

OLYMPIC PREPARATION IN BRAZILIAN JUDO ATHLETES: DESCRIPTION AND PERCEIVED RELEVANCE OF TRAINING PRACTICES

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ABSTRACT

Franchini, E and Takito, MY. Olympic preparation in Brazilian judo athletes: Description and perceived relevance of training practices. *J Strength Cond Res* 28(6): 1606–1612, 2014—The aim of this study was to describe the training routines used by judo athletes and their perception concerning the relevance, effort made, concentration needed, and pleasure obtained during the training sessions conducted 6 months before their Olympic participation and to compare with medal winners and other competitors in these aspects. Sixty-one Olympic Brazilian judo athletes (men = 39; women = 22), representing 66.3% of all Brazilian participants in this Olympic sport (from 1964 to 2008), including 10 medal winners (9 men and 1 woman) answered a questionnaire concerning their training routines. Mann-Whitney and Student's *t*-test for independent samples were used. Judo medalists and nonmedalists in the Olympic Games did not differ in: (a) the age when they started to practice and to compete in judo, (b) the age when they competed in the Olympic Games, (c) hours of training per week and per training session and the number of training sessions per day in their preparation for this event, (d) frequency and time spent for performing judo-specific and general exercises and their perceived relevance, effort, pleasure, and concentration for these activities performed during the preparation for the Olympic Games. The only differences found were the groundwork (ne-waza) randori practice, which was less frequently performed by medal winners, and perceived relevance attributed to this activity, which was considered less relevant by the medal winners compared with non-medal winners. Thus, judo Olympic medal winners and nonmedalists did not differ in many training aspects in the final phase of their preparation to the Olympic Games.

KEY WORDS martial arts, combat sports, competition, Olympics

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INTRODUCTION

The Olympic Games are considered the main competition for many sports in general (23) and for judo in particular (15,17). Judo was introduced in the Olympic program as a demonstration sport in 1964 for men and in 1988 for women. As a full sport, it was disputed for the first time in 1972 for men and 20 years later for women (7,24). Nowadays, judo athletes compete in 7 weight categories for each gender and 4 medals (1 gold, 1 silver, and 2 bronze) are distributed in each weight category (9,20).

To reach the Olympic level judo athletes train for a long period, starting when they are 6–7 years-old (17), using different methods of training, including both general (running, cycling, strength training, etc.) and specific (technique entrance or uchi-komi, throwing techniques execution or nage-komi, grip dispute or kumi-kata, standing and groundwork fight simulation or randori, etc.) (2,10,12,14).

During their career, judo athletes need to achieve an elevated technical-tactical development (15) and highly-developed physical fitness components (strength, power, endurance, speed, as examples) in sport-specific conditions (14). For outstanding judo athletes (e.g., Yasuhiro Yamashita: 4-times World Champion, Olympic gold medal winner, 15-times All Japan gold medal winner, and 203 consecutive match wins during his career; and Neil Adams: 2 silver medals at Olympic Games, 1 gold, 1 silver, and 2 bronze medals at World Championships), some information about their training routine are available (1,26). However, the information concerning the development of these aspects in combat sports athletes are not frequently reported in the scientific literature (19). Training is considered one of the main aspects to achieve success in high-level competitive sports, but its contribution to final performance is a debatable and unanswered question. Additionally, no investigations have been published describing training routines used by Olympic level judo athletes, and little is known about the differences in training approaches between Olympic medal winners and nonmedal winners. Thus, the objectives of

TABLE 1. Age at the beginning of judo practice and judo competition and training characteristics 6 months before the Olympic Games in Brazilian judo medalists and nonmedalists.*

| | Medalists (n = 10) | Nonmedalists (n = 51) | All (n = 61) |
|--|--------------------|-----------------------|--------------|
| Age when started to practice judo (y) | 6.9 ± 3.1 | 8.1 ± 3.7 | 7.9 ± 3.6 |
| Age when started to compete in judo, (y) | 8.1 ± 3.0 | 10.2 ± 3.4 | 9.9 ± 3.4 |
| Age when competed in the Olympic Games (y) | 23.5 ± 3.2 | 24.3 ± 4.1 | 24.2 ± 3.9 |
| Hours of training per wk | 26.3 ± 8.4 | 22.9 ± 8.9 | 23.5 ± 8.8 |
| Training days per wk (n) | 6 ± 1 | 6 ± 1 | 6 ± 1 |
| Training session per d (n) | 2 ± 0 | 2 ± 3 | 2 ± 3 |
| Hours per training session | 2.1 ± 0.7 | 2.1 ± 0.7 | 2.1 ± 0.7 |

