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Comparison of the Matveev Periodization Model and the Verkhoshansky Periodization Model

Artur L. B. Oliveira[1], Carlos A. Sposito-Araujo[1], Gilmar W. Senna[1,2], Tomires C. Lopes[1], Erik S. Godoy[3], Estevão Scudese[1,2], Paula Paraguassú Brandão[1], Fabiana R. Scartoni[1,2], Cristiano Q. de Oliveira[2], Estélio H. M. Dantas[1,4]

[1]Doctoral Program in Nursing and Biosciences - PpgEnfBio, Federal University of the State of Rio de Janeiro, Rio de Janeiro, Brazil, [2]Sports Science and Exercise Laboratory, Catholic University of Petrópolis, Petropolis, Brazil, [3]Post-Graduation Program in Sports Science, de Trás-os-Montes e Alto Douro University, Vila Real, Portugal, [4]Doctoral Program in Health and Environment - PSA, Tiradentes University - UNIT, Aracaju, Brazi

ABSTRACT

Oliveira ALB, Sposito-Araujo CA, Senna GW, Lopes T, Godoy ES, Scudese E, Brandão PP, Scartoni FR, Oliveira CQ, Dantas EHM. Comparison of the Matveev Periodization Model and the Verkhoshansky Periodization Model. **JEPonline** 2018;21(6):60-67. The purpose of this study was to compare the Matveev periodization model and Verkhoshansky periodization model with regards to performance improvements measured by power, flexibility, strength, fatigue, and muscle damage across a 3-month period. General improvements obtained with the Matveev model were significantly higher than those produced by the Verkhoshansky model after 3 months of training. Regarding power, fatigue, and dynamic strength, we observed a significant difference ($P \leq 0.05$) before 3 months in the Matveev periodization model compared to the Verkhoshansky periodization model. While the findings indicate that the Verkhoshansky periodization model did not increase performance at any point of verification during the 3 months of analysis, the Matveev periodization model resulted in a significant increase in power, flexibility, and dynamic strength after 3 months of training, which supports the efficiency of this model.

Key Words: Exercise, Physical Effort, Strength Training, Wrestling

INTRODUCTION

Sports training periodization is fundamental to optimizing training responses. During the last 50 yrs, the field of sports training periodization has embraced different concepts such as Matveev's Classic periodization model (MP), Verkhoshansky's Blocks periodization model (VP), Vorobiev`s Modulate, Arosjev`s Pendulous, Tschiene`s High Volume Load (5), Valdivielso`s ATR (12), Platonov`s Multi-cyclical (17), and Bompa`s Priority (1,11), while frequently modifying itself in line with the evolution of athletic competition.

Changes in the nature of athletic competition engendered criticism of the MP model that was proposed during the 1950s. It is based on the general adaptation syndrome that is consistent with the athletes' improvement in performance as a response to physical stress (14). It is characterized by the variation of training loads split into three stages (13,14): (a) preparation; (b) competition; and (c) transition. The main criticism is that this model is intended to be used by athletes of the Olympic Games, where the athletes have 4 yrs of preparation for a relatively short competition. The MP model was designed to achieve one performance peak each season. But, it is obvious that multiple peaks per season are required for professional athletes today (13).

The Verkhoshansky's periodization model (VP) was developed to overcome the flaws of the MP periodization model. It uses concentrated loads of the same nature and does not rely upon MP's transition period, which is considered to decrease performance (13). Given this brief analysis of the two models and the use of the models of periodization around the world, a comparative analysis was considered appropriate to identify which model should be applied to athletes.

Considering the demand to understand the ideal periodization model for sports training, the purpose of this study was to compare the periodization models by analyzing performance improvements in physical parameters such as flexibility, isometric strength, and dynamic strength. We also monitored creatine kinase (CK), a widely-used biomarker for muscle damage, during the 3 months of training with each model.

METHODS

Subjects

Twenty-three males who compete as world-class wrestlers (weight, 86.7 ± 2.3 kg; height, 1.75 ± 4.8 cm; age, 24.5 + 3.9 yrs old) volunteered to take part in this study. The athletes had a minimum of 5 yrs of wrestling experience. The subjects were initially submitted to an anthropometric and laboratory analysis. They denied using ergogenic supplements and/or drugs. All the subjects reported that they had not sustained any injuries during the previous 6 months. They read and signed a consent form, and the study was carried out under guidelines from the ethics committee for human research at the Castelo Branco University (protocol 0003/2008), as well as the requirements for research in human subjects established at the Helsinki Conference and Health National Council.

