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Original Article

Comparison of the thermal profile of judokas and Brazilian jiu-jitsu athletes

HELENO ALMEIDA JÚNIOR [1], AFRÂNIO DE ANDRADE BASTOS [2], FELIPE JOSÉ AIDAR MARTINS[3], RAPHAEL FABRICIO DE SOUZA[4], CARLOS OTAVIO DAMAS MARTINS[5], ALISSON GOMES DA SILVA[6], THIAGO ABNER SOUSA [7], RICARDO PRUNES REGI [8]
[1,2,3,4] Graduate Program in Master's level in Physical Education, Federal University of Sergipe – UFS, BRAZIL.
[5] Departament of Materials Engineering – UFS, BRAZIL.
[6] Post-graduation Program Federal University of Viçosa, BRAZIL
[6] Preparatory School of Air Cadets – EPCAR, BRAZIL.
[7] Graduate Program in Health Sciences, Federal University of Sergipe – UFS, BRAZIL.
[8] Clinic of Rehabilitation – ReabFisio, BRAZIL.

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Abstract:
At higher levels of competitiveness, there is a need to create injury prevention programs in the judo and jiu-jitsu modalities. Both modalities present in common the excessive forearm muscular request. One tool that has been used within these programs is the Infrared Thermography (IRT), which allows the identification of a possible injury. However, in order to avoid misunderstanding of the results, it is necessary to know the athlete's thermal profile. Therefore, the objective of this study was to identify and compare the skin temperature (T_{sk}) of judo and jiu-jitsu athletes in the forearm region, as well as to verify the level of attention for asymmetry in the forearm of these athletes. The sample consisted of 26 male athletes, 12 judokas and 14 jiu-jitsu practitioners. The results of the comparison of T_{sk} of the forearm between the groups did not present any significant differences. The T_{sk} of judo and jiu-jitsu athletes in the forearm are similar, something that may help in future research using thermography with both modalities.
Key Words: thermograph; asymmetry; prevention; judo; jiu-jitsu.

Introduction

Judo and Brazilian Jiu-Jitsu have similarities that can be justified by the origin of each modality. Just as judo was derived from Japanese Jiu-Jitsu, Brazilian Jiu-Jitsu was derived from an older judo school that in the mid-1940s was known as Kano Jiu-Jitsu, with emphasis on ground fighting and vale tudo (NUNES and RUBIO, 2012).

Most judo actions are highly explosive, requiring strength and coordination to overcome opponents with rapid execution of the techniques (DRID et al., 2015). Similar to judo, jiu-jitsu stands out for projections, “joint locks", chokings and short techniques that require great muscular strength (COSTA et al., 2009). These sports also require the use of aerobic metabolism to maintain a high intensity in the actions, providing a faster recovery between each attack (SILVA et al., 2014).

Both methods present a great forearm muscular demand, because of the demand of manual grip strength, which is fundamental for any fighter to be able to impose oneself before the opponent by the ability to carry out the "kumikata" (GASPAROTTO et al., 2015; LIMA et al., 2014). The higher the athlete’s competitive level, the greater the manual grip force (FRANCHINI et al., 2011; SILVA et al., 2014) and, consequently, the greater the demand of the forearm muscle groups.

At higher levels of competitiveness, the importance of programs for injury prevention increases (SCOGGIN et al., 2014; KIM et al., 2015). An emerging tool in sports injury prevention programs is the Infrared Thermography (IRT), which allows visualizing irradiated heat from the body surface and measuring skin temperature (T_{sk}) in a fast and non-invasive way, and without physical contact (VARGAS et al. Al., 2009). With the regular obtaining of thermographic images, it is possible to trace the athlete's thermal profile and monitor the behavior of the T_{sk} throughout the training and competitions (MARINS et al., 2014b), assuming that changes in T_{sk}, considering both T_{sk} of a body region of interest (ROI) and bilateral thermal symmetry may be related to overtraining, incomplete recovery, and exercise-induced muscle damage (AL-NAKHLI et al., 2012; FERNÁNDEZ-CUEVAS et al., 2014; BANDEIRA et al., 2014).

