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THE INFLUENCE OF CONTINUAL RECREATIVE EXERCISES IN RHYTHMIC GYMNASTICS ON THE MODEL OF ANTHROPOLOGICAL STATUS EXERCISORS

(Professional paper)

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Abstract

Establishing the condition of athletes is very important for planning of training and sport selection process. Designing of the model should take into account all factors that have impact on the results in rhytmic gymnastics. Such factors are: 1) Morphological characteristics 2) Motor abilities 3) Psychological characteristics 4) Social status, 5) Technique 6) Tactics as well as 7) Musical abilities, which are of great importance in RG. Girls start training rhytmic gymnastics in thpre-school period and achieve best results at the age about 17. Rhytmic gymnasts have average height, but reduced "ideal weight" for 15-20 % on the account of fat tissue and bone morphological type. The Body Fat is 12 % of Body Mass. To achieve good competition results gymnasts have to have values of oxygen consumption above 50 ml/min/kg. In the field of strength, they have less than average of the absolute muscle strength, but average of the relative strength as well as the average of the legs explosive strength. To prevent side effects highly professional trainer work is needed, it is necessary to have cooperation with physicians, nutritionists, orthopaedists, psychologists, as well as education of coaches, exercisers and parents.

Keywords: *training, body height, body weight, adipose tissue, motor abilities, psychological charasteristics, musical abilities*

INTRODUCTION

Developing Tendencies in Rhythmics Gymnastics

Quite accelerated development of sports activities started from the second half of the 20th Century. When looking at the Rhythmics Gymnastics, development tendencies in almost all segments of anthropology area can be noticed. Rhythmics Gymnastics belongs to acyclic polystructural sport branches, exclusively intended for female population, where competition results are achieved by performing compositions, which are judged by adjudicating panel. Competitive compositions are limited by space and time, performed with musical accompaniment, in complex combination of movements of some body parts and handling with the specific props such as rope, hoop, ball, clubs and ribbon. The esthetic component is significant and sometimes the key component in composition performance.

It is "Art in Sport and Sport in Art" because "the creation of logical entity of complex movements, gradual increase of their amplitude and tempo of performing, introduction of more difficult and more original elements, contrast alternation of fast and slow, sharp and flown motions, alliance of motion and music, expression of individuality and passing powerful emotions to the audience, until reaching an effective, complex and original culmination up to perfection, means playing a kind of drama and achieving sports and artistic piece of art in one.

It should be mentioned that there are big changes in the performance of group exercises, which made rhytmiccs gymnastics even more attractive. In Japan, rhythmics gymnastics for men became also popular. We can assume that it will be soon spread to the other parts of the world. Exercises which are supposed to be per-

formed in pairs, even mixed ones, like in sports aerobic gymnastics, could be particularly interesting.

Intensive development of this sport branch, reflected in the mentioned trends, led to significant qualitative changes in anthropological status of female gymnasts. It was proved that practicing rhythmics gymnastics causes other effects on anthropological status than it did a few decades ago. Consequently, in accordance with these changes, the requests regarding the selection of competitors on all levels also changed. This could be assumed on the basis of the fact that requests regarding complexity and hardness of technical elements level continue to increase. It can be even visually assessed that modern gymnasts, compared to those of three decades ago, are slimmer, more graceful, and more motile and perform much more complex exercises in terms of coordination.

Review of the model of anthropological status of sports players

Management and Modeling During Training

For training management, an example of cybernetics is very important, which is a science of an optimal management in complex dynamics systems. The application of cybernetics enabled the development of exercise management theory that represents an open and very complex dynamic system. In the process of a system management, a change of the system condition is made, i.e. the change of its elements from the existing to wanted and aimed condition. This process understands a detailed introduction to the system, i.e. its elements and characteristics, as well as to the relation of the elements within certain systems. Furthermore, the aim and desired condition must be defined, ways and methods for it achievement must be found and the success of the process must be envisaged.

