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Aspects of heart rate monitoring in rhythmic gymnastics exercises

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Abstract

The purpose of this paper is to monitor heart rate during Rhythmic Gymnastics exercises and to observe the modifications occurred. This physiological parameter was measured using the "Garmin 910 XT" device, which indicated the values of heart rate during Rhythmic Gymnastics exercises. The series comprised in this study included a second-category team, consisting of 4 female gymnasts who participated to the hoop and ball finals. After data interpreting, the vales of HR in hoop exercises ranged between 166 b/min. and 179 b/min., X ± S = 171.5 ± 21.38. For the same exercises, maximum HR values ranged between 183 b/min. and 192 b/min., X ± S=187.25 ± 22.34. During ball exercises, HR varied between 155 b/min. and 176 b/min., X ± S =164.5 ± 20.94. Maximum HR values for ball exercises ranged between 179 b/min. and 192 b/min., X ± S = 186.5 ± 22.3. As a general conclusion, we highlight that hoop exercises are more dynamic, compared to ball exercises. These aspects were actually highlighted by HR values throughout the monitoring of hoop and ball exercises.

Keywords: Sports event, individual routine, physiological parameter.

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1. Introduction

Rhythmic Gymnastics is as an artistic and aesthetic sport with a particular training process: very young athletes, earlier specialization before bone maturation, big volume of training, many hours of intensive training per week, lots of repetition, high level of technical elements performed, different abilities are required. Moreover, high levels of physical and psychological stress are demanded in competition. The development of good rhythmic gymnasts requires specific knowledge of the sport (Bobo-Arce & Mendez-Rial, 2013). That is why the capacity of performing in rhythmic gymnastics is very complex, since the gymnast is frequently facing dual-task situations: jumping, twisting or balance with starting or handling apparatus. Therefore, we cannot consider only the quantitative aspect, but also the quality of execution that depends directly on the level of coordination, technical mastery, and physical performance of the gymnast (Mkaouer, Amara & Zouhair, 2012). Gymnasts are required to apply high level technique in order to achieve the specific movements' complexity while also demonstrate creativity, beauty, feelings, sensations, behaviors and actions (Botti & Nascimento, 2011). Despite having a huge number and variety of body movement difficulties, movements that involve different qualitative and quantitative requirements are often seen running within the same category or level of difficulty, hence the lack of variety in compositions (Agopyan, 2014).

Each sport has a number of demands that, if followed, help a sportsman achieve high performance. For being successful in rhythmic gymnastics, young female gymnasts need to develop flexibility, balance, speed, strength, endurance as well as the artistic components: beauty and elegance of movements, "postural sense", culture of movements etc. (Rumba, 2013). The rhythmic gymnasts needs an extreme flexibility and also strength skills to rapidly reach and fix the wide shapes of technical leaps required by International Code of Points (Brooks, 2003). Rhythmic leaping performance is evaluated by scores awarded by judges (subjective evaluation). Judging could be defined as a measurement process without the use of quantitative measurement tools - empirical evaluation (Di Cagno et al., 2010).

2. Material and method

The complex character of rhythmic gymnastics movement is provided, first of all, by the diversity of simple motor acts comprising a movement and by the number of muscle groups engaged. The complete appraisal of effort from the "internal" perspective concerns the morphological and functional modifications, as well as the duration of the restoring period.

In this case, the indicators are time of reaction, time of execution, heart rate, respiratory rate, and others (Grosu et al., 2008). Therefore, the purpose of this paper is to monitor heart rate during rhythmic gymnastics exercises and to observe the modifications produced.

We measured this physiological parameter using the "Garmin 910 XT" instrument, which indicated the values of the heart rate during rhythmic gymnastics exercises. The research series included a second category team, comprising 4 female gymnasts who participated to the hoop and ball finals.

3. Findings and discussions

The series comprised in this study included a second-category team, consisting of 4 female gymnasts who participated to the hoop and ball finals. After data interpreting, the vales of HR in hoop exercises ranged between 166 b/min. and 179 b/min., $X \pm S = 171.5 \pm 21.38$. For the same exercises, maximum HR values ranged between 183 b/min. and 192 b/min., $X \pm S=187.25 \pm 22.34$. During ball exercises, HR varied between 155 b/min. and 176 b/min., $X \pm S =164.5 \pm 20.94$. Maximum HR values for ball exercises ranged between 179 b/min. and 192 b/min., $X \pm S = 186.5 \pm 22.3$. As a general conclusion, we highlight that hoop exercises are more dynamic, that they involve numerous artistic jumps and launching compared to ball exercises, which include mainly elements of balance, flexibility,

and pirouettes. These aspects were actually highlighted by HR values throughout the monitoring of hoop and ball exercises.

