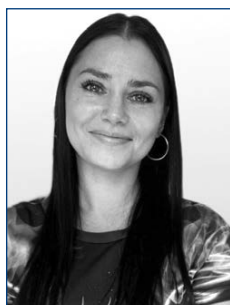




Elements of rhythm in apparatus movements: training gymnasts

UDC 796.412.2



PhD, Associate Professor **A.A. Suprun**¹

Dr. Hab., Professor **E.N. Medvedeva**¹

N.Yu. Vlasova¹

PhD, Associate Professor **V.V. Borisova**²

¹Lesgaft National State University of Physical Education, Sport and Health,
St. Petersburg

²Tula State Pedagogical University Lev Tolstoy, Tula

Corresponding author: aleksandrass@mail.ru

Received by the editorial office on 15.07.2024

Abstract

Objective of the study was to based on the evaluation of the impact of electrical stimulation of the primary muscle groups and the kinematic characteristics of movements during the execution of technical maneuvers with an object to music with varying rhythmic patterns, we aim to determine the focus of subject training in rhythmic gymnastics.

Methods and structure of the study. To investigate the mechanics of motion in elite athletes (n=12), we employed the Qualisys optoelectronic system, which includes the Qualisys Track Manager (QTM) software.

Results and conclusions. The findings of the research allowed us to pinpoint the areas of focus for subject training in order to develop the rhythmic abilities of athletes at various stages of long-term training in rhythmic gymnastics. The focus of subject training for mastering the tempo-rhythmic structure of movements of an object, based on the identified factors that influence them, will be: enhancing coordination abilities, improving inter-muscular coordination, increasing the level of subject, musical, motor, and compositional preparedness of athletes, utilizing the subject as a means to create an image in the composition of gymnasts, and achieving high performance in competitive activities through proficiency in the majority of technical elements of the all-around.

Keywords: *artistic gymnastics, rhythm, tempo, motor expressiveness, biomechanical indicators, model characteristics.*

Introduction. Among all coordination abilities, rhythmic ability is one of the leading ones for achieving maximum sports results in rhythmic gymnastics, and different components of tempo-rhythmic characteristics of movement are significant for movements of both the body and the object [1, 5]. It is known that this type of coordination abilities is largely determined by the hereditary level of human inclinations, but if targeted development of rhythmic abilities is applied in the most favorable age periods, it is possible to achieve an increase [2]. However, there are few modern research works in this area, and the issue of the most appropriate ratio of means and methods for developing a sense of rhythm [3] in rhythmic gymnastics remains insufficiently studied.

Progressive development of rhythmic gymnastics poses more and more complex tasks for athletes to create not only technically virtuosic, but also emotional, bright, internally meaningful, musically convincing compositions with objects [4]. In accordance with the requirements of the European Gymnastics Standards and the rules for the sport of

rhythmic gymnastics, when performing competition programs of various disciplines, judges evaluate program components according to a number of criteria, many of which are related to the manifestation of a sense of rhythm, namely: specific elements of the apparatus, coordinated with specific accents/phrases or dynamic changes in the music to create a visual impact, expression of the character and rhythm of the music.

Objective of the study was to based on the evaluation of the impact of electrical stimulation of the primary muscle groups and the kinematic characteristics of movements during the execution of technical maneuvers with an object to music with varying rhythmic patterns, we aim to determine the focus of subject training in rhythmic gymnastics.

Methods and structure of the study. To study the kinematics of movements of highly qualified female athletes (n=12), the Qualisys optical-electronic hardware-software complex with the Qualisys Track Manager (QTM) software was used. The electrical activity of muscles was recorded during video filming



of the combinations of work with an object to musical accompaniment with different rhythmic patterns in laboratory conditions and was recorded using surface (skin) electrodes (using a modern 16-channel electromyograph «MegaWin ME 6000» (Finland, 2008), and the obtained data were processed using a special computer program «MegaWin»). The accuracy of hitting the rhythm with the ball and hoop when performing technical work to different rhythmic patterns in different phases of movements was analyzed. Based on the data, features of the quality of the implementation of motor programs in each of the phases of movements were identified.

Results of the study and discussion. Technical actions with an object are caused by muscle tension of the musculoskeletal system, acting within a certain limited space and time. Any rhythmic error in working with an object will be a consequence of a poorly calculated relationship between the force of a given movement and the corresponding measure of time and space. It is necessary to know exactly what degree of force should be applied to a given proportion of time and space.

In this regard, a study was conducted aimed at determining the factors that determine the tempo-rhythmic characteristics of the movements of female athletes with an object. To solve this problem, the degree of influence of electrical activation of the main muscle groups, kinematic

parameters of movements on the accuracy of reproduction of the rhythmic pattern when performing technical actions with an object to music was identified (Table 1).

It was determined that a greater number of factors determining the complexity of accurately hitting the rhythm with an object manifest themselves when performing a starting movement. Thus, when rolling the hoop across the hands, out of 75 factors studied, 26,83% determine the accuracy of rhythm reproduction in the starting action. This is primarily due to the physical properties of the object. When performing the hoop «spinner», it is also difficult to reproduce the rhythmic structure of its movement to get into the rhythm, since until the end of the rotational movement of the hoop in the vertical plane around the neck («spinner»), it is in an unsupported position. In this regard, getting into the rhythm in the final phase depends on the initial phase of performing the hoop «spinner», as indicated by 24,1% of the factors of the influence of electrical activation of the main muscle groups and kinematic parameters of movements on the accuracy of reproducing the rhythmic pattern when performing technical actions with an object to music (Table 2).