Analyses of exercises emphasize that the efficiency is the subject of management while the aim of exercising is an increase in efficiency. Efficiency, in any sports activity, depends on the five basic factors: 1) the correctness of motion performance (sports technique), 2) energetic abilities, 3) contractile characteristics of muscles, 4) joint mobility and 5) tactics.

Model of Anthropological Status

The basic subject in exercise management is a sportsman, an exerciser. Sportsman represents a complex dynamic and organizational integral system. It consists of several sub-systems with very compound mutual relationships. That is why a multimedia approach to studying a personality of a sportsman is used, in order to learn about the status of its individual segments.

In designing the model of a sportsman condition, the most important factors should be taken into account, which significantly affect the result and represent the following segments of anthropologic area, such as: 1) morphological, 2) motor, 3) psychological, 4) social, 5) technical and 6) tactical. In rhythmics gymnastics, musical abilities also influence the result, so they must be established and followed.

Indicators that define the model of a sportsman condition are called **model characteristics.** Knowing the model characteristics of top athletes is an important link in the chain in some stages of modeling the selection of athletes.

In our country there are just a few studies related to the model characteristics of the competitors in rhythmic gymnastics. Motor and morphological characteristics were examined the most. The most extensive and the most comprehensive researches of model characteristics were done by Popovic (1986), in which she established a significant theoretical basis for studying this sport branch. This study was performed with an aim to establish "The importance of Morphological Characteristics, Motor Dimensions, Musicality and Some Conative Personal Characteristics for the Success in Rhythmic Sportive Gymnastics". The study specimen included 62 female gymnasts (senior, junior and younger junior ones) who were participating at the State Championship in RG in 1981. Unlike these researches of transversal character, Kocic J. (1966) applied an experimental program of rhythmic gymnastics, on the specimen of 40 girls aged 6-9. She examined the influence of morphological and motor characteristics on the success in RG.

Morphological Characteristics

The initial researches of the morphology status of female gymnasts in our country were related to manifested morphological characteristics. First of all, the aim of the researches was to establish the way rhythmic gymnastics, as a mean of physical education, influences certain morphologic characteristics. In one of such longitudinal researches, it was proved that students, after one year of practicing the experimental program of rhythmic gymnastics, were having significantly decreased subcutaneous fat tissue (thickness of skin fold), as those who were included only in the regular study program of physical education.

Furthermore, it was interesting to establish the relationship between the anthropometric characteristics and the specific motor abilities, i.e. technique. The results of the research show that, for the success in exercise with the ribbon, the highest statistical importance lies in the length of hand, width of shoulders and skin fold of the armpit. This was explained by the specificity of this prop. Specificity of the technique of work with this prop is that the ribbon has to be kept in the air during the exercise of all specific elements. Performing shapes, spirals and snakes is more successful when the hand lever is longer. Gymnasts with long limbs, graceful musculature and less quantity of fat tissue, are able to cope more efficiently with the specific motor tasks in rhythmic gymnastics, in terms of achieving the rational technique and performing movement in space. (Kocic, J. 1996).

The most extensive and the most comprehensive research of the morphological characteristics of gymnasts was made by Popovic, R. (1986), who gave a significant theoretical basis for this sport branch. In morphological space, 17 anthropometric measures were applied, which covered all four dimensions. In the analysis of factors, a three-dimensional structure was established: 1) volume and body mass, 2) factor of longitudinal dimensionality and 3) factor of transversal dimensionality. A sufficiently high correlation between the manifest morphological characteristics and success in RG has not been established. On the contrary, the latent dimensions (volume and body mass, as well as, longitudinal measures) had the biggest influence on the success in RG. For the transversal dimensionality, a negative but not statistically important participation has been established.

As it can be concluded from observing and analyzing the free compositions (competitive compositions) in RG from various periods, and also by comparing the test results of various generations, it can be established that morphological characteristics of gymnasts have changed in the last several decades. By following the model characteristics of gymnasts, in the Republic Institute for Sport (in the period 1976-1995), it has been established that gymnasts in the early age begin to practice and achieve the best individual results and, thereby, have longer and longer sport experience. The height of body was increasing, but the body mass, the index of obesity and the fat component of body composition (in absolute and relative values) were decreasing. A statistically significant difference in these indices has not been established, but it was recorded in the mutual relationship, i.e. index of obesity. Also, the values of the body mass component have been decreased.