*Values are mean ± SD; training aspects in this table include all training activities performed by the judo athletes.

this study were (a) to describe the training routines used by judo athletes and their perception concerning its relevance, effort made, concentration needed, and pleasure obtained during the training sessions conducted 6 months before their Olympic participation; and (b) to compare with medal winners and other competitors in these aspects.

METHODS

Experimental Approach to the Problem

The questionnaire was adapted from previous articles with judo athletes (3) and wrestlers (19). Before application, its content was evaluated by 3 judo experts (i.e., judo teachers, coaches, and ex-athletes) with experience in physical education and sport research. A group of state level judo

TABLE 2. Frequency of uchi-komi (technique entrance exercise), nage-komi (throwing technique exercise), kumi-kata (grip dispute exercise), and randori (match simulation) practice by judo Olympic medalists and nonmedalists in their preparation for the Olympic Games.

| | Medalists (n = 10) | | | | | Nonmedalists (n = 51) | | | | |
|------------------|--------------------|----------------|----------------|----------------|----------------|-----------------------|----------------|----------------|----------------|----------------|
| | Never (%) | 2-3 per mo (%) | 1-2 per wk (%) | 3-4 per wk (%) | 5-7 per wk (%) | Never (%) | 2-3 per mo (%) | 1-2 per wk (%) | 3-4 per wk (%) | 5-7 per wk (%) |
| Uchi-komi | | | | | | | | | | |
| Shadow | 20 | 0 | 20 | 50 | 10 | 22 | 12 | 16 | 37 | 14 |
| Static | 0 | 0 | 0 | 30 | 70 | 0 | 0 | 2 | 10 | 88 |
| Dynamic | 0 | 0 | 10 | 30 | 60 | 4 | 2 | 8 | 25 | 61 |
| Strength | 10 | 20 | 50 | 10 | 10 | 14 | 18 | 41 | 20 | 8 |
| Speed | 0 | 0 | 20 | 60 | 20 | 2 | 16 | 20 | 51 | 12 |
| Groundwork | 30 | 20 | 20 | 10 | 20 | 20 | 12 | 33 | 20 | 16 |
| Nage-komi | | | | | | | | | | |
| Static | 0 | 0 | 0 | 60 | 40 | 6 | 8 | 12 | 37 | 37 |
| Dynamic | 0 | 0 | 10 | 60 | 30 | 0 | 2 | 24 | 33 | 41 |
| Strength | 70 | 0 | 10 | 10 | 10 | 49 | 16 | 22 | 6 | 8 |
| Speed | 0 | 20 | 10 | 50 | 20 | 16 | 16 | 24 | 27 | 18 |
| Kumi-kata | | | | | | | | | | |
| | 20 | 0 | 30 | 20 | 30 | 10 | 12 | 14 | 33 | 31 |
| Randori | | | | | | | | | | |
| Complete | 30 | 10 | 20 | 10 | 30 | 27 | 10 | 22 | 14 | 27 |
| Standing | 0 | 0 | 10 | 20 | 70 | 0 | 0 | 0 | 12 | 88 |
| Groundwork* | 10 | 10 | 50 | 10 | 20 | 0 | 4 | 22 | 45 | 29 |

*Lower frequency of groundwork randori for medalists compared with nonmedalists (P ≤ 0.05); Shadow—the athlete performed the technique repetition alone; Static—the athlete performed the technique with a partner in static position; Dynamic—the athlete performed the technique with a partner while moving; Strength—the athlete performed the technique against 2 or more other athletes, who tried to resist to the technique; Speed—the athlete performed the technique as fast as possible.

