Justification of the need to concretize the ways of mastering combined elements in rhythmic gymnastics

Suprun Alexandra Alexandrovna
Candidate of Pedagogic Sciences, Associate Professor,
Medvedeva Elena Nikolaevna
Doctor of Pedagogic Sciences, *Full Professor,*
Chebykina Ksenia Vladimirovna
Master
Lesgaft National State University of Physical Education, Sport and Health, St. Petersburg

Abstract. The methods of mastering the combined elements in rhythmic gymnastics are primarily due to the content of the technique of their implementation. The characteristics of the latter are biomechanical parameters of movement, which predetermine coordination difficulties, as well as the degree of manifestation of physical qualities and abilities. In this case, in accordance with the laws of maintaining balance, the area of support, the height of the overall center of gravity, the lever of the retracted link, the amplitude of the element, the deviation of the body from the vertical, the direction of the working leg during the transition from one element to another, etc. are objective indicators of the difficulty of completing the second element. All of the above factors must be taken into account when mastering the combined elements.

Keywords: combined elements, performance technique, kinematic characteristics, competition rules, rhythmic gymnast.

As in many other sports, competition rules in rhythmic gymnastics change every four years, after the games of the Olympics. A new cycle of development of the sport begins, designing the process of training gymnasts and updating the content of their competitive programs. The analysis of the international rules for rhythmic gymnastics from 2000 to 2020 showed that in the process of long-term cyclicality there have been significant changes in the requirements for the content of competitive programs [2 P.215]. Significant changes in the requirements for the quantitative and qualitative content of competitive programs have made adjustments to their compositional structure. And since, according to the current competition rules, the combination of series of elements has not been evaluated since 2009, the number of elements in one type of all-around from 30 elements (2000) decreased to 9 elements (2021), competition programs until 2019 contained mostly isolated elements. However, the constant complication of competitive compositions is one of the most important trends in the development

of rhythmic gymnastics. In this connection, at large tournaments, athletes become prize-winners who accurately perform the most difficult original compositions, in which the composition of 2-3 elements of increased difficulty began to be included more and more often [1]. In this connection, a tendency was revealed to increase the difficulty of competitive compositions with various objects based on the inclusion of combined elements from one structural group such as "jump + jump", "balance + balance", "turn + turn" into the exercise. The analysis of the competitive activity of highly qualified gymnasts showed that only individual gymnasts include in their competitive compositions combined compounds, consisting of elements of high difficulty of various structural groups such as "turn + jump", "turn + balance", "jump + balance" or "tilt + jump "," tilt + balance "and" tilt + turn". Thus, the aim of the study was to concretize effective methods of technical training, taking into account the factors that predetermine the quality of mastering the combined elements in rhythmic gymnastics.

To study the methods of mastering the combined elements in rhythmic gymnastics, used in the modern practice of rhythmic gymnastics, a survey of specialists was conducted. The survey found that:

- the inclusion of combined elements in competitive programs increase the entertainment of the compositions (100%). At the same time, first of all, elements that include turns (81.8%), in second place are jumps and balances (9.1% each);

- first of all, the choice of elements by coaches for mastering mixed elements is the physical and technical readiness of gymnasts to perform them (65.2%);

- it is preferable to combine elements of only one structural group (balance + balance, turn + turn, jump + jump) (85%); the most rational combination of elements from different structural groups is jump + balance and turn + balance;

- from the table of structural elements of the rules of competitions in rhythmic gymnastics 2017-2020, coaches believe that it is more effective to combine those elements that gymnasts perform in their competitive compositions and do them at a high technical level (67%); 13.2% - believe that gymnasts will cope with such elements as combining elements with a value of 0.1 - 0.3 points. For gymnasts of the stage of higher sportsmanship, in order to gain the highest difficulty of the exercise, coaches prefer a combination of elements of increased complexity, that is, from 0.5 points and more (12.1%);

- selecting the technical work of the subject during the performance of the combined elements, the respondents are guided by the direction of the subject in relation to the element being performed (34.1%); 37.3% - focus on the plane of the object and 28.6% - focus on the axis of the element;

- errors when performing combined elements: fuzzy and not fixed form of one of the elements + error when moving from one element to another (49.3%); then follows - support on the heel during balance during the transition to another element + sliding movement during the element (32.8%); the axis of the body is not in a vertical position or at the end of the element 1 step + bouncing during the element is made (17.9%).