Table 1. HR values obtained in hoop exercises

	Media HR - hoop (b/min)	HR max - hoop (b/min)
M.A.	172	189
P.D.	166	183
S.M.	169	185
P.S.	179	192
$\overline{X} \pm S$	171.5 ± 21.38	187.25 ± 22.34

Graphic representation HR in hoop exercises

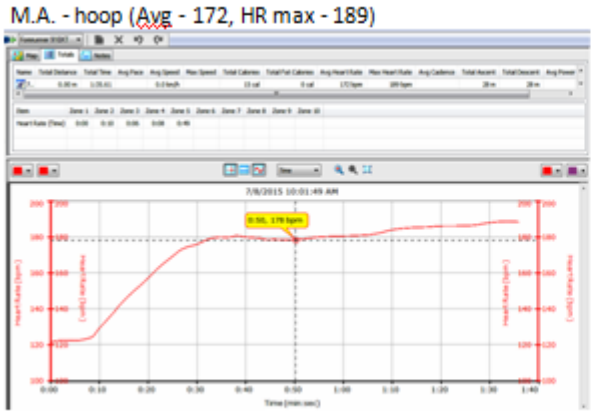

Figure 1

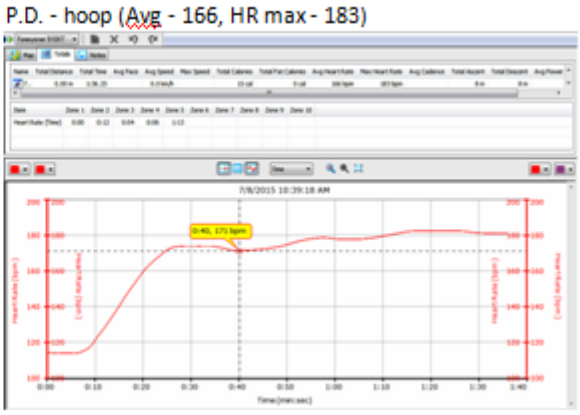

Figure 2

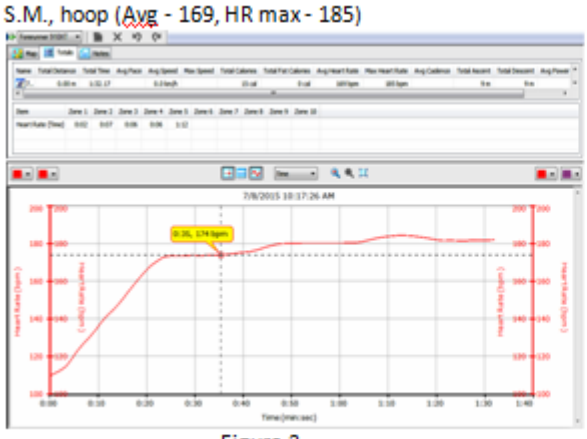

Figure 3

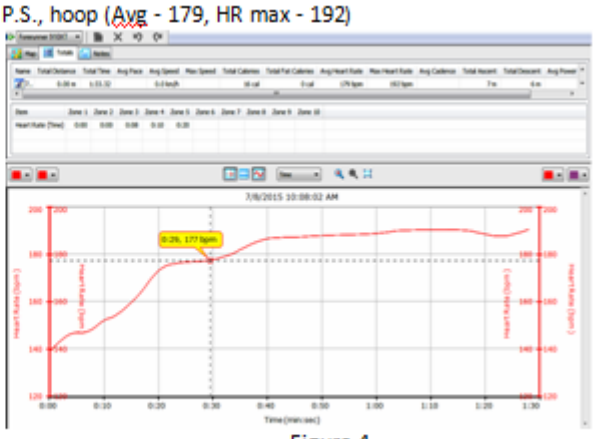

Figure 4

Table 2. HR values obtained in ball exercises

	Media HR - ball (b/min)	HR max - ball (b/min)
M.A.	157	184
P.D.	155	179
S.M.	176	192
P.S.	170	191
$\overline{X} \pm S$	164.5 ± 20.94	186.5 ± 22.3

M.A., ball (Avg -157, HR max - 184)

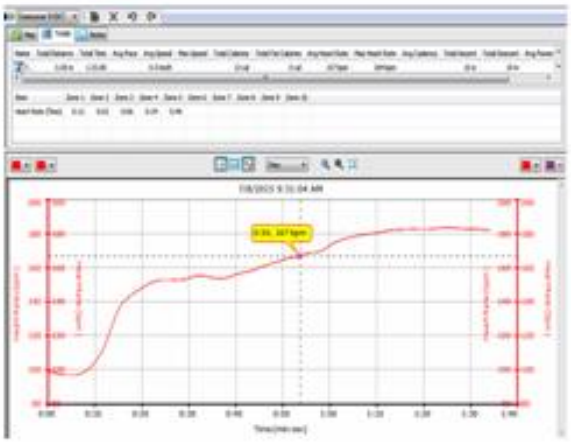

Figure 5

P.D., ball (Avg -155, HR max - 179)