Procedures

All the subjects formed a single training group. Immediately after returning from a 2-month transition period, the subjects followed the protocol of the VP model for 3 months. Then, they went through another 2-month transition period before starting training with the MP protocol of the MP model for another 3 months. During both protocols, the subjects trained 5 $d \cdot wk^{-1}$ for 4 hrs a day. The subjects only trained part-time because of their semi-professional status. The protocols were also designed to allow the subjects to achieve peak performance.

The training consisted of 2 sessions per day, which required specific technique practice in the morning and physical training during the evening. Only the approach to physical training was altered during the experiment. The subjects' technique practice remained the same for both protocols.

When following the VP model, the subjects performed 4 sets of 8 rep at 90% of 1 repetition maximum (1-RM) of leg press, bench press, lat pull-down, seated rowing, shoulder press, abdominal curls, and knees curls for ~1 hr every day. The exercises were intended only to develop muscle strength. Following the exercises, the subjects engaged in 1 hr of wrestling-specific drills that was designed to improve their strength.

The MP model (13) always started with running 1 $hr \cdot d^{-1}$ for the 1st month, 45 $min \cdot d^{-1}$ for the 2nd month, and 30 $min \cdot d^{-1}$ during the last month. Muscle building exercises, leg press, bench press, lat pull-down, seated rowing, shoulder press, abdominal curls, and knees curls were designed for endurance during the 2nd month (with 2 sets of 20 reps at 60% of 1-RM) and for strength development during the 3rd month (with 3 sets of 10 reps at 80% of 1-RM). The physical drills at the end of each physical training session were designed to develop multiple physical qualities simultaneously.

Physical Evaluation Tests

All physical tests were performed during the 1st weekend of each month of training. The subjects' flexibility was not considered a general characteristic since it presents different characteristics from one joint to another in the same subject. Therefore, in order to evaluate the subjects' flexibility, an average of 6 upper and lower body movements was used (6). Isometric strength was measured with a hand-grip dynamometer (Smedley Hand Dynamometer, USA). Peak and dynamic strength were evaluated by the Sargent Jump Test, and the 1-RM Test as previously described (7,15). Anaerobic endurance was determined by the Wingate Test (8), and the subjects' localized muscular endurance (LME) was measured using the Abdominal Strength Test (16).

The normalized increase in total body flexibility was calculated by the average range of motion of 6 measurements: (a) shoulder flexion, extension, and abduction; and (b) lumbar flexion, hip extension, and abduction. Dynamic strength was represented by the average improvement of 3 movements: (a) bench press; (b) lat pull-down; and (c) squat. All athletes were tested before and after each month of training.

Blood Sampling

The subjects' blood samples were collected following venipuncture at rest before the 1st training session of each month. The following samples were collected during the morning after the last day of training of each month, for a total of 4 blood samples from each training protocol. Samples for the biochemical assay were collected into tubes with a coagulation enhancer and splitting gel (Vacuette, Greiner Bio-One), which was immediately centrifuged

(3,000 x g, 10 min). Aliquots of blood serum were stored in liquid nitrogen for later analysis. Samples were analyzed using clinical kits for CK.

Statistical Analyses

The data are presented as mean ± SD. If necessary, the data were normalized to pre-exercise values. Intergroup statistical significance was calculated by a one-way analysis of variance (ANOVA) followed by the Bonferroni *post-hoc* and intragroup significance that was established by the Student's *t*-test. The alpha level for significance was set at $P \leq 0.05$. The SPSS software 21.0 version was used for statistical analyses (IBM, Inc).

RESULTS

For Relative Peak Power Output (RPPO) increased 7% after 2 months of training and 8% after 3 months of training when using the VP model (Table 1). The MP model generated a 15% increment after 2 months of training and 22% after 3 months of training (Table 2). Significant differences between the groups were only observed after 3 months of training.

Fatigue displayed a trend opposite to that of power output. The VP model showed a decrease in anaerobic fatigue of 5% and 6% after 2 and 3 months, respectively (Table 1). The MP model values were 11% lower than the pre-test values after 1 month of training, 14% lower than the pre-test values after 2 months, and 21% lower in anaerobic fatigue (Table 2). Differences between groups were observed during the 2nd and 3rd months of training.

The subjects' localized muscular endurance (LME) values following the VP model showed an increase of 11% after 3 months of training when compared to pre-training (Table 1). The MP model did not generate improvements in the subjects' LME (Table 2).

The MP model achieved an 8% increase after 2 months of training and reached a 12% increase after 3 months of training in total body flexibility (Table 2). The VP model achieved a 6% improvement in flexibility after 3 months of training, which was the single time-point when the values were significantly higher than the pre-training values (Table 1). No significant differences were observed between the groups during training.

