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Determinants of competitive performance in rhythmic gymnastics. A review.

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ABSTRACT

Bobo-Arce M, Méndez-Rial B. Determinants of competitive performance in rhythmic gymnastics. A review. *J. Hum. Sport Exerc.* Vol. 8, No. Proc3, pp. S711-S727, 2013. Rhythmic Gymnastics is as a complex artistic and aesthetic sport with a particular training process and which demands high levels of physical and psychological stress in competition. Not many studies explain a good proposal which determinate the predictors of a competitive performance and a useful interaction-model of training and sport performance for the different context, ages and levels in rhythmic gymnastic. In this perspective, based on a critical examination of the literature about "Rhythmic Gymnastics" and "Performance", the aim of this research was to identify the factors that have been studied to predict a higher performance in Rhythmic Gymnastics, analyze them and determinate an "effectively training proposal" to achieve the higher results in competitions. We divided the references in different groups: a) Physiological and biological condition; b) Technical aspects; c) Psychological factors; d) Training process, e) Other dimensions and f) Performance analysis. The results show that most studies on rhythmic gymnastics are descriptive studies about a topic, fewer studies have examined one or more variables related with the performance and more scarce are the studies that show a global perspective and try to explain the predictor of the level of performance. In conclusion, we found some determinants of a competitive performance in Rhythmic Gymnastics which define our proposal. Further intervention studies and studies on the way of the Metamodel studies, "The theoretical and interaction of training and sport performance", would permit identify the contribution of each factor to the performance and would explain our model on a properly and scientifically way. **Key words:** HIGH PERFORMANCE, TRAINING PROCESS, TALENTS, SPORT.



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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 an specific knowledge of the sport. Coaches, judges, gymnast or other staff involved in it do not have time to write the way of training and sometimes they do not want to explain it because there is competition. That is one reason why not many references are about this topic.

A quickly review of the literature show that some studies try to identify useful indicators for talent identification and development training plans but they explain separately each parameter: anthropometric characteristics (e.g. Di Cagno et al., 2008, Di Cagno et al., 2009 or Wang, 1989), physiological parameters (Di Cagno et al., 2013) or the explosive strenght (Douda et al., 2008). Hume (1993) explained some predictors of attainment in rhythmic sportive gymnastics (physical, psychological and training measures to performance of a sport) and Rutkauskaitė & Skarbalius (2009), Rutkauskaitė & Skarbalius (2011) and Rutkauskaitė & Skarbalius (2012) established the preconditions of training optimization for 11 to 15 year old rhythmic gymnasts.

In general, we did not find a completely proposal which could identify the determinants of a competitive performance and a good interaction-model of training and sport performance for different context, ages and levels in rhythmic gymnastic (Illustration 1).

That is why, the aim of this research was to establish, through a critical examination of the literature about "Rhythmic Gymnastics", the factors that have been studied to predict a higher performance in Rhythmic Gymnastics. If we analyzed them, we could determinate an effectively training proposal to: a) Talent identification and development (TID); b) Improve and optimize the training process and c) Achieve the higher results in competition. It would be very useful for all the protagonists involved in this sport (gymnasts, parents, coaches, judges, federation and technical staff, politicians, others).



Figure 1. The Specific Context of Rhythmic Gymnastics

MATERIAL AND METHODS

Data sources and searches:

The following databases were searched: SportDiscus and PubMed the 15th of March 2013 (table 1). The coverage of both database are from 1949 until nowadays. After the combinations of key words entered with boolean operator: "performance" and "rhythmic gymnastics" we found one hundred sixty-one references. SportDiscus had one hundred forty-seven references and PubMed twenty-eight. Fourteen studies were repeated. All other references were obtained from other citations but, we only included a hundred or references at the end of this article.