TABLE 3. Time per session spent performing different types of uchi-komi (technique entrance), nage-komi (throwing technique exercise), kumi-kata (grip dispute exercise), and randori (match simulation) practice by judo Olympic medalists and nonmedalists in their preparation for the Olympic Games.*

| | Medalists (<i>n</i> = 10) | Nonmedalists (<i>n</i> = 51) | All (<i>n</i> = 61) |
|-----------------------------|-------------------------------|----------------------------------|----------------------|
| Uchi-komi (min per session) | | | |
| Shadow | 9 ± 8 | 13 ± 18 | 12 ± 17 |
| Static | 37 ± 30 | 26 ± 15 | 28 ± 18 |
| Dynamic | 19 ± 7 | 16 ± 10 | 17 ± 10 |
| Strength | 21 ± 14 | 16 ± 13 | 17 ± 13 |
| Speed | 16 ± 7 | 16 ± 8 | 16 ± 8 |
| Groundwork | 19 ± 20 | 15 ± 11 | 15 ± 13 |
| Nage-komi (min per session) | | | |
| Static | 13 ± 4 | 13 ± 8 | 13 ± 7 |
| Dynamic | 14 ± 5 | 14 ± 9 | 14 ± 8 |
| Strength | 4 ± 7 | 7 ± 9 | 6 ± 8 |
| Speed | 16 ± 8 | 11 ± 9 | 12 ± 9 |
| Kumi-kata, min | 13 ± 10 | 10 ± 8 | 11 ± 9 |
| Randori (min) | | | |
| Complete | 32 ± 27 | 36 ± 32 | 35 ± 31 |
| Standing | 59 ± 28 | 64 ± 39 | 63 ± 37 |
| Groundwork | 30 ± 15 | 38 ± 21 | 36 ± 20 |

*Values are mean ± *SD*; Shadow—the athlete performed the technique repetition alone; Static—the athlete performed the technique with a partner in static position; Dynamic—the athlete performed the technique with a partner while moving; Strength—the athlete performed the technique against 2 or more other athletes, who tried to resist to the technique; Speed—the athlete performed the technique as fast as possible.

athletes (*n* = 10) was used to test its reliability. This group had similar age characteristics as the judo athletes we would interview but did not reach international level (i.e., did not compete for Brazilian National Team in Continental and World Championships or Olympic Games). They answered the questionnaire twice with 1-month interval as suggested by Nevill et al. (22). To evaluate the reliability of all questions whose answers were numerical and parametric, a 2-way (trials 3 athletes) random analysis of variance model of the intraclass correlation coefficient (ICC) was used as suggested by Weir (25). The percentage of agreement between the test and retest scores for those questions whose answers were dichotomous (i.e., yes or no) was used. For those questions whose answers were in a frequency scale (5 possibilities), the proportion of participants who (a) recorded the same answer on the 2 occasions or (b) disagreed using a previous or posterior frequency range on the scale of training activities were calculated as recommended by Nevill et al. (22). The questions whose answers were parametric presented a very stable result with ICC varying from 0.94 to 0.99. The percentage of athletes who recorded the same response between test and retest in the dichotomous questions were

.90%. The proportion of athletes who recorded the same response or who disagreed only by 1 neighbor frequency in the 5-point scale training frequency was .85%. As the training preparation for and participation in the Olympic Games are considered a very remarkable life achievement, it is possible that the Olympic athletes in our sample had better recollection than the athletes who were used to test the reliability of our questionnaire as suggested by Gould et al. (18) in an interview study with Olympic wrestlers. This questionnaire was composed of 4 main parts: (a) personal information about the athlete and judo initiation; (b) information about judo-specific training protocols, considering the relevance, effort, concentration, and pleasure perceived by the athlete; (c) information about complementary strength and conditioning training protocols, considering the relevance, effort, concentration, and pleasure perceived by the athlete; and (d) information about daily life activities during preparation for the Olympic Games.

Subjects

The sample consisted of 61 Olympic Brazilian judo athletes (men = 39; women = 22). This sample represents 66.3% of all Brazilian participations in this Olympic sport (92 participations), including 10 medal winners (9 men and 1 woman), during the period of 1964–2008. From the introduction of judo in the Olympic program to the Beijing Olympic Games, Brazil was ranked 12th in the judo medal table (2 gold, 3 silver, and 9 bronze medals for men and 1 bronze medal for women). Athletes voluntarily agreed to take part in this study, answering a detailed questionnaire concerning their training routines under the supervision of 1 researcher. Data were collected from August 2008 until July 2009. From the 31 athletes taking part in this study, 29 were found at the time the study was conducted and only 2 refused to take part in this research because of lack of time to answer the questions. All procedures were approved by the local ethics committee, and the athletes taking part in this study signed an informed consent form.

