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**THE EVALUATION OF INTERNAL FACTORS OF PERFORMANCE
CAPACITY THROUGH ALGORITHMICALLY LEARNING OF
TECHNICAL ELEMENTS WITH ROTATION IN TRANSVERSE AXIS IN
THE WOMEN'S ARTISTIC GYMNASTICS**

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The gymnastics has seen a considerable rise over the years. Analysis of major competitions in recent years highlights that, women's artistic gymnastics is developing continuously, especially in terms of increasing difficulty, complexity and vision it exercises, while perfecting the art and skill of execution. On the technical level, we can appreciate that being at an upper limit, the difference between two gymnasts equal in terms of technical performance, makes it the correctness of the execution and complexity of artistic level. Also, individualized training has a significant contribution in achieving the best results in competitions and achieving maximum performance.

Learning elements must be preceded by verification of the motor skills that condition the execution, and improvement requires means which lead gradually to the independent and creative execution, both of elements, as well and full exercises. Learning any technical element is carried out based on a biomechanical model, which includes the integration of multi-and cross-disciplinary information in several areas of knowledge.

The research is divided in three major parts:

Part I contains the theoretical aspects of the research and is structured in four major chapters. The research starts with a historical description showing the evolution of: artistic gymnastics, Code of Points, apparatus; and the factors that condition the attainment of performance.

In artistic gymnastics, performance is assessed through the results of competitions, as part of the development process-adaptation, learning, improvement in the level of physical, psychological, artistic, technical, functional touched at some point, and by the operational value of formative components, psycho-social that have brought the contribution to getting them.

The performance behavior depends on showing the structure and its forms, the nature and characteristics of the stimulus that causes it, but the peculiarities of the gymnasts too. Further, performance ability, as a result of a complex process of preparation based on internal factors (skills, attitudes, characteristics of functional activity and body structure) and harness the external factors (ambiance, the reference to the natural environment, technical-material and social), shall be assessed in the competition based on rigorous criteria established and known in advance.

The internal factors involved in women's artistic gymnastics and which have been studied in this work, have in center the coordination capacity because the analysis of the information in the literature with regard to the motor and psychomotor skills highlights the fact that different components of coordination and psychomotor capacity establish relationships of mutual conditioning that should be exploited in the process of training.

In this context, the learning process in general and the motor learning in particular, may not be effective if the gymnast, besides physical necessary support, his body consciousness, does not know its laterality, may not be situated in space, is not self-reliant during motor action, do not charge the appropriate pace of the correct execution, did not obtained sufficient coordination, safety and precision in his movements.

- a. For the vault apparatus, gymnast will focus primarily on a schematic representation that is a crucial component in the implementation of vault. In the same measure should be given proper attention and training education moral-volitional qualities among which we emphasize: courage, confidence in their own forces, will and perseverance, necessary for achieving outstanding results in sports activity.

The feature of "Handspring forward with 1½ tucked salto forward" vault that we study is the transverse axis rotation with 1½ tucked salto forward met in the second phase of jumping. Each phase is subject to certain requirements of mechanic, necessary in the execution of a jumping as close to perfection.

- b. For a very high level of preparation of the women's balance beam, it is compulsory to a morpho-functional integrity of the musculoskeletal system, a good joint mobility and muscle elasticity, and a very good neuro-muscular coordination.

The element "Free (aerial) walkover forward, landing on one foot" (Danilova forward) on beam, is an acrobatic element dynamically, classified in salto group that is found in most integral exercises to the balance beam and /or floor exercise and may be presented in many forms. According to gymnast skills, the coach can choose the basic variant (the one shown by us) with landing on one foot, or landing on both feet.

Rational training at this apparatus requires learning the technique as right from the beginning and to educate the sense of balance, considering the biomechanical principles.

To conclude the theoretical part, learning elements in women's artistic gymnastics should be preceded by verification of the motor qualities and psychomotor skills which condition their execution and improvement requires means which lead gradually to the independent and creative execution, both of the elements and full exercises.

Part II - contains the preliminary research focusing on the methodology of developing performance capacity by highlighting the fundamental elements of the methodology of preparing for artistic gymnastics performance (physical-technical report during each period of training, establishment of quantitative and qualitative indicators of the preparation, aspects of the organization of training and practice within them).

Preliminary research hypotheses were:

1. Participation to a large number of competitions at european and world level increases the possibility of obtaining some notable performances.
2. Effectiveness of training reflected in the number and value of the medals obtained by gymnasts in high-level competitions, cannot be assessed solely

in terms of quantitative indicators, the performance being multiple determined.

3. Implementation of an individualized training can lead to better use of the skills women gymnasts, issue materialized in the number of medals obtained in the individual apparatus finals.

The study is based on analysis of training planning documents of national team gymnasts. Get into the consideration that the training runs individualized, we analyzed personal data of four gymnasts, respectively two gymnasts from training period 2001 – 2004 and another two gymnasts from training period 2005 – 2008, and having as reference the dynamic results obtain in most important competitions.

The dynamic results obtain in competitions

Table nr.1 Results obtained during the Olympic cycle 2001 – 2004

COMPET. LEVEL	THE TOTAL NO. OF MEDALS	EDITIONS NO.
E.C	- 5 medals	1
W.C.	- 9 medals	3
O.G.	- 6 medals	1

The evolution of the results of the Romanian gymnastics team, both the individual and the homogeneity of the team, demonstrates that the preparation of the training focused on achieving sporting form in the most important competitions such as Olympic Games. Affirm this taking into account the low number of editions of the European Championships that we attended.