Growth of body height in senior gymnasts, of 3.5 cm in the period 1976-1995 is in accordance with the appearance of the accelerated physical growth, i.e. acceleration.

Opposite to this, the body mass of senior gymnasts did not follow the general tendencies of growth and their values even moved towards the opposite direction.

Motor Characteristics

A scientific field, which examines the human movement, is called anthropomotors. Elementary abilities of man, which are responsible for realization of movements in the broadest sense, including a static strain, are called anthropomotor or motor abilities, noting that not knowing the technique of movement is not a limiting factor. They are in less or more extent genetically conditioned and they can be partially acquired.

The structure of motor abilities is complex and belongs to a latent (hidden) area of motors, which is defined through manifesting area that is visible and can be identified with the technique of performance through movement or motion. Many authors have established the structure of motor abilities, and the majority of them emphasize factors such as: strength, speed, endurance, mobility and agility (coordination, preciseness and balance).

Motor Characteristics of Female Gymnasts

Based on the characteristics of a competition program and process, as well as, on the quotations in the available studies and books, for the success in rhythmic gymnastics, the following motor abilities are important: mobility, balance, strength (static, repetitive and explosive), speed, coordination and endurance. The first information about the motor abilities of female gymnasts was gathered with an aim to establish sports fitness and for the need of selection. Krakova (according to Popovic, 1986) conducted a research with an aim to estimate the level of multipurpose physical preparation of competitors in relation to sports achievements in RG.

In our country, this problem was thoroughly researched by Popović (1986), who has established "the influence of segments of psycho-somatic status of gymnasts on the success in RG." She determined the link between success in RG and motor abilities. Coefficient of multiple correlations was surprisingly high (0.98), which explains the mutual variability between the latent motor dimension and success in RG with even 96%. In the research, the 18 manifesting tests were applied, which covered the latent structure of motor area: 1) structuring of movement, 2) tonus and synergy adjustment, 3) excitation intensity adjustment and 4) excitation duration adjustment. The analysis of the achieved results established the existence of five components. It was concluded that in the basis of all elementary motor abilities lie mechanisms that are responsible for their real existence and manifestation, as well as that, the success in RG depends on the coherent action of all mechanisms responsible for expressing balance, mobility, speed, coordination and explosive strength.

Mobility

Mobility is a motor ability for which various terms are being used: pliability, elasticity, pliancy and flexibility. This term implies the ability to perform movements of great amplitude.

Mobility has always been an important characteristic of female gymnasts and has always taken a special place. However, since rhythmic gymnastisc has been included into the competition program of the Olympic Games, even higher mobility has been demanded from the gymnasts. First of all, the pliancy of body trunk has been maximally increased. Then, the gymnasts performed bigger and bigger amplitudes of legs opening in lateral plane. In the beginning, the amplitudes went just a bit over 180° and then they went more and more. During the last several years, the mobility of hips in the frontal plane has been increasing. The amplitudes performed in jumps, turns and particularly in balances, significantly increase the angle of 180°, in all planes. Extreme mobility requires certain characteristics of body constitution and composition. First of all, it refers to bone and joint

and muscle systems. Then, it refers to fat tissue, which can limit the maximum amplitudes. In order to fulfill the demands of mobility, a systematic and long-term work is needed within the scope of physical preparation. Gymnasts with gentic predisposition have the advantage here.

It is necessary that gymnasts have an exceptional mobility of all body parts, of active (dynamic and static), as well as, of passive character. The movements of spinal column, shoulders and pelvic girdles are related. Most often they are performed simultaneously, or flown together, by the whole body. In the spinal column, shoulders joints and hips, the performance of the maximum amplitude of movements in all planes is demanded.

