

# DESCRIPTION OF A SCHOOL SPORTS TRAINING PROGRAM FOR NOVICE GYMNASTS: THE LOAD DISTRIBUTION AND WELLBEING RESPONSES

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## **Abstract**

*The description of the training program structure and the measurement of dose-response for novice gymnasts at the scholarly level is still not elucidated in the literature. The study aimed to describe a rhythmic gymnastics training program for novices and to examine their perceptions of training load and wellbeing. Eight Brazilian gymnasts (10.6±0.5 years old), from a specific school, participated in a training program that lasted 26 weeks, and was separated into general preparation (1), specific preparation (2), intensification (3), tapering (4), competitive (5), and transitioning (6) phases. In each session, wellbeing and the internal training load (ITL) were measured by a Likert scale. The comparison of wellbeing and ITL during the program was performed by repeated-measure tests, with a significance of  $p < 0.05$ . A significant difference in ITL amongst the phases was found ( $\chi^2 = 110$ ,  $p < 0.001$ ), with Phases 3, 4, and 5 presenting higher values compared to 2 and 6. Phase 6 had lower ITL compared to 2. Higher values of wellbeing were described during the program, however, Phase 6 presented a significantly higher score compared to Phases 2 and 5 ( $\chi^2 = 12.0$ ,  $p = 0.018$ ). In conclusion, the rhythmic gymnastics training program developed for novice scholar participants seems to be adequate in terms of structure and training load distribution. In addition to the gymnasts reporting higher overall wellbeing during the program, attention should be paid to the competitive week, to avoid a decrease in wellbeing and possible negative effects on the gymnasts' performance.*

**Keywords:** *Gymnast, Training load, Sport school, Extra activities.*

## **INTRODUCTION**

The practice of rhythmic gymnastics in a scholarly context can provide benefits to the participants' motor skills, growth,

development of body components (Campos-Perez et al. 2021), and also help young participants develop a motor

repertory for other sport disciplines or for practicing other physical activities. School sports are generally an optional extracurricular activity, outside the regular physical education classes, offered in some regular schools, for students to choose a specific sport they can connect with. Participating in such program can have several benefits, including enhancing physical health, cognitive function (Bradley, Keane, and Crawford 2013), motor development (Nieto 2021), and social networking (Schaefer et al. 2011), as well as preparing the participants for a potential sport specialization and the professional side of the sport.

A training program for novice participants needs to focus on learning and improving the basic movements of gymnastics, and at the same time improve the participants' performance and prepare them to be able to perform a gymnastics routine in competitions. In Brazil, the difference between school sports and professional training centers for rhythmic gymnastics is well noted. Training centers focus on *incentivizing the development and engagement of higher-performance athletes, and provide the infrastructure compatible with the athletes' needs* as described by Antualpa and Paes (2013). Gymnasts from these training centers represent the country in international competitions. However, gymnasts from training centers also compete in scholarly competitions, where also some schools are represented. It has been demonstrated recently that in the Brazilian Scholarly Games, a high percentage of rhythmic gymnasts (66.7%) were also Olympian athletes (Arantes, Rúbio, and Melo 2020).

Therefore, considering the high level of Brazilian gymnasts competing at scholarly levels, the Parana Gymnastics Federation, from Parana State in South Brazil, founded a competition called *Parana Championship for Debutants*. The state stands out in investment in training centers, and consequently achieves the best results in Brazilian competitions compared

to the rest of the states in Brazil (Antualpa and Paes 2013). Thus, the debutant competition offers a fair opportunity to novice gymnasts that have never competed on any level, and is meant to be the first competition in a gymnast's career. To prepare the novice gymnast to compete in debutant categories, a training program should be well planned and should consider the participants' experience. One of the challenges faced by coaches is how to optimize the dose-response of the training load in order to increase the young gymnast's performance and minimize possible negative aspects of the sports training. Scientific literature has described the distribution of the load and the physiological and psychological responses in professional and/or elite Brazilian rhythmic gymnastics athletes' (Antualpa, Aoki & Moreira 2017, 2018; Debien et al. 2020). However, at the scholarly level, the training planning and measurements are still not well documented.