Table nr.2 Results obtained during the Olympic cycle 2005 – 2008

COMPET. LEVEL	THE TOTAL NO. OF MEDALS	EDITIONS NO.
E.C.	- 16 medals	4
W.C.	- 6 medals	3
O.G.	- 2 medals	1

The results highlight the attention far too high given to the European Championships, competition with low importance compared to the other two races to which we relate. In the period 2001-2004 gymnastics team participate at just one edition of the European Championship where he earned 5 medals including 4 gold. In 2005-2008 the Romanian team was present at four editions of .E.C, where he accumulated a total of 16 medals, of which only 3 gold. We believe that these differences are due to the different nature of the approach to the preparation in different periods of training (specially designed training) and on the other hand the objectives proposed for each competition.

1. The above results disapprove the *first hypothesis* according to which research the *participation to a large number of competitions at european and world level increases the possibility of obtaining some notable performances.*

After the analysis of training programs in the period 2001-2004 and 2005-2008, on the technique and physics training, made by the woman artistic gymnastics, at the four apparatus (vault, uneven bars, beam and floor) regarding the technical preparation and physical training we can affirm that training program during the 2001-2004 Olympic cycle had been directed and focused heavily on the fulfillment and realization of full exercises as correctly from technical point of view, these assessments have been developed as a result of the number of inquiries and competitions. This led the women's gymnastics team on the first step of the podium in the highest competitions such as Olympic Games.

In comparison, the preparation of the 2005-2008 was making the number of checks, at the number of full exercises in preparatory period and the attention given to the determination of the competitive effort in competitive period. There was too much emphasis put on developing physical support in all three periods of preparation and it was not respected during the recovery necessary for body, this has resulted in overload and automatically to a deviation from the best results obtained at Olympic Games.

All these data are coming *to confirm the research hypothesis*, according to which *preparation efficiency reflected in the number and value of the medals obtained by sports in high-level competitions cannot be assessed solely in terms of quantitative indicators, the performance of being multiple determined.*

Part III of the research involved the motor skills tests to assess some parts of coordinative ability and to select the six gymnasts who will accomplish the algorithmic program for those two elements; and biomechanics analysis in learning (appreciated by two tests - initial test and final test – where gymnasts are evaluated through notes).

The research hypotheses are:

1. Use of specific preparatory, in a proper dosage of particularities of women gymnasts, shortens the time affected for learning of the two elements that we study;

2. Use an algorithmic program based on the organization of the three series of exercises in the period of learning, may lead to a more faster and accurate learning of "Handspring forward with 1½ tucked salto forward" vault and element "Free (aerial) walkover forward, landing on one foot" (Danilova forward) on beam.
3. Biomechanical analysis of qualitative research in parallel with the use of video recording will promote the removal of technical mistakes and will lead the gymnast to achieve the model execution.

The results of the motor skills tests intended to evaluate certain components of coordinative ability: *the balance rail, Bass test, Fukuda test, the Miron Georgescu test, hands stand maintained and facial support maintained*, considered fundamental in learning demonstrated that the different level of motor skills of women gymnasts put their mark on learning of both technical elements studied.

Gymnasts who showed a high motor potential recorded the best results at the tests designed to assess the quality of execution of "Handspring forward with 1½ tucked salto forward" vault and "Free (aerial) walkover forward, landing on one foot" (Danilova forward) on beam.

Thus confirming the *first research hypothesis* according to which use of specific preparatory, in a proper dosage of particularities of women gymnasts, shortens the time affected for learning of the two elements that we study.

Thorough analysis of the biomechanical data allows more detailed conclusions outline, such as those related to the kinematic and the dynamic errors, which leads to and causes other errors. Through these examples, I actually wanted to highlight the usefulness and limitations of qualitative biomechanical analysis, which covers both analytic tool for finding and interpreting analytical way. Specifically in our case, *the gymnasts who took the two tests have managed to improve their evolution being very close to the evolution of the model gymnast.*

Research Conclusions

The data for the gymnasts at the end of the research shows that:

Women's artistic gymnastics performance represents a technical sports with spectacular combination, with simple elements or high complexity, that present a certain degree of difficulty and requiring women gymnasts body close to the limit.

The exercises of the competition must contain combinations of elements of static and dynamic force that achieves a reasonable balance of forces in time and space, but also elements of suppleness, flexibility and balance, resulting from the effect of conjugate plasticity, expressiveness and harmony of movement.

Individual training is mandatory both in terms of physical condition, as support of the entire technical-artistic accumulations, as well as in learning /improving performances by building on the internal factors of psycho-motor and of the external factors too (the ambient).

As regards the participation of women gymnasts at ***major competitions*** highlight the fact that ***not always the high density of them is generating progress***, through the accumulation of experience, because in some cases (2005-2008 Olympic cycle) can accumulate physical and mental fatigue, and as such the results are not as expected.

In artistic gymnastics, learning of any technical element is carried out based on a ***biomechanical model*** that includes the integration of multi-and cross-disciplinary information in several areas of knowledge and involves completing the following steps:

- a) decomposition of movement in components phase;
- b) identification of key joints and joint movements;
- c) determination of the agonists and antagonistic muscle groups involved in specific action in each phase;
- d) the identification of specific technical elements addressed (amplitude, force or muscular power);
- e) body alignment.

The high level of performance, constrained by the difficulty of technical performances, requires the use in training of modern technology designed to capture the movement from more angles, with all the kinematic and dynamic characteristics to duplicate the "eye" of coach and provide feedback in learning.