Table 1. Data base analyzed

Data base	SPORTDiscus	PubMed
Description	Covers serial and monographic literature in sport, recreation, exercise physiology, sports medicine, coaching, physical fitness, the psychology, history and sociology of sport, training, and conditioning. Full text is available for 550 titles.	Includes over fourteen million citations for biomedical articles back to the 1950's. These citations are from MEDLINE and additional life science journals. PubMed includes links to many sites providing full text articles and other related resources.
Coverage	From 1949 to 15th of March 2013	From the 1950 to 15 th of March 2013

Selection of studies and analysis process:

Each reference we found was read (title, abstract, key words and the full text in the articles we found) and we analysed all of them according to this five criteria:

1. Publication year: 1) before 1982; 2) from 1982 to 1991; 3) from 1992 to 2001; 4) from 2002 to 2011; 5) after 2011;
2. Type of reference: 1) Academic Journal; 2) Book; 3) Dissertation/Thesis, 4) Electronical resource/video recording; 5) Government document;
3. Topic of the study: 1) Physiological and biological condition; 2) Technical aspects; 3) Psychological factors; 4) Training process; 5) Other topics and 6) Performance analysis;
4. Point of view of the study: 1) Group 1: Descriptive studies of a topic, aspect or variable; 2) Group 2: Partial view, one or more aspects and the relationship with the performance and 3) Group 3: Whole view studies, the relationship between training and performance;
5. Other information: 1) Gender differences; 2) type of sample; 3) age of the gymnastics sample and 4) Level of the performance.

RESULTS

1. Publication year: One hundred and sixty references were analyze (Illustration 1). One of the studies did not have the year of publication. Most of the references (78,8%) were publish between "1992 and 2011". From 2012 to 2011 was the decade with more references (45,3%).

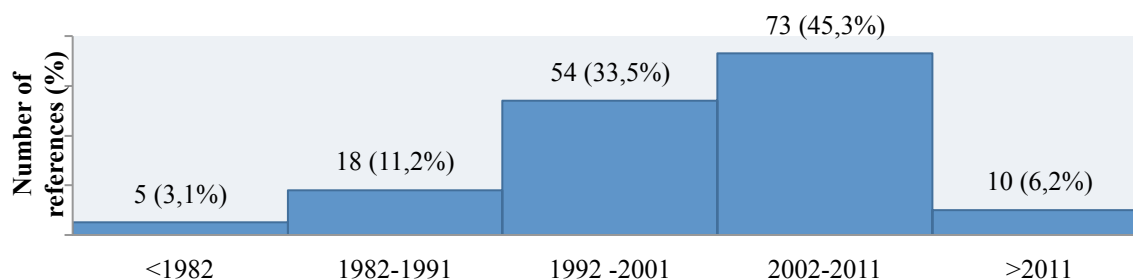


Figure 2. References “Rhythmic Gymnastics” AND “Performance” in SportDiscus and PubMed per year (15th of March 2013)

2. Type of document: The “Academic Journal” was the most common type of references (88,2%). Eleven references (6,8%) were books and seven (5%) were other type of document (Government document, electronic resource, video recording or dissertation/thesis).

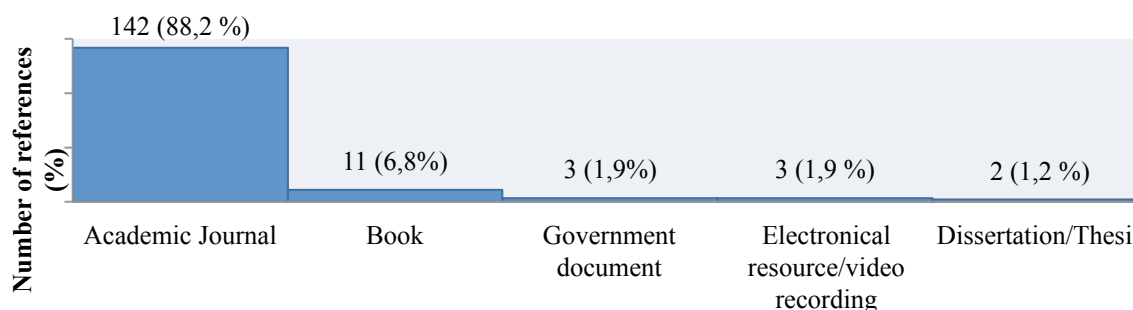


Figure 3. References “Rhythmic Gymnastics” AND “Performance” in SportDiscus and PubMed per type of document (15th of March 2013)

3. Subject/ topic: Classifying the studies per topic, some of them included more than one topic. In general there were two hundred ninety-two topics. The analysis of the distribution of the topics (Illustration 4) explained that the 47,2% of the references were about technical aspects (7,4%), twenty two about psychological factors (8,2%), thirty-five related with the training process (13%) and fifty about physical and biological condition (18,6%) opposite to the 52,8% of the references which explain Performance (32%) and Other topics (20,8%).