TABLE 4. Perceived relevance, effort, pleasure, and concentration for each judo-specific exercise performed judo Olympic medalists and nonmedalists in their preparation for the Olympic Games.*

| | Medalists (n = 10) | | | | Nonmedalists (n = 51) | | | |
|------------|--------------------|--------|----------|---------------|-----------------------|--------|----------|---------------|
| | Relevance | Effort | Pleasure | Concentration | Relevance | Effort | Pleasure | Concentration |
| Uchi-komi | | | | | | | | |
| Shadow | 8 ± 2 | 5 ± 3 | 7 ± 3 | 9 ± 1 | 7 ± 3 | 6 ± 3 | 7 ± 2 | 8 ± 2 |
| Static | 9 ± 1 | 7 ± 2 | 8 ± 2 | 9 ± 1 | 9 ± 2 | 8 ± 2 | 8 ± 2 | 9 ± 1 |
| Dynamic | 9 ± 1 | 7 ± 2 | 8 ± 2 | 9 ± 1 | 9 ± 2 | 8 ± 2 | 9 ± 2 | 9 ± 2 |
| Strength | 9 ± 1 | 9 ± 1 | 8 ± 2 | 9 ± 1 | 8 ± 2 | 9 ± 2 | 7 ± 2 | 9 ± 2 |
| Speed | 10 ± 1 | 9 ± 1 | 8 ± 3 | 10 ± 1 | 9 ± 2 | 9 ± 2 | 8 ± 2 | 9 ± 2 |
| Ne-waza | 8 ± 2 | 8 ± 2 | 7 ± 3 | 8 ± 2 | 9 ± 2 | 7 ± 3 | 8 ± 2 | 9 ± 2 |
| Nage-komi | | | | | | | | |
| Static | 10 ± 1 | 8 ± 2 | 9 ± 1 | 10 ± 0 | 9 ± 1 | 8 ± 2 | 8 ± 2 | 9 ± 1 |
| Dynamic | 10 ± 1 | 8 ± 2 | 9 ± 1 | 10 ± 0 | 9 ± 1 | 8 ± 2 | 9 ± 2 | 9 ± 1 |
| Strength | 9 ± 1 | 9 ± 2 | 8 ± 1 | 10 ± 1 | 8 ± 2 | 8 ± 2 | 7 ± 2 | 9 ± 2 |
| Speed | 9 ± 1 | 8 ± 2 | 9 ± 1 | 10 ± 0 | 9 ± 1 | 9 ± 2 | 8 ± 2 | 9 ± 1 |
| Kumi-kata | 10 ± 1 | 10 ± 1 | 9 ± 1 | 10 ± 1 | 9 ± 1 | 9 ± 2 | 8 ± 3 | 9 ± 2 |
| Randori | | | | | | | | |
| Complete | 10 ± 1 | 9 ± 1 | 9 ± 1 | 10 ± 1 | 10 ± 1 | 9 ± 2 | 9 ± 1 | 10 ± 1 |
| Standing | 10 ± 1 | 10 ± 1 | 10 ± 0 | 10 ± 0 | 10 ± 1 | 9 ± 2 | 9 ± 2 | 10 ± 1 |
| Groundwork | 8 ± 1† | 9 ± 1 | 8 ± 2 | 9 ± 1 | 9 ± 1 | 9 ± 2 | 9 ± 2 | 9 ± 2 |

*Values are mean ± SD; scales varied from 0 (for no perceived relevance, effort, pleasure, and concentration) to 10 (for high perceived levels of relevance, effort, pleasure, and concentration).

†Different from nonmedalists ($P \leq 0.05$); Shadow—the athlete performed the technique repetition alone; Static—the athlete performed the technique with a partner in static position; Dynamic—the athlete performed the technique with a partner while moving; Strength—the athlete performed the technique against 2 or more other athletes, who tried to resist to the technique; Speed—the athlete performed the technique as fast as possible.

