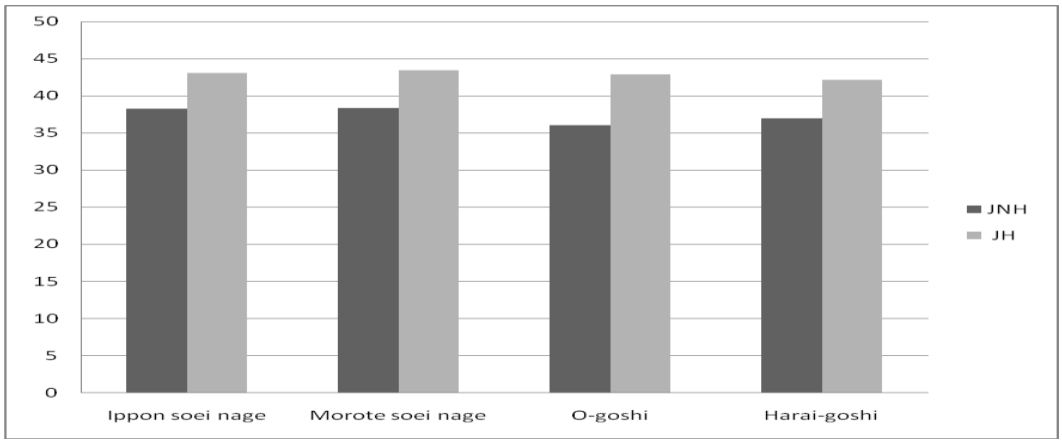


Fig.2 Comparison of the time taken during the execution of each technique " uchi-komi " between judokas hydrated and non-hydrated



JNH: judokas non-hydrated; JH: judokas hydrate

Heart rate in turn, has increased dramatically in non-hydrated subjects in this study. Decreased blood volume, secretion of catecholamines that have an effect on the heart during dehydration are certainly responsible for increasing heart rate and therefore increased blood flow to carry oxygen to the muscles. This thus results in an increase in heart rate and blood pressure.

Jentjens *et al* (2002) reported an average of 180bpm heart rate among cyclists working in dehydration status [10].

Shierrefs *et al* (2005) also reported an average heart rate of 178 bpm in football players. [11] The results of this study are consistent with the above authors. These results confirm that the degree of dehydration influences parallel elevation of the heart rate.

This change in core temperature consequently influences physical performance of our judokas. Indeed, our results report that hydrated judokas appeared more efficient than non-hydrated. In all workouts hydrated judokas achieved the highest number of 'uchi komi' 'whatever the technique compared with non hydrated subjects. Also set a time difference when running a technique was observed between the two: the judokas hydrated lounged more resistant than non-hydrated. Incidentally, Dougherty *et al* (2006) showed that performance basketball basket with the shot fell 45 ± 9 the total duration sprints decreased from 83 ± 9 and the total exercise duration of 73.3 ± 8 when the players were dehydrated [12]. The work of Solera *et al* (2003) also showed that the water loss significantly reduced performance basketball players in free throw. [13]

This performance decrease is explained by physiological constraints imposed by the loss of water or sweating: water loss would affect sports performance. The work of Hoffman *et al* (2009) showed a decrease of 2% by weight water loss (eg 1.4kg for sports 70kg) causes a loss of physical capacity by 20%. Also this dehydration is a source of accidents and muscle and tendon disease (strains, sprains, spasms, tendinitis ...) [14].

In conclusion, observing our results showed that at high temperature (32°C), our subjects lost weight by sweating and causing a dramatic increase in heart rate in the non-hydrated subjects. The change in

temperature therefore influences physical performance judokas: Our results confirm the trend of decline in physical performance of our athletes into account the degree of dehydration.

Our results confirm the trend of decline in physical performance of athletes by the degree of dehydration.

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