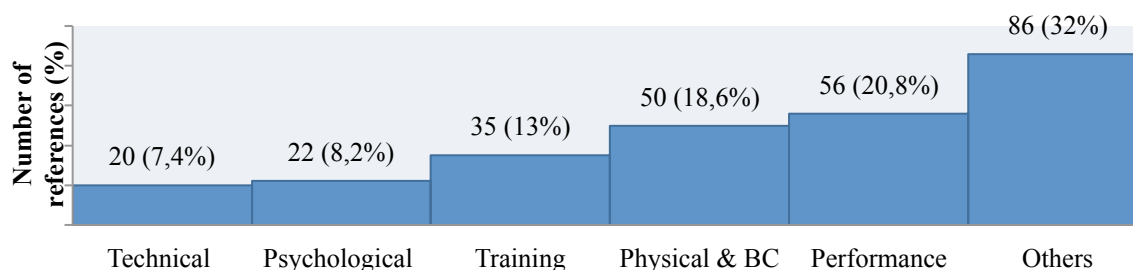


Figure 4. References “Rhythmic Gymnastics” AND “Performance” in SportDiscus and PubMed per topic (15th of March 2013)

Under each topic we found other dimensions analyzed.

- 3.1. Regarding the technical aspects, the dimensions analyzed (table 2) were five: apparatus, kinematic analysis, motor abilities, skills and technical elements. Jumps are the skills mostly studied (Di Cagno et al., 2008b; Di Cagno et al., 1995; Dyhre-Poulsen, 1987; Kums et al. 2005; Miletić et al., 2004b; Mkaouer et al., 2012; Özengin et al., 2011 and Purenović et al., 2010) and we did not found many studies about apparatus (Ávila-Carvalho et al. 2010; Ávila-Carvalho et al. 2011; Ávila-Carvalho et al. 2012 and Tsopani et al, 2012).

Table 2. Dimensions and studies about technical aspects

Dimensions of analysis	References
<u>Apparatus:</u> Apparatus motor skills, apparatus (ball), Apparatus difficulty group routine (roops, hoop and clubs).	Ávila-Carvalho et al. (2010), Ávila-Carvalho et al. (2011), Ávila-Carvalho et al. (2012), Komanthi et al. (2012), Mkaouer et al. (2012) and Tsopani et al. (2012).
<u>Kinematic analysis:</u> Kinematic analysis, kinesiology skills evaluation, movement analysis - motor aspects.	Purenović et al. (2010) and Šebić-Zuhrić & Smajlović (2009).
<u>Motor abilities:</u> Motor abilities, motor skills, basic motor abilities.	Kioumourtzoglou et al. (1997), Miletić et al. (1998), Miletić et al. (2004b) and Šebić-Zuhrić & Smajlović (2009).
<u>Skills:</u> Splits leaps (physiological recordings, leaping performance) Leaping ability, Jumping or leaping performance	Dyhre-Poulsen (1987), Di Cagno et al (1995), Di Cagno et al. (2008b), Mkaouer et al. (2012), Özengin et al. (2011), Purenović et al. (2010), Kums et al. (2005) and Tsopani et al. (2012).
<u>Technical elements:</u> Technical elements, technical mastery or technical evolution.	Buarque (2003), Bozanic and Miletić (2011) and Sekulic et al. (2002)

- 3.2. Studies about psychology, explains psychological dimensions in the higher performance (anxiety, attentional and pre-attentional process, self-consciousness); behaviour analysis (preceptual process, movement analysis); personality traits and other studies.