Mobility in distal joints also plays an important role in rhythmic gymnastics. Mobility in feet joints (dorsal and plantar) is necessary. Mobility in the joints of hands is characteristic for rhythmic gymnastics, because handling with props is, almost always, done with hands. The movements are made in all planes, for example when practicing with clubs, so called "mills"are performed with one or both hands, which can be unilateral and scalene. In exercises with the ribbon in a complete sequence, the so called "snakes" and "spirals" are done flown together.

Strength

Strength is a motor ability which is reflected in overcoming or countering the resistance, primarily using the muscle strain. Depending on the strength of the resistance and the speed of movement, maximum, explosive and speed strength stand out. In sport a division is important, between absolute strength (maximal muscle force that man can express) and relative strength (quantity of maximal strength per kilo of the body mass), according to the criteria of the relation between force and body mass.

By analyzing exercises in rhythmic gymnastics, it can be immediately noticed that they are characterized by a large number of various jumps. Out of all motor abilities, the explosive strength of legs and the repetitive strength of body trunk have the biggest correlation with judging the specific level of well trained features in gymnasts. This has been established by Kocic. (1996) in an experimental research within her final examination, made during three months at a sample of girls aged 6 – 9 years.

Similar results have been obtained in the research of Popović. and Bogdanovic G. (1996) at the sample of school girls, aged 7–8 years, after six-month experimental program in rhythmic gymnastics.

The proper performance and the number of jumps have a significant influence on success. A value grade in rhythmic gymnastics correlates the most with a group of far and high jumps, for which the explosive strength is necessary.

In rhythmic gymnastics, it is necessary to work on the development of the specific strength of legs of the gymnasts. Training of jumping ability, in top gymnasts of the USA, has significantly contributed to the increase of the jump height (for 16.2%), to the decrease of the reaction time (for 50%) and the increase of the explosive strength (for 220%).

Endurance

Endurance, as a motor ability, is the ability of man to longer perform any movement without decrease in efficiency, i.e. to perform activities with unabated intensity, for longer time. Energy is needed for doing any work. Energy for the work of muscles is achieved in aerobic and anaerobic conditions, depending on biochemical and physiological processes. In expressing this ability, motivation i.e. the ability to bear very heavy feeling of tiredness and continue to work, plays an important role.

The central nervous system, which is very important in work that is characteristic for rhythmic gymnastics, (expression of coordination, balance) is sensitive to the lack of oxygen. In rhythmic gymnastics, the smallest mistake in estimation during throwing of a prop, or a shorter endurance in balance, can imperil the placement. And finally, aerobic ability influences the gymnasts' recovery process. It speeds it up and facilitates it.

In rhythmic gymnastics, the endurance has never been the primary motor ability, but its significance was increased at the beginning of the nineties. In respect of the fact that endurance has just recently gained an important place in the model characteristics of gymnasts, as well as that it has its specificities in this sport branch, it is necessary for it to become more treated both in theory (research) and practice (training) of rhythmic gymnastics.

Balance

There are different opinions about balance as a motor ability. Most authors do not speak about balance as a special motor ability. Some of them go against its existence because it is difficult to determine it, so they classify it in the part dealing with agility, together with coordination and preciseness. It tests interaction between the managing system, i.e. central nervous system and the system that is managed, i.e. locomotor apparatus.

In rhythmic gymnastics, balances belong to the elements of technique. They belong to the fundamental group of body elements. In each exercise, with or without props, a gymnast must show the ability to manage keeping the complex balances as characteristic structural group. Furthermore, the ability of keeping balance appears as an important factor in the technique of performing other movements, which do not belong to the balances in the narrow sense, such as turns or similar. Composition must necessarily have balances, which are visibly kept on the reduced surface of support, with high legs openning, (over 180°). Turns of 720°, performed as triple turns in pass (180°) require fantastic ability to keep the balanced position of a gymnast.

