ORIGINAL ARTICLE

Application of training periodization models by elite judo coaches

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A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

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Abstract

Background and Study Aim: Periodization and structured training models are prominent concepts in the field of sports science. Nevertheless, the structure of the training of Brazilian elite judo athletes and the periodization models used remain unclear. This study investigated how coaches of high-performance judo athletes plan and organise the sports preparation process. Therefore, we aimed to answer the following questions: Do the coaches in this study use sports training periodization to prepare their athletes? Which periodization models do they employ? Is there a preferred periodization model used by this group?

Material and Methods: Eight judo coaches took part in this research. The subjects were purposely selected and met at least two of the following inclusion criteria: being a National Club Grand Prix finalist, being coach of the athletes of the Brazilian national team (junior to 18+ years) and being a member of the Brazilian Judo Confederation coaching staff. A semi-structured interview was used for the investigation.

Results: The participants were divided into two groups: Group 1, composed of six coaches who adopted a classic periodization model following Matveev's theory and Group 2, consisting of two coaches who used a current periodization model following Verkhoshansky and Tschiene's theories.

Conclusions: Our analyses revealed that the coaches in this study applied the precepts of theoretical constructions in sports training periodization as the basis of planning and structuring the training regimen. This sample showed a preference for Matveev's classic periodization model (six out of the eight coaches).

Keywords: combat sport • athletes • training load • qualitative methodology • semi-structured interviews

Conflict of interest: Authors have declared that no competing interest exists

Ethical approval: The research was approved by the Local Bioethics Committee

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INTRODUCTION

Among sports science concepts, structured and periodization models deserve attention since these premises are the basis of planning, creating and controlling the variables that are part of sports training. The structuring of sports training involves the organisation of all stages of athlete preparation, inter-relating moments of preparation and competition [1]. Sports coaches, the primary figures in sports preparation, are in charge of leading, coordinating and structuring the entire training process [2].

Knowledge of sports planning, as well as control of training, is essential for every sports coach. This programme is based on the concept of periodization (divided into phases) and should be governed by the training principles and specificities inherent to each modality [3].

Structuring and planning training to include the correct amount of physical, technical and tactical aspects for each period of the sports calendar, measuring training load (intensity, volume* and density) and respecting the specificity and variability of judo are daunting challenges for coaches of this sport. However, it is still difficult to determine the structure of the training of Brazilian elite athletes, their coaches' view of training and the periodization model they use.

This study investigated into how judo coaches who train high-performance athletes plan and organise the preparation process. To that end, we sought to answer the following questions:

- Do the coaches in this study follow the principles of sports training periodization while preparing their athletes?
- Which periodization models are used by the coaches?
- Does this group prefer a particular periodization model?

MATERIAL AND METHODS

This study of multiple cases used a qualitative design and was approved by the Universidade Estadual Paulista (UNESP), as well as its investigative instrument (protocol no. 0607 and decision no. 081/13).

Eight judo coaches took part in this research and gave their informed consent The sample was composed of young coaches ($\bar{X}$ = 37.4 ±3.8) who had obtained significant results in their careers. All the subjects were former athletes, with national and even international titles and extensive experience in the field (between 21 and 35 years). Six of the coaches were from São Paulo state, one from Rio de Janeiro and one from Minas Gerais. All the coaches had a degree in physical education, and six held graduate degrees (four specialists and two masters), thus demonstrating scientific as well as practical experience. The subjects were selected purposely and exhibited at least two of the following inclusion criteria (Table 1):

- Being a Club National Grand Prix finalist (most important Club Competition in Brazil).

Table 1. Study population and inclusion criteria.

Coach identification	Criterion		
	A	B	C
T1	YES	YES	NO
T2	YES	YES	YES
T3	NO	YES	YES
T4	YES	YES	NO
T5	YES	YES	NO
T6	YES	YES	NO
T7	YES	YES	NO
T8	YES	YES	YES

Periodization – annual cycle of sports preparation, divided into phases or periods and characterized by the organization of training loads.