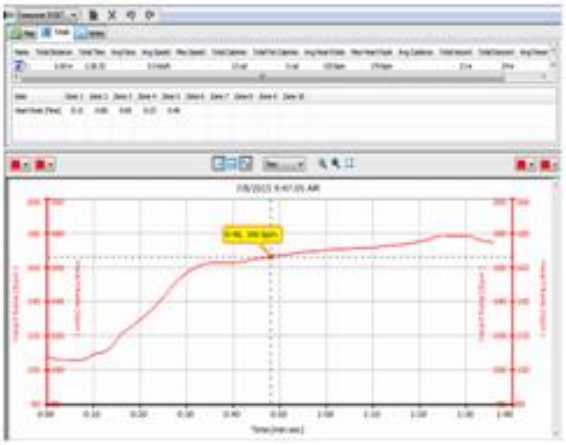

Figure 6

S.M., ball (Avg -176, HR max - 192)

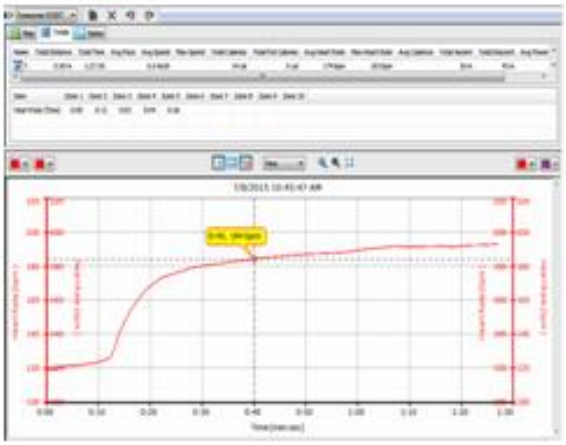

Figure 7

P.S., ball (Avg -170, HR max - 191)

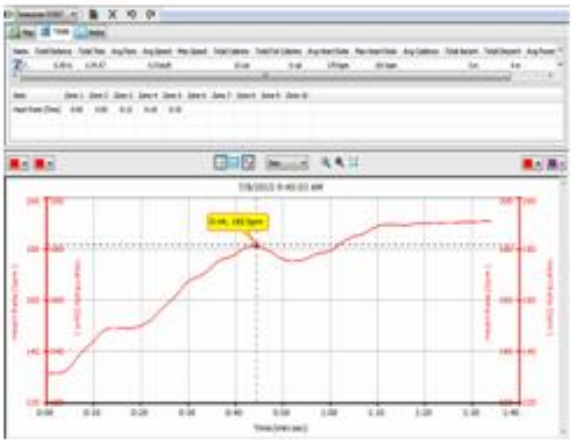

Figure 8

4. Conclusions

The choreography of competition exercises represents the dynamic expression of a composition within which the gymnast/gymnasts (group event) and the apparatuses used, together with the musical accompaniment, are in perfect symbiosis, where the technical execution, with its elements of mastery and artistic-motor expressivity, define the gymnastic perfection of a group or of an individual athlete (Manos & Popescu, 2014).Most of this research concerns scientific aspects of the effects of music applied to a particular sport and the way in which music contributes to enhancing or affecting the athlete. Sports that consist of music and choreography are more concerned with synchronization and congruency, as in the field of dance. Synchronous music is explained as the "rhythmic and temporal aspects of music used as a type of metronome that regulates movement patterns", while asynchronous music is used to provide a background simulation without conscious synchronization between movement patterns and musical tempo". (Karageorghis, Terry, Lane, Bishop & Priest, 2011).

The contribution of music to sports in providing ergogenic, psychological, psychophysical, and psychophysiological effects have also been shown in much research (Loo Fung, 2012). Considering the aforementioned aspects, we formulate the following conclusions: the mean of HR values in hoop exercises is higher than in hoop exercises, because the composition of these exercises is dominated by artistic jumps, while ball exercises are dominated by suppleness elements and pirouettes.

In addition, considering the weight of the object, hoop launches can be made from higher points; this leads to the execution of several elements under the launch, compared to ball launches. Another factor leading to the differentiation of the heart rate is musical tempo. It is known that ball exercises are generally executed on slow music to underscore the lyrical character and the characteristics of this apparatus.

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