In response to the MP model, dynamic strength improved 16% after 2 months of training and 22% after 3 months of training (Table 2). The VP model resulted in an increase of 12% from pre-training measurements after 3 months of training (Table 1). The MP model generated an 8% increase in isometric strength after 3 months of training, which was the only point of significant difference from the VP protocol concerning this parameter (Table 2). The VP model did not present any significant difference after 3 months of training, and no differences between groups were observed at any point (Table 1). For the peak strength after 3 months of training with the VP model, it had increased by 10% relative to the pre-training values while the MP model resulted in an increase of 12% and 15% after 2 and 3 months of training, respectively. No difference between groups was observed (Tables 1 & 2).

The subjects' CK was elevated from pre-training values in both models, but the elevation during the 1st 2 months of training was higher with the VP model. Both models culminated in a blood accumulation peak of the same magnitude after the 3rd month of training (Figure 1).

Table 1. Verkhoshanski´s Periodization Model (Absolute Values).

Verkhoshanski's	Month 1	Month 2	Month 3	Month 4
RPPO (W)	1064.00 ± 5.2	1117.00 ± 1.0	1149.00 ± 1.1 #	1170.00 ± 1.0 #*
Fatigue (%)	28.49 ± 1.30	25.64 ± 0.50 #	24.50 ± 0.80 #*	22.79 ± 1.00 #*
LME	56.00 ± 1.20	57.12 ± 0.60	57.68 ± 0.80	58.80 ± 0.60
Flexibility (°)	108.00 ± 1.10	110.16 ± 0.50	111.24 ± 0.70	114.48 ± 0.90 #
Dyn Str (kg)	220.00 ± 2.5	233.00 ± 1.0	239.00 ± 1.1	250.00 ± 0.9*
Isom Str (kg)	59.00 ± 1.30	57.82 ± 0.80	60.18 ± 0.90	61.36 ± 1.00
Peak Str (kg)	47.00 ± 1.70	49.82 ± 0.80	51.23 ± 1.00	52.17 ± 1.10 #

RPPO = Relative Peak Power Output; **LME** = Localized Muscular Endurance; **Dyn Str** = Dynamic Strength; **Isom Str** = Isometric Strength; **Peak Str** = Peak Strength. Values are shown as mean ± SD. **#** = Difference from Sample 1, *** =** Difference between Groups

Table 2. Matveev´s Periodization Model (Absolute Values).

Matveev's	Month 1	Month 2	Month 3	Month 4
RPPO (W)	1046.00 ± 5.4	1108.00 ± 1.1	1203.00 ± 1.3 #	1297.00 ± 1.2 #*
Fatigue (%)	28.59 ± 1.20	28.01 ± 0.60	27.16 ± 0.70 #*	26.87 ± 0.80 #*
LME	55.00 ± 1.20	56.65 ± 0.40	58.85 ± 0.70	61.05 ± 0.50 #
Flexibility (°)	127.00 ± 1.4	133.00 ± 0.6	137.00 ± 0.7 #	142.00 ± 0.8 #
Dyn Str (kg)	220.00 ± 2.4	242.00 ± 0.9	255.00 ± 1.1 #	270.00 ± 1.0 #*
Isom Str (kg)	58.00 ± 1.50	56.84 ± 1.00	60.90 ± 0.70	62.64 ± 1.00 #
Peak Str (kg)	48.00 ± 1.60	50.40 ± 1.20	53.28 ± 0.90 #	55.20 ± 1.00 #

RPPO = Relative Peak Power Output; **LME** = Localized Muscular Endurance; **Dyn Str** = Dynamic Strength; **Isom Str** = Isometric Strength; **Peak Str** = Peak Strength. Values are shown as mean ± SD. **#** =Difference from Sample 1, *Difference between Groups