The coaches at scholarly level face some challenges, such as less time on systematic training and fewer resources. Therefore, the main aim of the present study was to describe a rhythmic gymnastics training program for novices in gymnastics, and to examine gymnasts' responses to the perception of training load and wellbeing. The study followed a theoretical background based on the previous literature to describe methodological procedures and adapted the training program to be executed in a scholarly environment for novice participants.

## METHODS

Eight young female novices in rhythmic gymnastics (age=10.6±0.5 years, body mass= 38.4 ± 6.52kg, height=1.44 ±0.6m), from a private school, voluntarily agreed to participate in the study. The selected school offers extra-class sports activities for students such as futsal, basketball, handball, athletics, volleyball,

swimming, and chess. To take part in the present investigation, the following criteria were considered: i) at least one year of participation in gymnastics in the extra-class program, ii) participation in all training phases, iii) intention to compete in the Parana Championship of Debutants, and iv) ethical consent form signed before the beginning of the program. Exclusion criteria included: completed less than 75% of training sessions, or not answering the scales during the investigation. All participants met the criteria and the data from all were included in the study. The present investigation had the approval of the Ethics Committee (number 3.206.292) and written informed consent was obtained from each participant and their respective parents or guardians.

A longitudinal study was carried out during 26 weeks of planning and execution of rhythmic gymnastics training program for novice gymnasts that were focused on competing in the Parana Championship of Debutants. The training program was to be executed in phases, paying attention to the load distribution in order to achieve better performance during the championship without compromising the wellbeing of the participants. The training program was performed between the beginning of June and middle of December of 2018, separated into phases of general preparation (i), specific preparation (ii), intensification (iii), tapering (iv), competitive (v), and transitioning (vi). As the literature still lacks information about training programs for the novice or recreational gymnasts, the program was based on the traditional periodization (Mujika et al., 2018) and previous studies on Brazilian professional gymnasts (Antualpa, Aoki & Moreira 2017), and adapted to this gymnasts' group. The training program consisted of two sessions per week in Phases 1, 2, and 6, and three weekly sessions in Phases 3, 4, and 5. A wellbeing questionnaire was completed before the sessions and the rating of

perceived exertion (s-RPE) was recorded afterwards.

The training program was conducted by a qualified rhythmic gymnastics coach who had 13 years training experience and a degree in physical education and a specialization in training rhythmic gymnastics.

*General preparation (Phase 1).* The training program started with a period of general preparation, in which the coach started by teaching the body difficulties elements that consist of three movements: jump, balance, and rotation (FIG 2018; Hashimoto et al. 2017). These movements correspond to most scores in a gymnasts' routine. The general process follows a learning progression from simple to complex movements. During this phase, the coach introduced the scales used in the study, the wellbeing scale and the rating of perceived exertion, reinforcing the importance and the purpose of each scale. This phase lasted 13 weeks and consisted of two 90-minute training sessions per week (Monday and Wednesday).

*Specific preparation (Phase 2).* The specific preparation phase comprised sessions with low to moderate intensity, low frequency of movements specific to the modality, and mixed training exercises such as resistance, power, flexibility, and core stability. This phase lasted four weeks (from week 14 to 17), two training sessions per week (Monday and Wednesday), 90 minutes per session.

*Intensification (Phase 3).* The intensification phase aimed to increase the gymnasts' workload with moderate and high intensity and an increase in specialized training. To intensify the training, the frequency and duration of the sessions were changed. This phase lasted four weeks (from week 18 to 21), with three training sessions per week (Monday, Wednesday, and Friday) each session 145 minutes long.

*Tapering (Phase 4).* In the tapering phase, the training volume was reduced, compared to the intensification phase, and

was focused on the execution of the gymnastics routine. This phase lasted two weeks (weeks 22 and 23) and consisted of three training sessions per week (Monday, Wednesday, and Friday), each session 115 minutes long.