Periodization – *noun* the act of planning a long-term training schedule for professional athletes, working around competitions [24].

Coach – *noun* someone who trains sports players or athletes; ***verb*** to train someone in a sport [24]

Athlete – *noun* **1.** someone who has the abilities necessary for participating in physical exercise, especially in competitive games and races **2.** a competitor in track or field events [24].

Volume* – quantitative training variables, according to the sport modality specificity (time, kilometres, number of repetitions, etc); *see EDITORIAL NOTE

Training – *noun* the process of improving physical fitness by exercise and diet [24]

Training intensity – the effort of training. A number of methods are used to establish training intensities which give maximum benefits. These include the lactic acid method, minute ventilation method, and target heart-rate [25].

Training periodization – depending of the phase of periodization plan, the training emphasis will shift to develop specific characteristics and manage fatigue. A truly comprehensive plan includes dietary recommendation and psychological training. If the training plan is not completely integrated, the like hood that the athlete will achieve successful results is significantly decreased. The annual training should contain at least preparatory, competitive, and transition phases [26, p. 146].

Mezocycle – training cycle of medium length, a part of the annual cycle (macrocycle) characterized by dynamic loads and the nature of work in the period of approx. 4 weeks.

- Being coach of the athletes of the Brazilian national team (junior to 18+ years).
- Being on the Brazilian Judo Confederation (CBJ) coaching staff.

All the participants were coaches of athletes of national team, and two subjects met all the inclusion criteria. This elite group was extremely restricted and a reference point in terms of judo training. In the initial analysis of the desired profile, fewer than 20 Brazilian coaches were contemplated.

To obtain an accurate picture of the study object, a semi-structured interview was used to investigate training planning. This instrument was sent to five PhD holders in the field of physical education and sports to assess the viability and suitability of the questionnaire (Chart 1).

Chart 1. Questions of the semi-structured interview to understand the periodisation model.

Did you plan your athlete's season?
Which conditional motor skills do you consider important in preparing judo athletes?
How do you distribute motor skills in the different training cycles?
How do you work with training loads in terms of volume* and intensity during the different phases of the season?
How many cycles or periods do you foresee in a training season?
What is the timing of each training period? How important is assessment in this transition?
How many annual peaks do you foresee for your athletes?
How do you handle competitions in the different training phases?

Data were collected on five different occasions, called rounds:

- Round 1c: initial contact (by email or telephone), introduction of the researcher, explanation of the reasons why each participant was selected and the aims of the study.
- Round 2c: presentation of the informed consent form and acceptance to participate.
- Round 3c: data collection through interviews (conducted personally or on Skype).
- Round 4c: presentation of the interview transcript and verification by the participant with corrections or acceptance of the text.
- Round 5c: presentation and modification or acceptance of the training periodization by the participant.

The research instrument provided descriptive data obtained from analyses and transcriptions of the interviews, which were compared with sports training studies in an attempt to interpret and understand the information collected during the investigative process. Its products were closely linked to the individuals, situations and events contextualised to judo training planning and its interventions.

Data analysis occurred in four different stages, also called rounds:

- Round 1a: initial interpretation of the interviews for transcription and presentation to the respective coaches for approval of the text; it is important to underscore that all participants accepted the transcribed text without changes.
- Round 2a: selection of the main training characteristics described by each coach, emphasising the following aspects: planning for the season, changes suggested and implemented during the season, allocation of the different conditional motor skills during the different training periods, variation in volume* and intensity during the competitive season, amount and timing of training cycles and organisation of different competitions during the sports calendar.
- Round 3a: comparison between the a priori selected characteristics and the published studies on sports training methodologies and the consequent creation of graphs that illustrate the recommendations of each coach in relation to training periodization for presentation to participants.
- Round 4a: verification by coaches of load dynamics graphs; none of the coaches changed the graph.