Table 3. Dimensions and studies about psychological factors

Dimensions of analysis	References
<u>Psychological dimensions in the higher performance:</u> Attentional and pre-attentional process Anxiety state on the performance, trait anxiety and competitive state anxiety. Self-consciousness or Self-efficacy.	Daroglou (2011), Fan et al. (2004), Ferrand et al. (2002), Ferrand & Tedard (2001) and Tsopani et al. (2011).
<u>Behaviour:</u> Preceptual process or perceptual and cognitive abilities. Movement analysis - mental aspects.	Ermolaeva et al. (1998), Giannitsopoulou et al. (2002), Hökelmann et al. (2006), Kioumourtzoglou et al. (1997) and Li and Guo (2000).
<u>Personality traits:</u> Personality.	Ferrand et al. (2005)
<u>Others:</u> Biofeedback. Ethical implications for the Sport psychologist. Job satisfaction coaches.	Drakou et al. (2008), Ferrand & Tedard (2001), Johns (1993), Peper & Schmid (1983).

- 3.3. Training process was analysis from three points of view: perspective of the learning process, the specific training process and the interaction between the training and the performance (table 4).

Table 4. Dimensions and studies about training process

Dimensions of analysis	References
Learning process: teaching program, learning gymnastics skills, teaching systems, learning. Feedback, process correcting technical mistakes. RG Curriculum, Levels.	Cristina-Elena (2012), Gloucester (1993), Komanthi et al. (2012), Loquet (2011) and Tsopani et al. (2012)
Training process: planning, methods, training cycle model, improving training levels, training volume, exercise training, problems, models. Precompetition warm-up, Pre-competition training and Competitive period.	Fang Huixin (1994), Fan et al. (2004b), Guidetti et al. (2009), Hu (2001), Madelyn et al. (2008), Kroetenhardt (1989), Rutkauskaitė (2005), Rutkauskaitė & Skarbalius (2009), Rutkauskaitė (2005), Rutkauskaitė & Skarbalius (2011), Rutkauskaitė & Skarbalius (2012), Sundgot-Borgen (1996) and Viru & Smirnova (1995)
Interaction between training (models) and performance.	Rutkauskaitė (2005) and Rutkauskaitė & Skarbalius (2012).

- 3.4. The physical and biological condition is one of the topics mostly studied (table 5) on the way of: the anthropometric values, physical condition, physiological parameters and psychomotor dimensions.

Table 5. Dimensions and studies about physical and biological condition

Dimensions of analysis	References
Anthropometric values: Anthropometric values, profile or characteristics. Somatic constitution, dynamic body equilibrium, body composition. Dermatology, somatotype and morphological models. Growth and pubertal development.	Deutz et al. (2000), Quintero et al. (2011), Di Cagno et al. (2008), Di Cagno et al. (2008b), Douda et al. (2008), Georgopoulos et al. (1999), Menezes & Filho (2006), Poliszczuk & Broda (2010) and Wang (1989).
Physical condition: Physical fitness, Physical aptitude characteristics. Balance (vestibular system, body sway, postural strategies (postural trials) or control in lateral directions). Stretching/ Static stretching. Flexibility or general flexibility	Beyer (1959), Calavalle et al. (2008), Di Cagno et al. (1995), Menezes & Filho (2006), Napias (1997), Özengin et al. (2011) and Tsigilis et al. (1998).
Physiological parameters: physiological characteristics, indices, determinants or responses. Exhaustion, energy deficits, maximal effort, energy Organic prerequisites, heart-rate responses, blood lactates, lipid profile and redox, ACE and AGTR1 polymorphisms. expenditure and rating perceived exertion.	Alexander et al. (1987), Bensar & Steender (1989), Case et al. (1980), Deutz et al. (2000), Di Cagno et al. (2013), Douda et al. (1997), Douda et al. (2006), Douda et al. (2008), Guerra et al. (2001), Mihaela et al. (2012), Miletić et al. (2004), Polischuk, (2001) and Portier et al. (2006).
Psychomotor dimensions: Corporal language or Body conception. Spatial-temporal orientation. Coordination or situational motor-coordination. Rhythm perception, musical abilities or rhythmic ability. Lateral differentiation or homolateral hand and food.	Antunes (1991), Capranica et al. (2005), Corat (2012), Fotiadou et al. (2006), Ma Xun (1993), Pavlidou et al. (2009), Penedo et al. (2006), Petkovic (2004), Popovic (2004), Soares (1981) and Wolf-Cvitak & Starosta (2002).