Another technical element of the object that is difficult to reproduce its tempo-rhythmic structure is the «eight» of the ball. The degree of influence of electrical activation of muscles and kinematic parameters of

Table 1. The degree of influence of electrical activation of the main muscle groups, kinematic parameters of movements on the accuracy of reproduction of the rhythmic pattern when performing technical actions with an object to music

Rhythmic groups	Rhythms	Tempo	Working with the subject	Degree of influence, %
Dicyledonous size	Simple Rhythms, No. 6 «The Doll's Disease»	Slow	Small circle with hoop in front plane in front of hand	11,40
			Small circle with hoop in front plane behind hand	10,46
			Beginning of long roll of hoop over arms and chest	17,22
			Ending of long roll of hoop over arms and chest	21,27
			Throwing ball from behind back in horizontal plane with left hand of ball over arms and back	19,92
			Catching ball on right with right hand	15,86
			Beginning of long roll of ball over arms and chest	15,86
			Ending of long roll of ball over arms and chest	3,70
	Rhythmic group eighth-two sixteenths No. 17 «Neapolitan song»	Fast	1 phase of long roll of hoop on arms and back	26,70
			2 phase of long roll of hoop on arms and back	18,57
			Throw hoop in horizontal plane with elbow from left to right	18,57
			Catch hoop with left hand	32,08
			1 phase of roll of ball on arms and back	7,76
			Roll of ball on arms and back	21,03
			3 phase of roll of ball on arms and back	17,22
Throw of ball from behind back	17,22			



Table 2. The degree of influence of electrical activation of the main muscle groups, kinematic parameters of movements on the accuracy of reproduction of the rhythmic pattern when performing technical actions with an object to music

Rhythmic groups	Rhythms	Tempo	Working with the subject	Degree of influence, %
Tripartite size	Simple Rhythms №3 «Playing Horses»	Fast	Phase 1: rotate the hoop around the neck from right to left with a forward movement, arm bent	10,46
			Phase 3: rotate the hoop around your neck at your right shoulder, bend your right arm and take the hoop	23,97
			Passing the ball from the left hand to the right hand, wrapping it around the right hand	13,16
			Throwing a ball from the elbow joint	14,51
			Catching the ball with the left hand	7,76
	Dotted «German Song»	Moderate	Twist the ball inwards and downwards to the side with the right hand	26,68
			Twist the ball outward on the horizontal line to the side	33,43
			Twisting the ball on the body line (vertical) outward and upward	22,62

movements on the accuracy of reproducing the rhythmic pattern when performing technical actions with a ball to music is 33,73%.

Moreover, in all its phases and especially in the phase of twisting the ball on the horizontal line outward to the side. The accuracy of rhythm reproduction directly depends on the speed of movement of the shoulder anatomical point in the first phase of the «eight» of the ball – twisting the ball inward down to the side with the right hand (the correlation coefficient is 0,58). Thus, 26,98% of factors determine the accuracy of reproduction of the tempo-rhythmic structure of the ball in this phase. Accordingly, the rhythmic structure of this type of work with the object will be one of the most complex. And 32,38% will depend on the influence of electrical activation of the main muscle groups and kinematic parameters of movements on the accuracy of reproduction of the rhythmic pattern, especially when catching the object with the left hand.

The accuracy of reproduction of the rhythmic structure of the movements of the apparatus is also affected by the tempo to which the rhythmic pattern must be reproduced. It is always easier to reproduce movements of the apparatus at a fast tempo with a uniform rhythm. When performing work with the apparatus to slow music, the gymnast will most often either hurry or be late, or make incorrect accents; only a high level of technical mastery of the apparatus allows one to maintain a slow tempo and convey the changing rhythm of the musical piece with the apparatus.

Conclusions. The focus of the subject training for mastering the tempo-rhythmic structure of the subject's movements based on the identified factors that determine them will be: increasing the level of coordination

abilities; improving intermuscular coordination; increasing the level of subject, musical-motor and compositional preparedness of female athletes; using the subject as a means of creating an image in the gymnasts' composition; achieving high efficiency of the gymnasts' competitive activity through free mastery of the absolute majority of technical elements of the all-around.

References

1. Bepalov B.I., Leonov S.V. Diagnostika chuvstva tempa i odnovremennosti dvizheniy u sportsmenok v sinkhronnom plavanii. Uchenyye zapiski universiteta im. P.F. Lesgafta. 2008. No. 8 (42). pp. 12-17.
2. Gorskaya I.Yu., Shkred M.D., Baymakova L.G. Effektivnost razvitiya ritmicheskikh sposobnostey u yunyx legkoatletov. Sovremennyye voprosy biomeditsiny. 2021. Vol. 5 (4). 277 p.
3. Kuznetsova L.V., Zhgun E.V. Razvitiye chuvstva ritma v figurnom katanii na kon'kakh na etape nachalnoy podgotovki. Integratsiya nauki v usloviyakh globalizatsii i tsifrovizatsii. Proceedings of the XIII International scientific-practical conference. Part. 1. Rostov-on-Don, 2021. 181 p.
4. Medvedeva E.N., Suprun A.A., Kivikharyu I.V., Vlasova N.Yu., Pivovarova E.A. Vliyaniye tempo-ritmicheskikh kharakteristik dvizheniy sportsmenok na kachestvo vypolneniya elementov s predmetami v khudozhestvennoy gimnastike. Uchenyye zapiski universiteta im. P.F. Lesgafta. 2020. No. 6 (184). 237 p.
5. Shcherbina N.N. Printsip «dinamicheskogo nasyshcheniya» ritmicheskoy struktury sportivnykh uprazhneniy. Belgorod: Logiya publ., 2009. pp. 171-172.