RESULTS

The coaches in the study exhibited individuality in training planning and in questions regarding the periodization applied, but it was possible to identify and separate the participants into two distinct groups in terms of how they created and conducted the training process:

Group 1

Composed of coaches T1, T4, T5, T6, T7 and T8, used a model whose guidelines and load distributions followed Matveev [4]. Some of the coaches in this group made adaptations, primarily due to

the modern calendar, with characteristics that coincided with Bompa's [3] recommendations or the linear model [5-7], which are also periodization methods created by Matveev. Thus, we consider that Group 1 used the classic training periodization model.

Group 2

Composed of coaches T2 and T3, this group used models whose guidelines and load distributions followed Tschiene [8, 9] and Verkhoshansky [10-13], demonstrating a break from the classic form of structuring training. Thus, we consider that Group 2 used a contemporary training periodization model.

The periods in Figure 1 are not named in accordance with the preparation phase since Group 1 coaches used different nomenclature in their models, which is discussed further on. However, these nominal differences do not indicate different approaches but rather were used for the same purposes by all coaches from this group during athlete preparation. Matveev's classic model to illustrate each period resulted in the following correlation: Period 1 (preparatory); Period 2 (competitive) and Period 3 (transition). Period 2 is divided by all coaches into two phases, which might be correlated to precompetitive and competitive mezocykles. However, Period 1 is divided into two or three mezocykles, depending on the trainer.

An analysis of the training load, volume* and intensity shows that Group 1 coaches adopted the same strategies to conduct the preparation process. All coaches started the season with a large volume* of work at moderate intensities, increasing intensity over the course of the season and decreasing volume* as the competition approached. This manner of modulating volume* and intensity was recommended by Matveev [4] in this classic training periodization theory. Other characteristics in the training models of Group 1 coaches that originated in the classic periodization model are:

- load distribution occurred at low intensity over the season, with more or less emphasis according to the intended direction at a particular preparation stage;
- at the start of the season, all coaches used a general preparation mezocykle before specific preparation;
- a number of conditional motor skills were addressed in the same preparation mezocykle;
- the athlete's performance was expected to improve gradually from the start of the season to the competitive period;
- two to three competitive peaks per season were recommended;
- preparatory and control competitions were used.

Despite many common characteristics, it is natural for each coach to exhibit individuality when creating and conducting their training periodization models. Their primary role within the preparation process requires organisation and systematisation in accordance with their needs and objectives.

It was not possible to create a single model representing T2 and T3 (Group 2). Even though both used Tschiene's structural model as the reference point, T3 employed two training models (Tschiene in the first semester and the block model in the second semester). In addition to the German

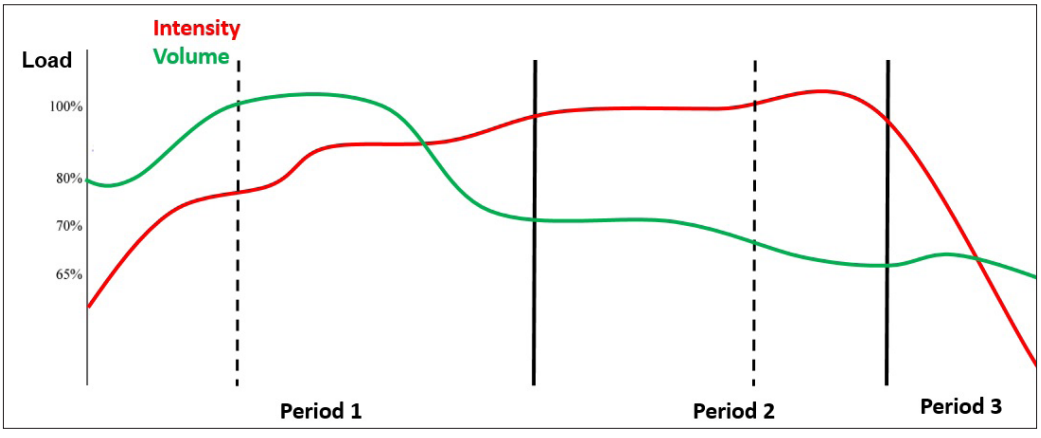

Figure 1. Group 1 periodization model.