The results of the survey revealed the need to search for more effective ways of mastering the apparatus work combined with difficult coordination in rhythmic gymnastics. Thus, there is a contradiction between the need to master the combined elements at the present stage of the development of rhythmic gymnastics and the lack of guidelines for the content of technical training, on the other hand, in coaching practice.

In this regard, a correlation analysis was carried out aimed at specifying the objective factors that determine the technique of performing the combined elements.

Thus, various degrees of relationship between the kinematic characteristics of the combined elements balance + turn and jump + turn were revealed. For the analysis, on the basis of pedagogical observation, isolated elements in competitive compositions with the highest value, which are most often performed by athletes, were selected: step jump; balance "Italian fouette"; leap anturnan touching; front horizontal balance with an amplitude of at least 180°; rear vertical balance with an amplitude of at least 180°; turn of the fouetté; balance of attitude; turn in the position of rear horizontal balance; back balance on the toe of one leg with a backward tilt of the other forward and upward with an amplitude of at least 180°.The Kinovea licensed program was used to study the kinematics of movements by individual body segments using the method of non-contact analysis of video sequences of movements. The following indicators were determined: the duration of the execution of the first and second forms of the element in the phase of realization of movement and the transition between them (t, s); ankle angle (ے°); knee joint angle (ے°); angle of the hip joint (ے°); angle of the hip joint (thigh and body (ے°)). The technique of execution of the listed elements was assessed with the help of an expert assessment, deductions in points were applied according to the FIG rules 2017-2020. The study involved 6 highly qualified athletes from Lesgaft National State University of Physical Education, Sport and Health.

During the correlation analysis of the kinematic characteristics of the combined element jump + balance, it was revealed that the duration of the jump in the implementation phase affects the angle of flexion in the knee joint upon landing (r=-0.89), i.e. the duration of the jump determines the quality of its execution and, as a result, the correct landing, contributing to the transition to another element (balance) without additional auxiliary actions, the return to balance is carried out due to extension in the knee joint. Maintaining a dynamic posture in the

implementation phase when performing jumps will contribute to the correct position of the body in space during the transition to the implementation of the next element, as the relationship between the angle of the kinematic chain trunk-pelvis-thigh was revealed both in the jump and in the position of transition to balance, then is at the moment of landing (r=0.83). The gymnast's actions during the transition from a jump to the next balance, to a large extent determine the quality of its implementation. For example, when performing the transition from a step jump to the Italian fouette balance, the following correlations were found: the angle of flexion in the knee joint upon landing has a relationship with the duration of the Italian fouette (r=-0.83) and the work of the ankle joint during its implementation (r=0.87) (table 1).

Table 1 – The relationship between the kinematic indicators when performing the combined element: step jump + balance "Italian fouette" (n=6)

		Transition						Form II					
		1	2	3	4	5	6	1	2	3	4	5	6
Form I	1	0.14	-0.60	**-0.89**	-0.20	-0.71	0.50	0.54	-0.66	0.70	0.20	0.26	0.03
	2	0.81	-0.04	-0.47	0.1	-0.44	0.51	0.50	-0.44	0.76	0.41	0.76	-0.39
	3	-0.44	-0.27	0.27	-0.36	0.64	0.51	-0.64	0.30	0.01	0.64	-0.21	0.64
	4	-0.16	-0.79	-0.27	0.07	0.24	0.51	0.01	-0.24	0.41	0.67	0.07	**0.90**
	5	0.65	0.37	-0.26	0.26	-0.60	0.50	0.54	-0.3	0.24	-0.26	0.43	-0.66
	6	0.50	0.50	0.50	0.50	0.50	1,00	0.50	0.50	0.51	0.50	0.50	0.61
Transition	1							0.37	-0.14	0.67	0.31	**0.94**	-0.31
	2							-0.49	0.71	-0.53	-0.43	-0.03	-0.49
	3							**-0.83**	**0.87**	-0.67	-0.14	-0.26	0.03
	4							0.60	-0.60	-0.10	-0.09	-0.14	0.20
	5							**-0.89**	**0.83**	-0.30	0.31	-0.03	0.371
	6							0.50	0.50	0.51	0.50	0.50	0.61