*Competition (Phase 5).* During the competition week (week 24), the gymnasts performed three 115-minute-long training sessions (Monday, Wednesday, and Friday) that focused on the routine execution. The competition took place in a nearby city, from 30/11 to 01/12 (Friday, Saturday, and Sunday). The gymnasts

competed in the afternoon ( at around 1.30pm) on 30/11 (Friday), as a group in the free category (with no apparatus).

*Transition (Phase 6).* The transition phase, also called off-season, included exercises with low intensity to maintain the gymnasts' fitness, aimed to rest, recover and regenerate. During this phase, training sessions were longer than at the beginning of the program (Phase 1). This phase lasted two weeks (weeks 25 and 26) and consisted of two 100-minute training sessions per week (Monday and Wednesday).

Table 1

*Description of the training session structure in Phase 2 to Phase 6.*

Phase II – Specific preparation (from week 14 to 17)		
Training phase	Duration	Training content
Warm-up	15 min	Loading exercises, dance and ballet exercises, and flexibility exercises
Physical training	15 min	Specific training for jumps
Technical training 1	20 min	Parts of routine, including repetitions of specific event elements
Break	10 min	
Technical training 2	20 min	Routine development
Physical training	10 min	Core exercises and flexibility training
Phase III – Intensification (from week 18 to 21)		
Training phase	Duration	Training content
Warm-up	30 min	Loading exercises, dance and ballet exercises, and flexibility exercises
Physical training	30 min	Specific training for jumps
Technical training 1	30 min	Parts of routine, including repetitions of specific event elements
Break	10 min	
Technical training 2	30 min	Routine development
Physical training	15 min	Core exercises and flexibility training

Phase IV - Tapering (weeks 22 and 23)		
Training phase	Duration	Training content
Warm-up	15 min	Loading exercises, dance and ballet exercises, and flexibility exercises
Physical training	---	-----
Technical training 1	15 min	Parts of routine, including repetitions of specific event elements
Break	10 min	
Technical training 2	60 min	Routine development
Physical training	15 min	Core exercises and flexibility training
Phase V - Competition (week 24)		
Training phase	Duration	Training content
Warm-up	15 min	Loading exercises, dance and ballet exercises, and flexibility exercises
Physical training	---	-----
Technical training 1	15 min	Parts of routine, including repetitions of specific event elements
Break	10 min	
Technical training 2	60 min	Routine development
Physical training	15 min	Core exercises and flexibility training
Phase VI - Transition (weeks 25 and 26)		
Training phase	Duration	Training content
Warm-up	45 min	Loading exercises, dance and ballet exercises, and flexibility exercises
Physical training	---	-----
Technical training 1	30 min	Parts of routine, including repetitions of specific event elements
Break	10 min	
Technical training 2	---	-----
Physical training	15 min	Core exercises and flexibility training

Monitoring and managing the training load is fundamental to improving the gymnasts' performance and minimizing

the risk of injury and illness, especially in the youth population. The training load was managed during the program by the

training frequency (sessions per week) and volume (time, intensity). Also, the internal training load (ITL), which represents the stress imposed and perceived by the gymnasts, was monitored using the session rating of perceived exertion (s-RPE) multiplied by training duration (in minutes) (Foster et al., 2001). At the end of each training session, the gymnasts rated the training session intensity using the Borg CR-10 scale, adapted by Foster et al., (2001), where 1 means nothing at all, and 10 means very very hard.

The perception of wellbeing was evaluated before each training session, using a psychological scale based on the Hooper and Mackinnon (1995), and McLean et al (2010) applications. The scale consists of the evaluation of fatigue, sleep quality, general muscle soreness, stress level, and mood by a 5-point Likert scale, with scoring of 1 to 5 points. The overall wellbeing was recorded by the sum of the five scores as suggested elsewhere (McLean et al. 2010).