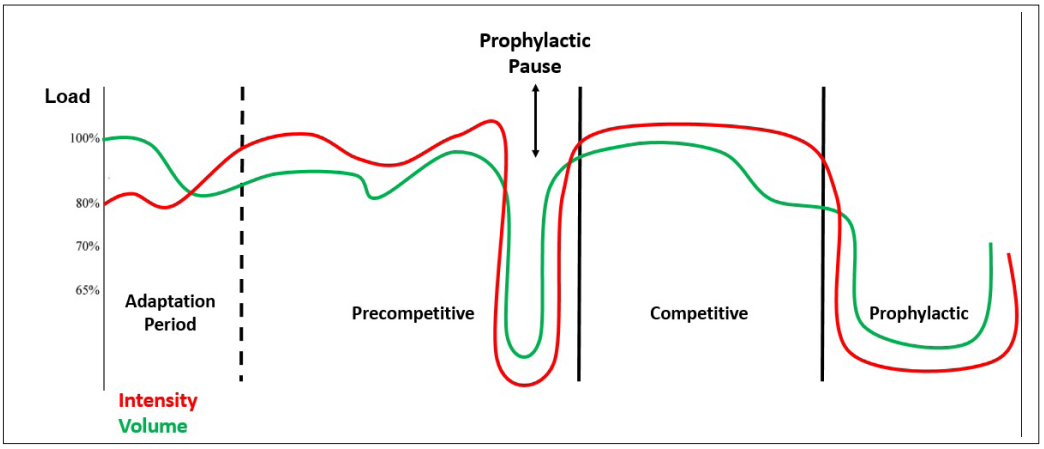

Figure 2. Periodization model T2.

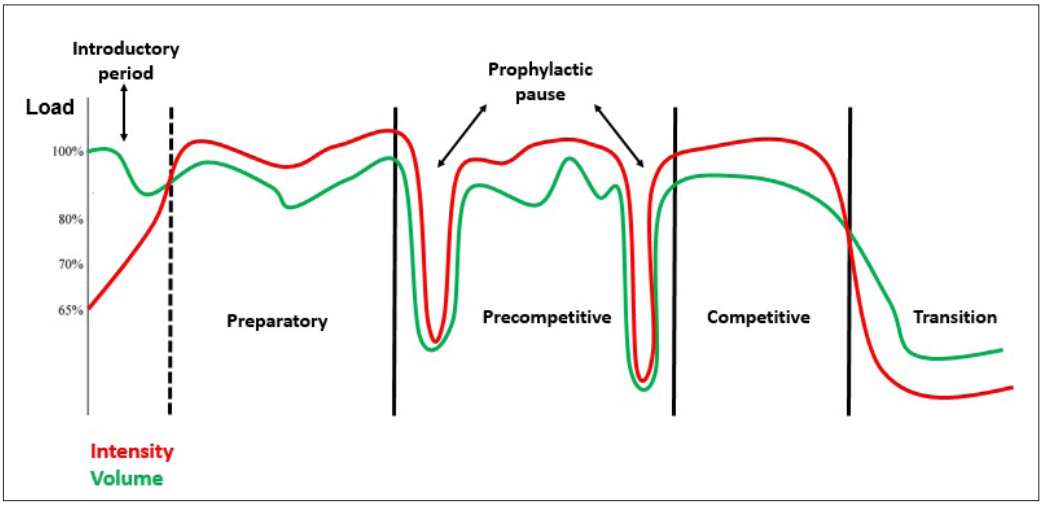

Figure 3. Periodization model T3 – first semester.

author's reference, there was the conception that the classic training model could not meet their demands. Thus, the concepts of structured training and load distribution clearly signal a break from Matveev's model in an attempt to find an alternative that is better suited to the modern competitive calendar and the specificities of judo.