- 3.5. The performance analysis was very mentioned (table 6) with the aesthetic parameters; choreography process; the exercise (trends, visual model, knowledge or exercises); the predictors and results of the performance and the competitive success.

Table 6. Dimensions and studies about performance analysis

Dimensions of analysis	References
<u>Aesthetic parameters:</u> Aesthetic competence parameters, Artistic value	Ávila-Carvalho et al. (2008); Avila et al. (2011)
<u>Choreography:</u> choreography creation and expresion	Nicklas et al. (1996)
<u>Exercise:</u> Rhythmic gymnastics exercises, Trends or tendencies and analyses, Visual model and knowledge of performance	Gantcheva (1987), Magill & Schoenfelder-Zohdi (1996), Sekulic et al. (2002), Stefanova & Yakimova (1987) and Wolf-Cvitak & Starosta (2002).
<u>Predictors and results of the performance:</u> Determining elements of the performance, factors influencing performance, predictor of attainment, performance characteristics, Sport performance, performance results, Level of the performance (reliability).	Di Cagno et al. (2009), Ferrando & Tedard (2001), Hume et al. (1993), Polischuk, T. (2001), Rutkauskaitė & Skarbalius (2011) and Rutkauskaitė & Skarbalius (2012).
<u>Success:</u> Success or competitive success.	Petkovic (2004) and Kroetenheardt (1989)

- 3.6. Other topics included different perspective about rhythmic gymnastics associate with (table 7): appreciation of the beauty, computer support systems; sport context (socio-cultural, ethical implications, etc.); descriptive studies of rhythmic gymnastics and gymnasts; judge's process, medical supervision and health promotion focusing specially in eating disorders or talent identification.

Table 7. Dimensions and studies about other topics

Dimensions of analysis	References
<u>Beauty:</u> Apreciation of the beauty	Li (1999)
<u>Disability:</u> deafness	Fotiadou et al. (2006)
<u>Informatics:</u> Computer support system	Cuk et al. (1992)
<u>Context:</u> Socio-cultural, ethical implications conditioning and gender differences,	Di Cagno et al. (2002) and Johns (1993).
<u>Descriptive studies:</u> evolution of performance, teams, general information about rhythmic gymnastics, sport, competition, interviews, clinics.	Bensar & Steender (1989), Crumlis (2001), Crumlish (2005), FISU (2003), Ho (1988), Kroetenheardt (1989), Kroetenheardt & Brzank (1988), and Yi (2000).
<u>Judges:</u> Judge's process, evaluation criteria, score, problems, computerized analysis, coherent majority average, comparative studies of judging or judgment of actions in experts	Babiloni et al. (2009), Bandettini & Piazza (1985), Bormann (1988) and Gianfranco & Gaetano (2012).
<u>Medical supervision and health promotion:</u> Medical supervision Nutritional needs, nutritional behaviours, Eating disorders (fasting & festing, energy intake.	Fang Huixin (1994), Gianfranco & Gaetano (2012), Johns (1993), Johns (1998), Vitali et al. (2003) and Sundgot-Borgen (1996).

Talent identification, development and promotion.	Di Cagno et al (2008), Di Cagno et al. (2008b), Di Cagno et al. (2009), Di Cagno et al. (2013) and Doua et al. (2008).
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4. **Point of view:** In respect of the point of view, only four studies (2,5%) explained a whole view about the relationship between training and performance [Group 3: Hume (1993), Rutkauskaitė & Skarbalius (2009), Rutkauskaitė & Skarbalius (2011) and Rutkauskaitė & Skarbalius (2012)], thirty-one (19,3%) explained the relationship between one or more aspects and the performance (Group 2), and all other references, hundred and twenty six (78,3%) focused in a description of a topic, aspect or variable (78,3%).