Considering that, at normal conditions, T_{sk} is similar between the sides of the body (BRIOSCHI et al., 2003; GATT et al., 2015) and that thermal asymmetries have been associated with physiological and structural

Corresponding Author: HELENO ALMEIDA JÚNIOR, E-mail: heleno.taichi@gmail.com

abnormalities in athletes (Hildebrant et al., 2010), Marins et al. (2015) proposed a care level scale based on the differences in T_{sk} obtained between contralateral ROI, namely: a) Normal: asymmetries ≤ 0.4°C; B) Monitoring: asymmetries ≥ 0.5°C, it is advisable to reassess and verify if there is influence of some external factor; C) Prevention: values between 0,8°C and 1,0°C, it is recommended a reduction of the training, or even its suspension and medical or physiotherapeutic evaluation; D) Alarm: values between 1.1°C and 1.5°C, immediate suspension of training and medical or physiotherapeutic evaluation; E) Severity: asymmetries ≥ 1.6°C, it suggests an asymmetry with a pathological characteristic or an important lesion, with recommendation of medical or physiotherapeutic evaluation.

Although some studies have determined normative values of T_{sk} in healthy adults, few studies of this nature have been carried out on athletes (Niu et al., 2001; MARINS et al., 2014a, CHUDECKA, LUBKOWSKA, 2015; GATT et al., 2015), especially in fighters. Knowing the values of T_{sk} in judokas and jiu-jitsu athletes is going to help generate information about the thermographic profile of athletes of these modalities. This information can be useful, so that technical teams formed by coaches, physical trainers, physiotherapists and doctors may prevent acute and chronic injuries that may interfere with the dynamics of training and competitions. Therefore, the objective of this study is to identify and compare the T_{sk} of judokas and jiu-jitsu athletes in the forearm region, as well as to verify the level of attention for asymmetry in the forearm of these athletes.

Material & methods

Participants

The sample consisted of 26 male athletes (22.54 ± 3.18 years old, 74.42 ± 7.06 Kg, 172 ± 3.2 cm), 12 judokas and 14 jiu-jitsu competitors enrolled in the Judo Federation of Sergipe and Jiu-Jitsu Federation of Sergipe, respectively. We adopt as criteria of inclusion: to compete at regional level; have at least 3 years of experience in their modality and have a frequency of training of 5 days a week. For exclusion: to be injured; have burns on the forearm skin; present fever in the last seven days; be doing physiotherapy; dermatological use of local creams, ointments or lotions; use antipyretic medications or diuretics, or dietary supplement that may interfere with water homeostasis or body temperature within the last two weeks.

After the screening, the volunteers received clarification on the study procedures and all of them signed the informed consent form. The anonymity and confidentiality of the data were ensured to the participants. This study was approved by the Human Research Ethics Committee of the Federal University of Sergipe (position paper n°.1,586,126).

Thermographic Images

The procedures for capturing thermal images (thermograms) were performed according to the recommendations of the European Association of Thermology (AMMER and RING, 2006), in an artificially illuminated room with fluorescent lamps, with no airflow directed to the collection site, and with environmental conditions, temperature (21.8 ± 0.7°C) and relative humidity (RH) (48.5 ± 2.4%), controlled and monitored by a thermohygrometer (HighMed, HM-01) (FERNÁNDEZ-CUEVAS et al. , 2014).

Individuals were instructed not to perform vigorous physical activity in the previous 24 hours, not to consume alcohol or caffeine, not to use any type of cream or lotions on the skin within the last 6 hours preceding the evaluation. We obtained the thermograms at approximately 8 p.m., after a minimum of 10 minutes of acclimatization, where the volunteers used only a bathing suit, stood, did not make any sudden movements, did not cross the arms and did not scratch themselves (MARINS et al. 2014c).

At the moment of acquisition of the thermograms, the volunteers were in an anatomical position and the camera remained stabilized on a tripod, 1.5 m from each person evaluated, with the lens positioned perpendicularly to the ROI.

The forearm T_{sk} was obtained by a thermal camera C2 (Flir System, Estolcomo, Sweden) with an object temperature range of -10°C to 150°C, accuracy of 2%, thermal sensitivity of <0.10°C, spectral range of 7.5 - 14 μm, image frequency of 9 Hz, IR sensor of 80 x 60 pixels, with emissivity set at 0.98 (STEKETEE, 1973).