#### *Statistical analysis*

A descriptive analysis consisted of central tendency and dispersion measures, displayed as mean and standard deviation respectively. The comparison of ITL and wellbeing from week to week within each phase presented a non-normal distribution, therefore, a non-parametric test was performed by the Friedman test for repeated measures and dependent sample (e.g., comparison amongst the week 14 to week 26). A comparison among phases was performed by the Kruskal-Wallis test, considering that each phase presents a different number of training sessions monitored (independent groups), for example, Phase 2 = 4 weeks and Phase 4 = 2 weeks. The Bonferroni' post-hoc test was used to detect significant differences. Statistical significance was set at  $p \leq 0.5$ .

Data was obtained using the JAMOVI software.

## **RESULTS**

The ITL reported by the gymnasts during the training program is displayed in Figure 1. We opted to not present the ITL reported during Phase 1 as this period was focused on the gymnast's familiarization with the scale. During Phase 2, weeks 14 and 15 presented higher values of ITL compared to weeks 16 and 17 ( $\chi^2= 11.8$ ,  $p=0.008$ ); in Phase 3; week 20 presented higher ITL compared to the rest ( $\chi^2= 29.3$ ,  $p<0.001$ ); in Phase 4, week 23 presented higher ITL compared to week 22 ( $\chi^2= 11.8$ ,  $p=0.008$ ), and in Phase 6, week 1 was higher than week 2 ( $\chi^2= 7.0$ ,  $p=0.008$ ). To compare the ITL by phase, the weekly data was grouped under their respective phase. The Kruskal-Wallis test demonstrated a significant difference among the phases ( $\chi^2= 110$ ,  $p<0.001$ ) whereby Phases 3, 4, and 5 presented higher ITL compared to Phases 2 and 6; and Phase 6 presented lower ITL compared to Phase 2.

Overall wellbeing reported by the gymnasts during the program is displayed in Figure 2. A comparison among weeks in each phase showed that Phases 2 and 3 presented a significant variation in gymnasts' wellbeing. During Phase 2, weeks 15 and 17 presented the best values (higher scores) of global wellbeing compared to weeks 14 and 16 ( $\chi^2= 10.8$ ,  $p=0.0023$ ); in Phase 3, week 18 presented higher scores of wellbeing compared to the remaining weeks ( $\chi^2= 7.97$ ,  $p=0.047$ ). To compare the wellbeing by phase, the weekly data was grouped under their respective phase. The Kruskal-Wallis test demonstrated a significant difference among the phases ( $\chi^2= 12.0$ ,  $p=0.018$ ). Phase 6 presented higher scores of wellbeing compared to Phases 2 and 5.

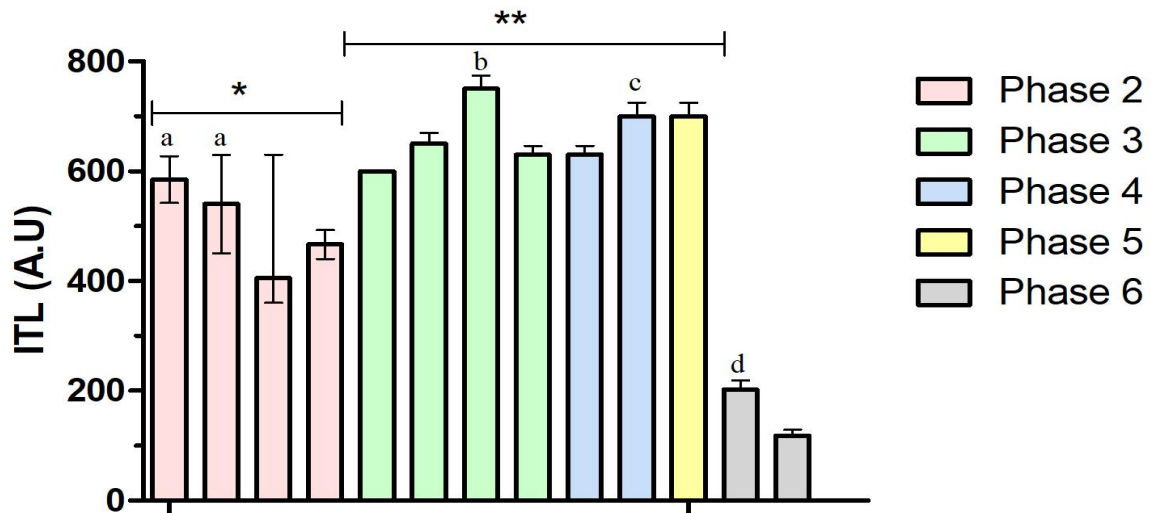


Figure 1. Internal training load during the training program.