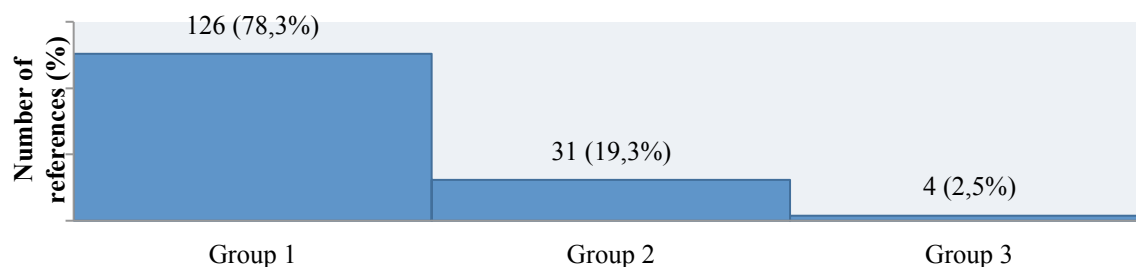


Figure 5. References “Rhythmic Gymnastics” AND “Performance” in SportDiscus and PubMed per point of view (15th of March 2013)

The review of the literature give us the information about that some studies started to identify and describe the determinants of a rhythmic gymnastics performance (Table 8). Some of them (Doua et al., 2008; Miletic et al., 2004; Di Cagno et al., 2009) explained only the relationship between antropometric and technical determinants of the rhythmic gymnastic performance. Others added the psychological factors and the training process in the first parametres (Hume, 1993; Rutkauskaite & Skarbalius, 2009; Rutkauskaite & Skarbalius, 2011; Rutkauskaite & Skarbalius, 2012).

Table 8. Some studies about determinants of a rhythmic gymnastic performance

Reference	Title	Sample of rhythmic gymnasts studied	P	P&B	TC	PSY	TR	OF
Douda et al (2008)	Physiological and anthropometric determinants of rhythmic gymnastic performance.	n = 34 elite (n = 15) no-elite (n = 19)	X	X				
Miletic et al (2004)	Some anthropologic factors of performance in rhythmic gymnastics novice	n = 50 Age 7.1 +/- 0.3 years	X	X	X			
Di Cagno et al. (2009)	Factors influencing performance of competitive and amateur rhythmic gymnastics-gender differences	n = 24 12 male and 12 female Age range 22±4 years	X	X	X			
Hume (1993)	Predictors of attainment in rhythmic sportive gymnastics	n =106 Aged 7-27 years	X	X	X	X	X	X
Rutkauskaite & Skarbalius (2009)	Training and sport performance of the 11-12 years old athletes in rhythmic gymnastics	n =25 National gymnasts Age 11—12 year old	X	X	X	X	X	X

Reference	Title	Sample of rhythmic gymnasts studied	P	P&B	TC	PSY	TR	OF
Rutkauskaitė & Skarbalius (2011)	Interaction of training and performance of 13-14 year old athletes in rhythmic gymnastics	n =15 National gymnasts Age 13—14 year old	X	X	X	X	X	X
Rutkauskaitė & Skarbalius (2012)	Models and interaction of intensive training and sport performance of 14-15 years old athletes in rhythmic gymnastics.	n =10 National gymnasts Age 14-15 year old	X	X	X	X	X	X

*Note: P = Performance; P&B = Physical and Biological Condition; TC = Technical aspects; PSY = Psychological factors; TR = Training process; OF = others factors.

5. Other information: A part from the four aspects we analyze in this article [1), Publication year, 2) Type of reference, 3) Topic of the study, 4) Point of view] other dimensions have been studied and included in the title of the reference: gender differences, type of sample, age of the gymnasts or level of the performance. The aspects analyze were:

- 5.1. Gender differences: in amateur rhythmic gymnastics (Di Cagno et al., 2009) or related with technical mastery (Bozanic & Miletic, 2011).
- 5.2. Type of sample: Gymnasts and runners (Deutz et al., 2000); artistic and modern rhythmic gymnastics (Bormann, 1988); gymnasts and no gymnasts (Pavlidou et al., 2009); artistic and rhythmic female gymnasts (Douda et al., 1997); coaches (Drakou et al., 2008); judges (Gianfranco & Gaetano, 2012); experts (Babiloni et al., 2009); teams (Bensar & Steender, 1989; Case et al., 1980; Fang Huixin, 1994; Yi, 2000) or Recognized Gymnasts: Irina Superestar (FISU, 2003); Inna Zhukova (Crumlish, 2005); Irina Chaschina (Crumlish, 2001).
- 5.3. Age of the gymnastics sample: children (Cuk et al., 1992); children with deafness (Fotiadou et al., 2006); infantile and pre-infantile rhythmic gymnastics (Penedo et al., 2006); rhythmic gymnastics novices (Miletic et al., 2004); youth age (Di Cagno et al., 2002); teenagers female gymnasts (Guerra et al., 2001); college women (Beyer, 1959); Female sport students (Ferrand et al., 2002; Ferrand et al., 2005); Rhythmic gymnasts girls (Poliszczyk & Broda, 2010); young female rhythmic gymnasts (Tsopani et al., 2011); 11 to 12 years old athletes in rhythmic gymnastics (Rutkauskaitė & Skarbalius, 2009); 13 to 14 years old athletes in rhythmic gymnastics (Rutkauskaitė & Skarbalius, 2011) or 14 to 15 years old athletes in rhythmic gymnastics (Rutkauskaitė & Skarbalius, 2012) or older women (Capranica et al., 2005).
- 5.4. Level of the performance: female gymnasts from different qualification levels (Menezes & Filho, 2006); amateur rhythmic gymnasts (Di Cagno et al., 2008); national gymnasts (Fang Huixin, 1994); sub-elite gymnasts (Guidetti et al., 2009); elite female gymnasts (Ávila-Carvalho et al. 2010; Deutz et al., 2000; Di Cagno et al., 1995; Di Cagno et al., 2008; Georgopoulos et al. 1999; Guidetti et al., 2009); Top level rhythmic gymnasts (Fan et al., 2004) or World and European rhythmic gymnastics (Bandettini & Piazza, 1985).

DISCUSSION

The results are similar to other researches, which have mentioned that not many studies explain a proposal of the determinants a competitive performance in Rhythmic Gymnastics (Hume, 1993).

We identify some studies which explain the predictors of a high performance in rhythmic gymnastics through a whole perspective (Illustration 6) and in which training and performance are related (Hume, 1993; Rutkauskaite & Skarbalius, 2009; Rutkauskaite & Skarbalius, 2011; Rutkauskaite & Skarbalius, 2012) and other studies which explain some predictors such as anthropometric characteristics, physical condition or technical aspects of a competitive performance separately (Douda et al., 2008, Miletic et al., 2004; Di Cagno et al., 2009).

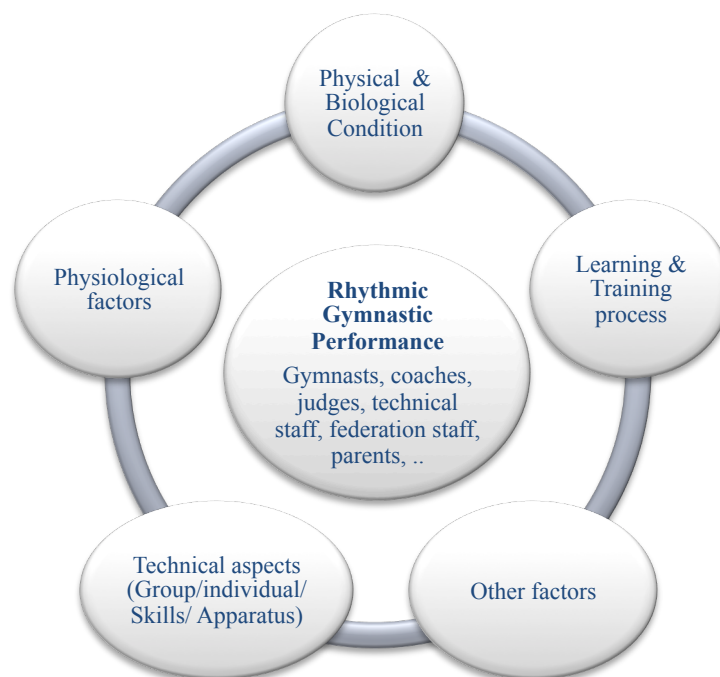


Figure 6. Dimensions of a competitive performance in the specific context of the Rhythmic Gymnastics

Researches has not established models of training and sport performance (as well as their interaction) of rhythmic gymnastics athletes of different ages and sport performance levels (basic and special) (Rutkauskaite & Skarbalius, 2009; Rutkauskaite & Skarbalius, 2011; Rutkauskaite & Skarbalius, 2012). Like other authors have explained (Di Cagno et al., 2008; Di Cagno et al., 2008b; Di Cagno et al., 2009; Di Cagno et al., 2013; Douda et al., 2008) if we verified which parameters are useful indicator and their contribution to a successful performance rhythmic gymnastics, we could have a guideline for talent identification, selection, development and promotion.