For the delimitation of the ROI, we adopted anatomical points on the anterior region of the forearm (from the cubital fossa to the distal-third of the forearm), and their corresponding points on the posterior region. This normalization was advocated by Moreira (2011), which was already used in other studies (MARINS et al., 2014a; SILVA, 2015). Figure 1 shows the thermogram of a participant with the ROI delimitation, performed in Flir Tools software (Flir System, Estolcomo, Sweden).

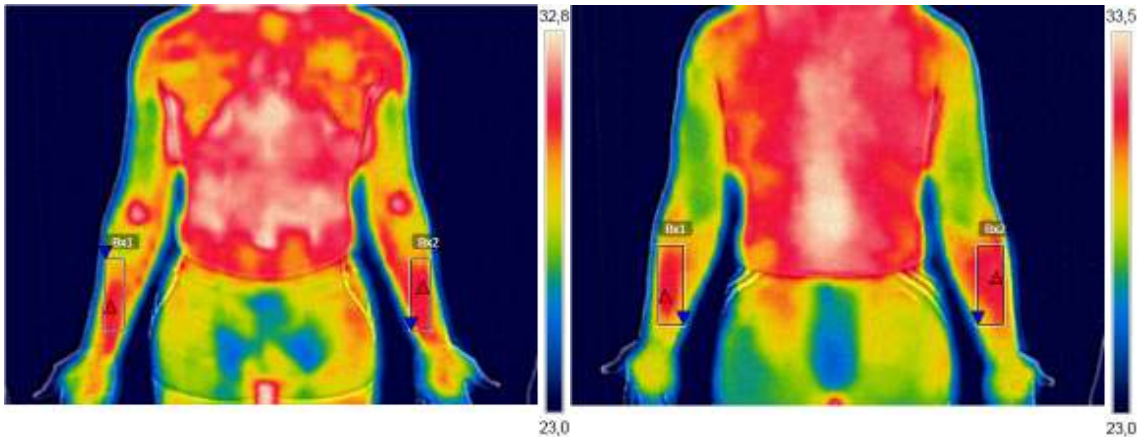

Figure 1. Thermograms of a participant with the ROI delimitation in anterior (a) and posterior views (b).

Statistical analysis

A descriptive statistic was performed in the SPSS Statistics 20.0 program, with data presentation on average, standard deviation, minimum and maximum values. The Shapiro Wilk test was used to analyze the distribution of the data. We performed a comparison of T_{sk} values between groups using the T test for independent samples, when the data presented a normal distribution. For the data that did not present normal distribution, the comparison of the T_{sk} between the groups was performed by the Mann-Whitney test. We considered as significance level the values of $p \leq 0.05$.

Results

Table 1 presents the results of the comparison between the groups from the mean values, standard deviation and the size effect of their foream T_{sk} (right and left), in both anterior and posterior views of each group, representative of the modalities jiu-jitsu and judo.

Table 2 shows the comparison between the groups from the mean ΔT_{sk} (°C), minimum, maximum, standard deviation and the size effect of each modality in the anterior and posterior view.

Table 1. T_{sk} means (°C) for the Jiu-Jitsu and Judo groups in the body region of interest (ROI).

ROI	T_{sk} (°C) Jiu Jitsu	T_{sk} (°C) Judo	*p*	Effect size
Anterior forearm R	31.45 ± 0.89	31.35 ± 1.03	0.799	0.10
Anterior forearm L	31.34 ± 0.93	31.25 ± 1.13	0.824	0.09
Posterior forearm R	31.08 ± 1.12	31.01 ± 1.13	0.878	0.06
Posterior forearm L	31.40 ± 0.87	31.27 ± 1.02	0.743	0.14

Note: R = Right ; L = Left

Table 2. Averages of ΔT_{sk} (°C) with the minimum and maximum values for Jiu-Jitsu and Judo groups in the body region of interest (ROI).

ROI	Jiu-Jitsu ΔT_{sk} (°C) (min – max)	Judo ΔT_{sk} (°C) (min – máx)	*p*	Effect Size
Anterior forearm	0.30 ± 0.19 (0.0 – 0.6)	0.25 ± 0.24 (0.0 – 0.8)	0.322	0.23
Posterior forearm	0.42 ± 0.31 (0.0 – 1.0)	0.43 ± 0.33 (0.0 – 1.1)	0.971	0.03

For the averages of the ΔT_{sk} of the anterior forearm, the values fled from normality. The mean ΔT_{sk} of the posterior forearm is within normal range. In both, no significant differences were found.