Note: ITL: Internal training load; A.U= arbitrary unity; \* higher ITL compared to Phase 6; \*\* higher ITL compared to Phases 2 and 6; a= higher ITL compared to week 3 and 4; b= higher ITL compared to week 1,2 e 4; c= higher ITL compared to week 1; d= higher ITL compared to week 2. Phase 2= general preparation; Phase 3= specific preparation; Phase 4= tapering; Phase 5= competitive; Phase 6= transitioning.

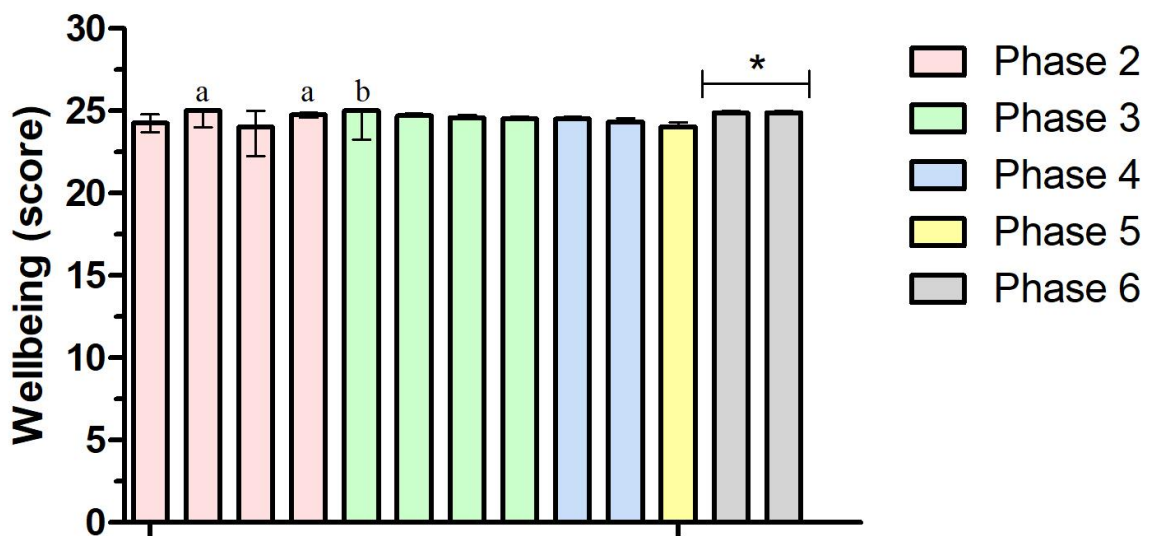


Figure 2. Wellbeing during the training program.

Note: \* higher global wellbeing compared to Phase 2 and 5; a= higher global wellbeing compared to week 1 and 3; b= higher global wellbeing compared to week 2, 3 e 4. Phase 2= general preparation; Phase 3= specific preparation; Phase 4= tapering; Phase 5= competitive; Phase 6= transitioning.

Regarding the gymnasts' performance at the Parana Championship of Debutants, it is important to highlight that the current team was awarded second place, the silver

medal. There were 11 debutant teams from schools, small clubs, and associations from the Parana State.

## DISCUSSION

The main aim of this study was to develop and describe a rhythmic gymnastics training program for novices and to examine their perceptions of training load and wellbeing. The program went through different phases as well as different load distributions. It used previous studies with professional athletes (Mujika et al. 2018; Issurin 2010; Antualpa, Aoki, and Moreira 2017) as its basis, with adaptations. The results demonstrated that the gymnasts acknowledged a progressive increase in the load, from the specific training (Phase 2) to the intensification (Phase 3), and during the competition (Phase 5). This was followed by a decrease in the load during the transition period (Phase 6). In addition, the gymnasts reported higher values of global wellbeing throughout the training program, even when there was a decrease in the specific training period (Phase 2), and during the competition (phase 5).