In general, the line of investigation needs to continue because it is not enough to understand and have a useful and empirical proposal of “training and sport performance” based on the theory and apply in the practice in the specific context of rhythmic gymnastics (Illustration 7).

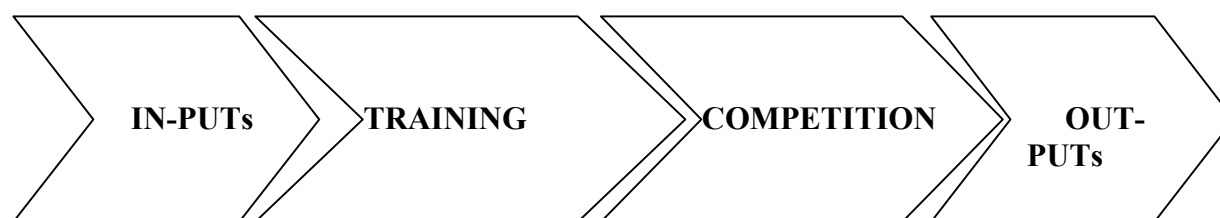


Figure 7. Interaction model of training-sport performance in competition in rhythmic gymnastics

CONCLUSIONS

After the analysis of more than a hundred of references about Rhythmic Gymnastics and Performance from two data bases here are the conclusions:

1. The digital references are increasing in the Database every year since 1982, a good sign of applied new technologies in sport.
2. The most common type of document still being Academic Journal something not new because we analyze two digital database but it is a good symptom of the investigation in rhythmic gymnastics. We found other types of document but in less number (Books, Government document, electronical resource/video recording and Dissertation/Thesis).
3. Most studies were descriptive studies about a topic (78,3%), fewer studies have examined one or more variables related to the performance (19,3%) and more scarce are the studies which show a global perspective and try to explain the predictor of the level of performance (2,5%) (Hume et al, 1993; Rutkauskaita and Skarbalius, 2009; Rutkauskaita and Skarbalius, 2011; Rutkauskaita and Skarbalius, 2012).
4. The usual topics studied were: the Performance (32%), Physical Condition & Biological aspects (18,6%) and training process (13%). Psychological (8,2%), technical aspects (7,4%) and other studies (20,5%) were the other topic studied.
5. Some dimensions of a competitive performance in Rhythmic Gymnastics which define part of a future proposal were found. Some of the dimensions are: a) Technical aspects (Aparatus, kinematic analysis, motor abilities and skills and technical elements); b) Psychological factors (Psychological dimensions in high performance, behavior analysis, personality traits and other factors); c) Training process (Learning, training, interaction between training and performance); d) Physical and biological condition (anthropometric values, physical condition, physiological parameters, psychomotor dimensions); e) Performance analysis (aesthetic parameters, choreography, exercise, predictors and results of the performance, success) and f) Other factors (beauty, informatics, context, descriptive studies, judge's process, medical supervision and health promotion, talent identification; others).
6. This study suggested that is necessary increase the research in this area. Some implications were found (Illustration 8) but further research could explain the determinants of competitive performance in rhythmic gymnastics and an interaction model of training – competition for different context, ages and levels in rhythmic gymnastics.

This study explain a critical examination of the literature about Rhythmic Gymnastics & Performance in two data base:

- Scare studies show a global perspective and try to explain the predictors of performance.
- Some predictors of a competitive performance in Rhythmic Gymnastics were founded .

Further research could explain:

- The determinants of competitive performance in rhythmic gymnastics.
- Interaction Training & competition model for different context, ages and levels in rhythmic gymnastic.

Figure 8. Implications and conclusions of this study

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