Statistical Analyses

Descriptive statistics included frequency and percentage for ordinal variables and mean and SD for continuous variables. Groups were compared with concerning activity frequency through the Mann-Whitney test. For continuous variables, the Student's *t*-test for independent samples was used to

compare with the medalist and nonmedallist groups. Significance level was set at 5%.

RESULTS

Table 1 presents the main characteristics of these groups of athletes.

TABLE 5. Frequency of strength and conditioning exercises practiced by judo Olympic medalists and nonmedalists in their preparation for the Olympic Games.

| | Medalists (n = 10) | | | | | Non-medalists (n = 51) | | | | |
|----------------------|--------------------|----------------|----------------|----------------|----------------|------------------------|----------------|----------------|----------------|----------------|
| | Never, % | 2-3 per mo (%) | 1-2 per wk (%) | 3-4 per wk (%) | 5-7 per wk (%) | Never (%) | 2-3 per mo (%) | 1-2 per wk (%) | 3-4 per wk (%) | 5-7 per wk (%) |
| Aerobic (continuous) | | | | | | | | | | |
| Running | 0 | 20 | 20 | 40 | 20 | 8 | 12 | 10 | 49 | 22 |
| Swimming | 80 | 10 | 10 | 0 | 0 | 76 | 2 | 16 | 6 | 0 |
| Cycling | 90 | 0 | 0 | 0 | 10 | 71 | 4 | 4 | 16 | 6 |
| Strength exercises | 30 | 0 | 0 | 60 | 10 | 27 | 0 | 14 | 45 | 14 |
| Sprint | | | | | | | | | | |
| Running | 30 | 10 | 30 | 20 | 10 | 20 | 8 | 25 | 41 | 6 |
| Swimming | 90 | 0 | 10 | 0 | 0 | 86 | 4 | 4 | 6 | 0 |
| Cycling | 100 | 0 | 0 | 0 | 0 | 88 | 2 | 8 | 2 | 0 |

TABLE 6. Time per session spent performing different types of strength and conditioning exercises by judo Olympic medalists and nonmedalists in their preparation for the Olympic Games.*

| | Medalists (n = 10) | Nonmedalists (n = 51) | All (n = 61) |
|--------------------------------------|-----------------------|--------------------------|-----------------|
| Continuous aerobic (min per session) | | | |
| Running | 44 ± 22 | 42 ± 24 | 43 ± 23 |
| Swimming | 7 ± 15 | 8 ± 15 | 8 ± 15 |
| Cycling | 0 ± 1 | 1 ± 1 | 1 ± 1 |
| Strength exercises (min per session) | 61 ± 46 | 54 ± 43 | 55 ± 43 |
| Sprint (min per session) | | | |
| Running | 28 ± 24 | 27 ± 22 | 27 ± 22 |
| Swimming | 0 ± 0 | 3 ± 8 | 2 ± 7 |
| Cycling | 5 ± 14 | 4 ± 12 | 4 ± 12 |

*Values are mean ± SD.

No significant difference was found between medalists and nonmedalists concerning general aspects related to the age at the beginning of judo practice and time spent for training before the Olympic Games.

Table 2 presents the frequency of judo-specific training activities practiced by judo Olympic medal winners and nonmedalists.

In specific judo training activities, medalists and nonmedalists differed only concerning the frequency of groundwork randori with medalists conducting such training with lower frequency than others ($Z = 2.16, P = 0.031$).

Table 3 presents the time spent per session for performing judo-specific training activities by judo Olympic medal winners and nonmedalists.

No significant difference was found between medalists and nonmedalists concerning the time spent per session in the different type of uchi-komi, nage-komi, kumi-kata, and randori exercises before the Olympic Games.

Table 4 presents the relevance, effort, pleasure, and concentration perceived by the athletes for each type of judo-specific exercise performed during their preparation for the Olympic Games.

No difference was found between medalists and nonmedalists concerning the perceived relevance, effort, pleasure, and concentration for all specific exercises performed in their preparation for the Olympic Games, except by the attributed relevance to groundwork randori, which was lower ($F = 5.60; P = 0.020$) for medalists compared with nonmedalists.