CONCLUSION

Rhythmic gymnastics has a very positive influence on the anthropological status of organism, if the process of activities is programmed and performed on a highly professional level. However, the negative influence of sport is an increasingly verified fact, and it did not evade rhythmic gymnastics. Certain model characteristics can lead to a health risk for gymnasts. First of all, it refers to the body mass and the quantity of fat tissue. The experts, who deal with these issues, emphasize the problem of strict demands for reduction of fat tissue in gymnasts in relation to those who do not train sport and to other sport branches.

The experts agree that, for men, the quantity of fat tissue must not be less than 5%, because certain fats are necessary for normal physiological functions. As far as women are concerned, the situation is more complex. That is why the risk of stress fractures and early osteoporosis is higher. Everything is even more complicated by a fact that sport amenorrhea is not only related to fat tissue and body mass but also to factors such as irregular menarche, improper diet, intensity and volume of training and mental stress. It has been noticed that gymnasts use unsafe diets for the body mass reduction, or they have improper diet in their intention to reduce the body mass and fat tissue, risking getting "female triad": diet disorder, amenorrhea and early osteoporosis.

Rhythmic gymnastics can be classified into sport branches with a high risk of bone and muscle system injuring. Rigorous diets, typical for rhythmic gymnasts, are counter productive for expressing requests in body composition of gymnasts. Furthermore, calories restrictions and great deficiency of energy can, among other things, provoke the negative effects on the competitive abilities.

Health risk for gymnasts exists also in the motor area. This is an extreme mobility, especially of the spine column and pelvic girdle. Hyperextension of the spine column, as well as, hyperextension and hyper abduction in the hipbone joint, bear risks of injuries that arise due to individual motions or, which is even more often, due to micro trauma or extensive repetition of certain motions and positions. Many authors speak about it, make researches and give warnings.

Gymnasts of the American national team often complain about the pain in the back, says the orthopedist. Most often, this is a consequence of a great volume of work and it is related to hyperextension. He noticed that these complaints come after certain motions and positions especially when they are performed in hyperextension.

In relation with this, there is a problem of spondilosis. It has been discovered that 11% of gymnasts has spondylosis, which is four times more than in people who are not athletes. Even higher percentage was found in ballet dancers. The percentage of ballet dancers who suffer from spondylosis is 15%-20%.

There is another problem related to mobility, which has been established in the research of model ones, and this is the asymmetry in mobility of pelvic girdle. It is supposed that there is uneven abductor strength of the left and right part of body in some gymnasts, which should be followed and examined. This asymmetry can lead to the disbalance of pelvis and total or compensatory scoliosis in the lumbal part of spine.

"High-level sport has no price". But, let us remind once more that, in order to achieve the highest results, rhythmic gymnasts must start training very early, in the pre-school period. They are immediately submitted to the demands of hyperextension and reduced body mass and fat tissue. Consequences which can happen due to improper diet and improper training can be disastrous for their health and life. The girls have not enough information about these problems, so it is not their responsibility for possible sacrifice for the sake of competition success. Training in the initial stages has to be adjusted to the age characteristics and to support the overall development of organism. It is possible to achieve that by and adequate representation of general preparation during exercises, as a counterweight to premature specialization.

Beside the highly professional work, in this sense, it is necessary to have serious and constant cooperation with the doctors, nutritionists, orthopedists, psychologists, as well as the education of trainers, gymnasts and parents. It is essential to emphasize the importance of good habits in gymnasts' diet, strict adherence to the given diet and parents intermediation. The risks in RG were increased by the change of model characteristics (body composition, mobility). In relation to this, many questions have been imposed. Whether those changes, which enabled performing of heavy and complex exercises, withheld the beauty in rhythmic gymnastics? Whether extreme mobility and bone morphotype, satisfy the esthetic criteria on which this "female sport", exceptionally useful and above all appealing, has been based.

Probably the stated phenomena were some of the reasons for the reduction of large membership in rhythmic gymnastics and for finding new gymnastic and similar female sport disciplines: aerobic gymnastics, fitness etc. where esthetic and musical qualities are being cherished and in which the natural forms of movement are modified. In this respect, these disciplines are closer to and more accessible to wider female population and finally, as its goal, have forming of a healthy and happy individual.

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