Note: 1 - t (sec); 2 - Ankle joint (ے°); 3 – Knee joint (ے°); 4 - Hip joints (ے°); 5 - Hip joint and body (ے°); 6 - Execution penalty (points); tcr. = 0,85 (p<0,05)

A long transition is usually associated with additional compensatory actions and, as a result, the athlete does not show the amplitude of balance movement to the proper degree - the element may not be counted (the correlation coefficient between the duration (s) and the angle in the hip joint is 0.94).

A similar tendency can be traced when performing a step jump in conjunction with back balance on the toe of one leg with a backward tilt, the other forward and upward with an amplitude of at least 180°. In this connection, the methodological foundations for the implementation of the combined element should be based on the technique of performing the transition from one element to another (table 2).

Table 2 - Methodological foundations for performing a combined element: a split step jump and back balance - on the toe of one leg with an inclination backward, the other forward and upward with an amplitude of at least 180°

Leap	Element	When jumping with a step forward from a short "explosive" takeoff run, the left/right is repulsed,

step	description	sending the free leg (right/left) forward and upward as if jumping over an obstacle. In flight, the angle of separation in the hip joint is 180°.
	Basic element execution basics	The push-off by the supporting leg during such jumps does not have a pronounced stopping character, the supporting leg is placed on the floor from the toe and then gently lowered "roll-over" over the entire foot. At the beginning of repulsion, the shoulders do not lean back, but rush forward. Hand swing movements are relatively free in nature and depend on the external design of the jump. They are directed in the direction of departure. In flight, the jump position is fixed. Landing occurs on the swinging leg, with pronounced shock absorption and maintaining forward movement. The quality of this element is moderately dependent on the electrical activity of the transverse abdominal muscles, the quadriceps femoris of the swing leg and the gluteus maximus muscle. When taking off, the greatest indicators of electrical activity were recorded in the rectus muscle of the left thigh, this is due to the implementation of the repulsion of the left leg from the support to ensure flight form. In the implementation phase, the highest indicator of electrical activity was recorded in the trapezius muscle of the left side of the body. This is due to the demonstrated form in flight, in all the jumps listed there is a tilt or turn of the left side of the body.
Back balance - on the toe of one leg with a backward tilt of the other forward and upward with an amplitude of at least 180°	Element description	From a stand on toes, hands above, one step on the toe, swing the other forward. When the swinging leg reaches shoulder level, the torso begins to tilt back until the toes touch the heel of the supporting leg. In this case, the swinging leg continues to swing, reaching the maximum amplitude
	Basic element execution basics	The moment the maximum amplitude is reached should coincide with the lowest point of the slope. Without lingering in the tilt position, the rise of the body immediately begins. In this case, the free leg, slightly lowering, adheres and remains at the level of the head after lifting the body, and then relatively slowly put on the half-toes to the supporting leg. Due to the backward bend, the overall center of gravity, the gymnast is located as low as possible, the angle of stability increases and the likelihood of imbalance decreases. When performing back balances, the tension of large muscle groups of the body is especially great.
Moving from one element to another	Technique of transition from one element to another	Coming to the support, it is necessary to soften the landing. Landing begins with a toe, and immediately, with tension, the lowering goes to the entire foot, and then the supporting leg is sequentially bent in the knee and hip joints. The cushioning is combined with a downward movement of the arms. Soft sequential bending of the body on the support reduces the negative acceleration that occurs when it comes to the support, and thus sharply weakens the impact. After depreciation, a transition is made to the execution of the next element in this chain of movements. In this case, the last phase of the jumping movement becomes the phase of preparatory actions for balance. After landing from a jump step onto the supporting right/left, straightening the supporting one and carrying the swing (left/right) "opening" and lowering the arms, there is a transition to a position close to vertical rear balance, without bending back. in the future, straightening and raising the leg higher and higher (and compensatory bringing the pelvis forward),
	Muscles that provide the transition from one element to another	At the final stage of the jump with a “split step”, the highest indicator of the average amplitude of turns of electrical activity was recorded in the rectus femoris muscle of the right leg. The reciprocity of pairs of muscles "straight femur and biceps", as well as "anterior tibial and gastrocnemius", "straight femur and gluteal", in accordance with the motor task solved at the stage of amortization, should have values slightly exceeding the norm (16%). When reaching balance, the muscles of the hip flexors of the moss leg, the muscles of the back, the muscles of the lower leg and the thigh of the supporting leg are most actively involved in the movement.