Strength and Conditioning

Table 5 presents the frequency of general training activities practiced by the Olympic medal winners and nonmedalists.

No difference was found between medalists and nonmedalists concerning the frequency of different type of strength and conditioning exercises conducted before the Olympic Games.

Table 6 presents the time per session spent for performing different types of strength and conditioning exercises conducted by judo athletes in their preparation for the Olympic Games.

No significant difference was found between medalists and nonmedalists concerning time spent per session in the different type of aerobic, anaerobic, or strength activities.

No difference was found between medalists and nonmedalists concerning the perceived relevance, effort, pleasure, and concentration for all general exercises (i.e., aerobic, sprint, and strength exercises) performed in their preparation for the Olympic Games (as the frequency of practice of these exercises was small and many athletes reported that they did not practice it, these results were not presented).

Daily Life Activities

Table 7 presents the time spent for performing different types of daily activities by these athletes in the last 6 months before their Olympic participation.

No significant difference was found between medalists and nonmedalists concerning the time spent in daily activities in the 6 months before their Olympic participation.

TABLE 7. Time spent performing different types of daily activities by judo Olympic medalists and nonmedalists in their preparation for the Olympic Games.*

| | Medalists (n = 10) | Nonmedalists (n = 51) | All (n = 61) |
|--|--------------------|-----------------------|--------------|
| Sleeping (h · d ⁻¹) | 8.1 ± 1.0 | 8.3 ± 1.2 | 8.3 ± 1.2 |
| Reading (h · d ⁻¹) | 1.1 ± 1.0 | 1.6 ± 4.2 | 1.5 ± 3.8 |
| Active leisure (h · d ⁻¹) | 1.1 ± 1.6 | 0.9 ± 1.1 | 0.9 ± 1.2 |
| Passive leisure (h · d ⁻¹) | 2.2 ± 1.4 | 2.0 ± 1.7 | 2.0 ± 1.7 |

*Values are mean ± SD.

DISCUSSION

The main findings of this study were that judo medalists and nonmedalists in the Olympic Games did not differ in: (a) the age when they started to practice and to compete in judo; (b) the age when they competed in the Olympic Games; (c) hours of training per week and per

training session and the number of training sessions per day in their preparation for this event; (d) frequency and time spent performing judo-specific and general exercises and their perceived relevance, effort, pleasure, and concentration for these activities performed during the preparation for the Olympic Games. The only differences found were the groundwork randori practice, which was less frequently performed by medal winners, and perceived relevance attributed to this activity, which was considered less relevant by the medal winners compared with nonmedal winners. This difference may be related to the fact that less time is spent in groundwork combat in judo matches compared with standing combat (21), and by the fact that fewer groundwork techniques are applied by super elite (athletes winning more gold medals in World Championships and Olympic Games from each weight category between 1995 and 2001) and elite judo athletes (medal winners in World and Olympic Championships, but who were not gold medal winners of who did not win more than 3 medals in these competitions) (15). Thus, medal winners seem to direct their time of practice to other key components of their preparation and to perceive this type of practice as less relevant to final performance. Actually, Franchini et al. (15) reported that direction of attacks and number of different techniques used in standing position differed among super elite and elite judo athletes, but the groundwork actions did not.

Most likely, other factors than training during the 6 months before judo competitions are associated with performance. In research conducted with wrestlers, Hodges and Starkes (19) reported that international level athletes had accumulated more hours of practice after 5 years of training when compared with regional level ones, suggesting that the total practice during the career may be an important discriminator in combat sports. However, there are no data available concerning the difference of hours of practice in their careers in combat sports athletes succeeding to win an Olympic medal compared with those who competed at this level.

It is probable that technical-tactical skills developed during the judo athletes' career be the main aspect that differentiates medal winners from nonmedalists, as the system of attack of these athletes has been reported as an important factor to judo performance (6,11,15) and grip control during matches (5). Future investigations about how successful Olympic judo athletes trained in their developmental phase are warranted, especially because a recent study (20) demonstrated that, for judo athletes, success in competitions when young is a poor predictor of success in adult competitions. Considering that the sample of our study started to practice judo when they were approximately 8 years old and started to compete at approximately 10 years old, an in-depth analysis of the career of these athletes compared with other athletes would help to understand which technical and tactical development strategies are associated with a broader system of attack and success in competition during adulthood.