As shown, there is an introductory or adaptation period, followed by mezocykle with high-volume* and high-intensity loads, forming a wave-like distribution pattern over the entire season, in addition to prophylactic pauses at opportune moments, which are characteristics in line with the high-performance structural training model [8]. Prophylactic pauses can be introduced at different times during preparation to minimise the significant fatigue caused by this type of preparation as compensation or to preserve performance. The individuality of this process is important to successfully apply loads and pauses [14, 15], a fact that was emphasised by each participant.

The coaches attributed the peculiarities of this training planning theory to the need to ensure that their athletes were prepared to compete at different times during the season in light of the large number of competitions [14, 15].

For the second semester, T3 used Verkhoshansky's block model. T3 scheduled one or two peaks depending on the athlete's objective. If he/she used 2 peaks, blocks B and C repeated, whereas block A occurred only once. Block A had extremely high volume* and intensity, which gradually declined in blocks B and C.

DISCUSSION

The coaches in the study tested new models and sought references and scientific fundamentals to construct their own training methodologies. In this respect, a number of adaptations were made to conventional models to meet the specific

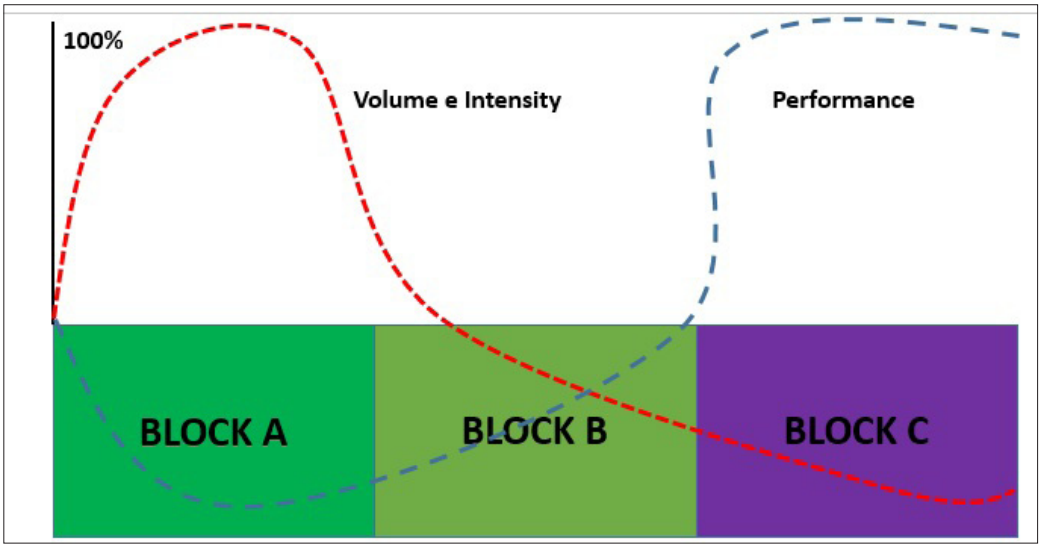

Figure 4. T3 Periodization model T3 – second semester.

demand of the sport, teams and sport calendar. This is a positive fact since it indicates that training models were not perceived as something inflexible and inanimate but rather as a work proposal that could be adjusted as needed [16]. This process should be guided by the coach's understanding [3, 17] provided scientific training principles are respected [13].

Most coaches in this study (six coaches) used a classic preparation system in line with the literature, which indicates that Matveev's model is more popular and encompassing in terms of sports training activities [18].

Even with the particular adaptations made, all six coaches included a general physical preparation stage as a foundation to allow athletes to subsequently develop and perfect specificities more closely linked to judo performance. Training was organised to concomitantly develop different conditional motor skills although some were more emphasised at particular moments of the preparation phase. The goal was to address a set of factors that allowed athletes to sustain their performance for as long as possible. They often adjusted this model, maintaining load distribution to generate more peaks during the competitive season, a precondition of modern sports.