Dicussion

The objective of the present study was to identify and compare the forearm T_{sk} between judo and jiu-jitsu athletes, as well as to verify the level of attention to asymmetry in the athletes. The ROI analyzed was the forearm, consisting of the most active and requested muscles by judo and jiu-jitsu athletes due to the need to perform "kumikata" (GASPAROTTO et al., 2015; LIMA et al., 2014).

The mean values obtained for T_{sk} of the right and left forearm in the anterior and posterior views are in accordance with other recent studies that reported normative data on body surface temperature in healthy adults (MARINS et al., 2014a, CHUDECKA, LUBKOWSKA, 2015), indicating that the judokas and jiu-jitsu practitioners of the sample are in a frame of thermal normality in this ROI.

The results of the comparison of the forearm T_{sk} between the groups did not present significant differences. Although Borges Junior et al. (2009) emphasize that jiu-jitsu fighters have a higher handgrip strength when compared to practitioners of other fighting modalities, this study showed that the values of forearm T_{sk} of judoka and jiu-jitsu practitioners evaluated were similar. This observation suggests that the muscular demand of the forearm between judo and jiu-jitsu fighters is similar.

Another finding of the study is related to the contralateral thermal asymmetry in the forearms of judo and jiu-jitsu fighters, in the anterior and posterior view, where no significant differences were also observed between the groups. The importance given to asymmetry is precisely because of the possibility of identifying inflammatory processes or possible injuries, in order to be able to make careful recommendations in training, and also to refer the athlete to the doctor or physiotherapist before the athlete's condition worsens (HILDEBRANDT et al., 2010).

The contralateral thermal asymmetry found in the groups can be considered normal in the anterior and posterior view, according to the attention levels for asymmetry proposed by Marins et al. (2015). The values verified in the present study were 0.25 ± 0.24°C in the anterior view and 0.43 ± 0.33°C in the posterior view for judokas, and 0,30 ± 0,19°C in the anterior view and 0.42 ± 0.31°C in the posterior view for jiu-jitsu fighters. In addition, T_{sk} in the forearm was always greater in relation to the non-dominant side. Our results are consistent with those presented in the pilot study of Arnaiz-Lastras et al. (2011), held with judokas from the Spanish National League. The authors reported asymmetry of 0.19°C in the anterior view and 0.36°C in the posterior view, both with higher values for the dominant forearm compared to the non-dominant forearm.

It is important to note that, although the mean values of asymmetry of the groups were classified as normal, we observed individual cases of athletes with asymmetry values in the posterior view of the forearm with 1.0°C for jiu-jitsu fighters and 1.1 ° C for judokas, showing levels of attention (0.8 ° C - 1.0°C) and alarm (1.1°C - 1.5°C), respectively. According to Marins et al. (2015), it is possible that the judoka's forearm present an asymmetry of 0.4°C up to 0,8°C, considered normal, due to the size of effort to carry out the "kumikata" with his dominant side. However, if it exceeds or maintains high values, they should be evaluated and follow the appropriate procedure according to the level of attention for asymmetry that is found. Therefore, the specificity of the modality and the individual thermal profile should be taken into account when classifying the athlete in relation to the attention level for asymmetry.

The explanation for this asymmetry in judo can be justified by the use of the dominant side, since according to Brito et al. (2005), judokas tend to make all sport moves towards the dominant side. This is probably also useful for jiu-jitsu fighters because they are similar modalities, according to Nunes and Rubio (2012). The thermal values for their forearm found in this study affirm another similarity between the modalities.

The present study is an incentive for new researches with thermography involving these modalities. May the future researches contemplate more participants, more days of analysis to be able to draw a thermal profile of these athletes. Another suggestion is to make analyses in other ROI that are susceptible to injuries such as shoulders, low back and knees, whether in training or competition.

Conclusions

The skin temperature of judo and jiu-jitsu athletes in the forearm region are similar. The level of attention to asymmetry of the groups is normal, but the thermal profile of each athlete must be considered in order to have adequate criteria and be used to prevent injuries, as some may escape from normality levels, i.e., above 0.8°C.

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Conflicts of interest

The authors declared NO conflict of interests regarding the publication of this manuscript.

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