To develop a rhythmic gymnastics training program for novices at a scholarly level, the authors based the structure of the training on a previous study with Brazilian professional gymnasts published in the literature (Antualpa, Aoki & Moreira 2017). The structure of the program was well-received by the gymnasts in this study, reflected in a variation in the ILT and higher values of wellbeing. The focus was on the preparation of the gymnasts for the Parana Championship of Debutants, where the gymnasts achieved the second place. This result leads us to assume that the program had a positive effect.

The variation in the training load plays an important role in short- and long-term training. Therefore, the present training program was planned to have a progressive increase in the load from one phase to another, with a decrease close to the competition and during the transition phase. Indeed, the gymnast perceived the load as planned in each phase, except for a decrease in the tapering period (Phase 4). At the professional level, decreased

volumes are recommended prior to a competition, in order to *diminish the possible detrimental impact of training while the physiological adaptations achieved during intensive training are further enhanced* (Mujika et al. 2018). In the present training program, for the tapering phase, the weekly training frequency and session duration were lowered in comparison to the intensification phase, and the focus was on the routine presentation. Considering that the gymnasts were not professional athletes, the lower volume of training seems to positively contribute to the performance in the competition.

Interestingly, changes in ITL during the program did not affect the global wellbeing outcomes. Studies in professional athletes reported that during the higher training load periods, their wellbeing tended to decrease when compared with the tapering period (Antualpa, Aoki, and Moreira 2017; Ouerqui et al. 2020). Taking into account the lower training time for novices compared to professional athletes, it is possible that the ITL was not increased enough to have an impact on the wellbeing responses of our gymnasts. The importance of monitoring the wellbeing in sports settings is to evaluate the athletes' responses to training, and also to avoid the negative effects of intense training periods. The gymnasts in the current study presented higher scores of wellbeing during the training program, as they reported values close to maximum (e.g., 25 points) in each week and phase (Figure 2). Even with a significant decrease in wellbeing during the competition (Phase 5), the values were still close to the maximum score. We speculate that those lower values for wellbeing during the competition week were due to possible stress and anxiety of the competition.

The routine and structure of scholarly devised training programs are different from the training for professional athletes. In non-professional settings, the



amount of training can vary from 2 to 3 sessions per week, requiring, therefore, a long period dedicated to the learning process. In our study, the general phase lasted 13 weeks and was focused on teaching the main elements required to perform a gymnast's routine. The scientific literature also highlights the importance of the learning-training process. This phase is the basis of the training progress and involves the acquisition of gymnastics skills, and the process of correcting technical mistakes (Bobo-Arce and Méndez-Rial 2013). In this phase, coaches should use strategies that fit each specific gymnasts' team.

Although the study presents novel information about planning a training program for novice gymnasts, it was not without limitations. The main limitations are the selection of just one rhythmic gymnastics novice team and the small size sample. It limited the present findings to the specific team. Applying these results to different teams and conditions should be carried out with caution. Additional information could also improve our understanding of novice gymnasts' responses during a training program, including monitoring their physical and technical performance, and measurements, such as social involvement and motivation as parts of the training program. We encourage further studies to address these limitations and adapt the training program to their team.

From the practical standpoint, the study presents a training structure of a school program that could be conducted with novice gymnasts that will compete in debutant championships, and the strategies used in the present study may be applied to teams in similar conditions. Additionally, coaches and team staff are encouraged to monitor the gymnasts' ITL and wellbeing, in order to see how novices respond to the training and be able to adapt the training intensity when necessary.

## CONCLUSION

The rhythmic gymnastics training program developed in the current study for novice scholar participants seems to be adequate in terms of structure and distribution of the training load. The gymnasts involved in the program posted a positive result, achieving the second place in the target competition. In addition to the gymnasts' overall wellbeing being higher during the training program, attention should be paid to the competitive week to avoid a decrease in wellbeing and possible negative effects on the gymnasts' performance.

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