Balance and pivot should also be done together, without additional steps. It is rational to perform "force" on a turn from the front balance by swinging motion forward across the side. Qualitatively, the fulfillment of the first element, in this case the balance of "attitude", determines the rational transition to the turn. The following relationships were revealed: there is a high relationship between the angle of the ankle joint in the implementation phase and the angle in the ankle joint at the time of transition to the turn (r=9), which determines the quality of its performance (r = -0.82); there is also a relationship between angle in the hip joint in the "attitude" position and are rational by the transition to the turn (r=0.81); timely swinging movements during the transition to the turn, without lowering the hip, contribute to accurate reproduction of the amplitude of motion in the hip joint in the turn (not less than 180°) (r=0.81) (table 3).

Table 3 - The relationship between the kinematic indicators when performing a combined element: balance "attitude" + rotation in the position of the rear horizontal balance with an amplitude of at least 180° (n = 6)

		Transition						Form II					
		1	2	3	4	5	6	1	2	3	4	5	6
Form I	1	0.04	0.09	0.69	-0.31	-0.37	0.26	0.09	0.21	0.67	0.61	0.21	**-0.92**
	2	-0.41	**0.90**	0.67	0.41	-0.78	**-0.82**	-0.39	0.32	0.50	0.41	-0.62	-0.07
	3	0.37	0.36	0.40	-0.03	-0.53	0.34	-0.57	-0.05	0.75	0.79	0.28	-0.63
	4	0.35	-0.36	0.16	-0.53	0.09	**0.81**	0.05	-0.18	0.33	0.47	0.56	-0.70
	5	-0.67	0.16	0.36	-0.26	0.03	0.00	-0.36	-0.05	0.17	0.81	-0.38	-0.11
	6	-0.37	-0.02	-0.52	0.03	0.42	-0.32	-0.03	-0.42	**-0.80**	-0.47	-0.49	1.00
Transition	1							-0.12	0.05	0.33	-0.17	**0.81**	-0.37
	2							-0.34	-0.02	0.41	0.29	-0.62	-0.02
	3							0.15	0.04	0.49	0.39	-0.47	-0.52
	4							-0.58	0.75	0.44	0.05	0.19	0.03
	5							0.26	-0.18	-0.70	-0.30	0.24	0.42
	6							0.00	-0.23	-0.02	0.15	0.78	-0.32

Note: 1 - t (sec); 2 - Ankle joint (∠°); 3 – Knee joint (∠°); 4 - Hip joints (∠°); 5 - Hip joint and body (∠°); 6 - Execution penalty (points); tcr. = 0,85 (p<0,05)

Thus, one of the ways to master the combined elements in rhythmic gymnastics is the high-quality implementation of the transition from one element to another. In the methodology for mastering the combined elements in rhythmic gymnastics, first of all, complexes of means for strengthening the ligaments in the hip joint should be included, since the elements in the ligament are most often performed in different planes and directions; leading combined exercises combining small jumps with balances and turns, due to the need to prepare the knee and ankle joint for landing and entering the element.

References

1. Gorokhova, V.E. Special physical training of gymnasts to perform a series of elements of increased difficulty.: abstract diss. cand. ped. sci/ Gorokhova V.E.; RSUPESYT. - M., 2002. - 26 P.

2. Medvedeva, E.N. Justification of the need to regulate the development of jumping technique in rhythmic gymnastics // E.N. Medvedeva, A.A. Suprun, E. B. Kotelnikova // Scientific notes of the Lesgaft University. – 2018. – № 4 (158). - P.215-219.