However, a number of authors report that this model is not suited to the modern sports calendar [9, 13] since frequent participation in important competitions means that the model cannot effectively maintain high performance. The few weeks between successive competitions make the classic load progression impossible. The progression from high volume* and low intensity to lower volumes* with high intensity, which produces the peak at the end of the cycle, is characteristic of the classic model [19-21].

In this regard, some coaches sought alternatives means of meeting the current demands of the sport. In this study, two coaches adopted contemporary periodization models. Specific judo-related aspects were emphasised, leaving no time for general preparation. Authors who criticise the classic model contend that high-performance athletes with a solid training foundation do not derive extra benefits from a general preparation regime since the idea of moving from general to specific training does not apply to these individuals [9, 13, 16, 22, 23].

These coaches worked with different loads in order to provide their athletes with more peaks, adopting an approach that could better meet the specificities of the sport. This view of training is supported in the literature, considering that Matveev's classic model is very rigid, with similar load variations and direction for different sports [9].

Another important aspect in current sports preparation is individualised training regimes since even in common calendars, different athletes might have different goals and objectives. This

was evidenced by the participants of this study, who adopted a preferential model, but who underscored the importance of adjustments or individual models to meet the requirements of different simultaneous preparations. The search for a better fit between the preparation system and the calendar gives rise to the rationality resulting from the scientific training of these coaches.

Since studies on this topic remain scarce, we do not have enough data to recommend a specific model or adjustments to a periodization model for judo. This issue pervades many other topics: level of the athlete, age group of the athlete, structural conditions of work, biological individuality, calendars and individual goals. Thus, it would be irresponsible to recommend any one specific model. Rather, their practical application is discussed so that coaches can master the different alternatives and use them as reference points to create strategies to meet their specific needs, while always respecting scientific training principles and consequent rational distribution of loads.

CONCLUSIONS

With respect to using the tenets of training periodization in preparing their athletes, our analyses revealed that the coaches in this study applied the precepts of theoretical constructions in sports training periodisation as the basis of planning and structuring the training regimen and preparing their athletes.

The coaches used two different periodisation models: one classic and one contemporary. The coaches who used the classic approach applied most of the configurations contained in Matveev's Classic Model [4], albeit with adjustments and references to Bompa's Extended State Yield Model [3] and the Linear Periodisation Model [6, 7] without adopting a new system, though. The coaches who used a contemporary model referred to Tschiene's Structural Model of High-Performance Training [9] and Verkhoshansky's Block Periodisation Model [10].

In relation to the preference for a particular periodization model, this sample favored Matveev's classic model of periodization, with six of the eight coaches applying models with main concepts regarding the distribution, oscillation and direction of the load very similar to those of the Russian author, who is considered the father of sports training. Some of the adaptations detected are not sufficient to recommend another periodization model since the main characteristics related to structuring a macrocycle and the classic progression of loads remain unchanged: from high volume*, low intensity loads to lower volumes* with high intensity and from general to specific training regimes.

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EDITORIAL NOTE

The authors of the manuscript used the term '*volume'* in a sense not only recommended by the Russian sports science methodology experts [27]. '*Training volume'*, also other terms related to *training load* appears in some of the manuscripts submitted to the *Archives of Budo* [28-30].

The term 'volume' is an ambiguous term, unfortunately, used in publications dedicated to the theory and practice of training and also into the ambiguous way. „A simple mathematical model of training load can be defined as the product of qualitative and quantitative factor. This reasoning may become unclear whenever the quantitative factor is called 'workload volume' or 'training volume' (...) interchangeably with 'volume of physical activity' (...). Various units have been adopted as measures, i.e. the number of repetitions, kilometres, tons, kilocalories, etc. as well as various units of time (seconds, minutes, hours). Although in the training experience and scientific analyses, the time is assumed to be the most general measure of this volume, in academic textbooks, research and methodological papers the term 'workload volume' and its synonyms have not been supplanted by any adequate term" [31, p. 238].

Many of articles dedicated to sports science (especially sports science methodology) were created in the period when the world was divided by the Iron Curtain. This situation is widely discussed in the paper of Barczyński BJ et al. [32].

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