Additionally, factors associated with physical fitness (maximal strength and muscle power, anaerobic power

and capacity in general, and specific tests) have been identified as discriminant factors between elite and nonelite judo athletes (8,16), but not when titular (first placers in the national selection) and reserve/alternate (second placers in the national selection) judo athletes in national teams were compared (4,13). As both groups in our sample trained similarly in terms of hours and activities conducted and reported the same perceived concentration, effort, pleasure, and relevance to competitive performance, it seems that physical fitness aspects were not the discriminant ones with regard to performance at this level.

One limitation of our study is related to memory bias for judo athletes competing in 2008 this should not be a problem as their participation was very close to the data collection, but less precision should be found in athletes competing 30–40 years ago. However, as this is one of the most important goals in the athlete's career it is possible that they accurately recalled their preparation for the Olympic Games. It is important to consider that maybe the training methods used by these athletes and their perception are not similar to those used in other countries although specific training methods in judo are commonly used in different countries (1,26).

In conclusion, judo Olympic medal winners and nonmedalists did not differ in many aspects in the final phase of their preparation to the Olympic Games. The exception was the frequency of practice of and the perceived relevance attributed to groundwork randori, which was less frequently performed and perceived as less relevant by the medal winners compared with nonmedal winners. When grouped results were considered, these athletes started to compete when they were approximately 10 years old and achieved Olympic level after 14 years. In the last 6 months before Olympic Games participation, these athletes trained approximately 24 hours per week, 6 days per week, and 2 times per day. Match simulations (especially in standing position), dynamic (the athlete performed the technique with a partner while moving) and static (the athlete performed the technique with a partner in static position), uchi-komi (technique entrance exercise), and static nage-komi (throwing technique exercise) were the most frequent exercises practiced with a high percentage of athletes performing these activities 5–7 days per week and for long periods in each session. Strength exercises and aerobic running were the most practiced complementary exercises. For all activities performed, both medal winners and other Olympic athletes reported high levels of perceived relevance, effort, pleasure, and concentration, indicating that Olympic level athletes perceive all activities performed during training as highly relevant, requiring high levels of effort, and concentration but at the same time resulting in enjoyable moments.

PRACTICAL APPLICATIONS

Judo Olympic medal winners and nonmedal winners had the same training frequency and duration during their preparation for this competition. Additionally, type of exercises included in their training routines were similar and the

psychological perception concerning relevance, effort, pleasure, and concentration to conduct different types of exercises. These data suggest that other aspects related to training organization, technical-tactical training, or long-term athlete development are responsible by the different performance, especially because judo athletes reached the Olympic level after 14 years of experience in competition. Thus, initiation to competition seems to be necessary in age categories ranging from 10 to 12 years old.

The only difference found between groups was that Judo Olympic medal winners spent less time performing groundwork randori and perceived this activity less relevant compared with nonmedal winners probably because the small period athletes have to conduct groundwork actions during the competitive match. Both groups performed strength training and continuous aerobic running as complementary physical conditioning exercises. Thus, coaches should adopt specific measures to avoid interference because of concurrent strength and aerobic training.

As in the 6 months before the Olympic participation, athletes practiced individualized training programs composed of approximately 24 hours per week, 6 days per week, and 2 training sessions per day, and also specific measures should be taken by national federations to assure extra financial support and trained personnel (coaches, physical and conditioning trainers, physiotherapists, psychologists, etc.) to assist the athletes during this period of preparation.

Match simulations (especially in standing position), dynamic and static uchi-komi, and static nage-komi were the most frequently conducted exercises by Olympic judo athletes. These activities were practiced 5–7 days per week. Thus, coaches should give special attention to duration and intensity combinations during the practice of these exercises. Furthermore, future research should be conducted to investigate the best combination to increase performance and decrease fatigue associated with these specific exercises.

Strength training is an important complementary training component used by the athletes, and linear and undulating strength-training periodization should be tested by coaches and sport scientists in high-level judo athletes to verify the best strategy to program this kind of exercise.

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