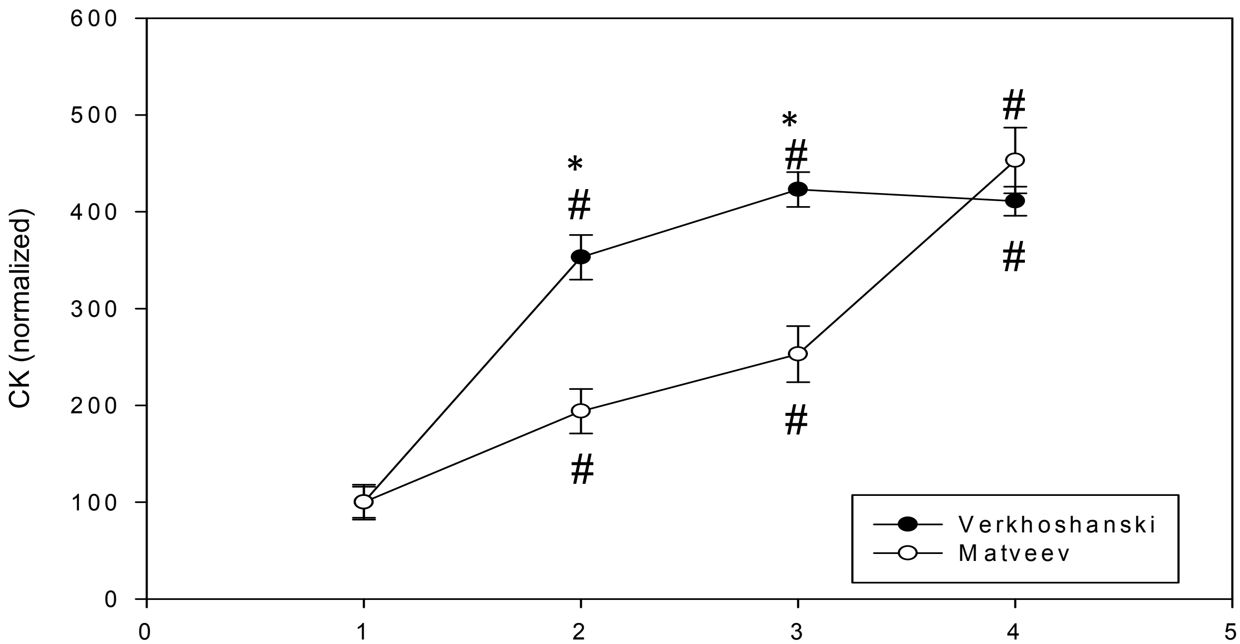

Figure 1. Creatine Kinase in the Verkhoshanski Periodization Model versus the Matveev Periodizations Model. # = Difference from Sample 1, *Difference between Groups

DISCUSSION

The purpose of this study was to compare the Matveev periodization model and the Verkhoshansky periodization model for 3 months on specific performance improvements while also verifying the subjects' CK level as a biomarker of muscle damage. The Wingate test provided information regarding the athlete's endurance capacity: RPPO and anaerobic fatigue (AF). As expected, both training protocols resulted in an improvement in performance because the athletes were coming from a transition period. Improvements obtained with MP were significantly higher than those promoted by VP after the 3 months of training. For MP, the goal was to achieve one peak of performance after a macrocycle (13,14). Athlete performance with VP did not exceed that observed with MP at any point in time. This does not support the stated goal of VP, which might allow the athlete to compete many times during a single competitive season. Localized muscular endurance followed the same evolution pattern as RPPO and AF.

Creatine kinase (CK) has been widely used to quantify muscle damage (10), and thereby infer the intensity of previous training sessions (3,4). The blood concentration of CK after a training period can reflect the magnitude of tissue damage or the inability to clear CK, which can be caused by an over-trained condition. The findings indicate that the MP model (with alternating high and low-intensity sessions) allowed the athletes to recover and obtain better performance results.

Flexibility training is very demanding and may cause severe damage to the athletes' joints and tendons. Developing flexibility is essential when involved in combat sports because one of the main goals during combat is to strain the opponent's joints. Both training protocols were efficient in developing the athletes' flexibility, and although differences between groups were observed, we were unable to identify a superior training protocol using this experimental approach.

The results regarding strength development were surprising. Verkhoshansky (13) considers strength training to be fundamental in every sport and his protocol involves extensive strength training. However, the results showed that the MP model was either similar or even superior to all of strength subdivisions: dynamic, isometric, and peak. One possible reason for the lower performance of the VP model may be its lower training volume. Verkhoshansky believes that the tendency to increase the training volume, as one of the necessary conditions to improve results is fully justified in cyclical sports, but that an automatic transfer of this tendency to speed-strength sports is wrong (9).

The success of the MP model can be partially explained by its careful manipulation of the length of the rest period between training sessions of similar nature. This is an important factor when planning a resistance training session (10). The athletes went through two transition periods, one before VP and another between the VP and MP. There were no other differences found when comparing the test scores at the beginning of both training protocols. Therefore, a residual effect favoring the MP model can be discarded.

CONCLUSIONS

Considering the results obtained in this research, concerning performance improvements as measured by several physical parameters, the Matveev's classic periodization model, characterized by the alternation of high and low-intensity sessions, seems to be more effective than the Verkhoshansky's periodization model during a 3-month training period.

Address for correspondence: Gilmar Senna, PhD, Federal University of State of Rio de Janeiro, Xavier Sigaud, 290/401, Praia Vermelha, Rio de Janeiro, RJ, Brazil, 22290-180.
Email: sennagw@gmail.com

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