CORRELATION ANALYSIS OF INTEGRAL TRAINING IN 12-17-YEARS-OLD GYMNASTS

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Abstract: Correlational analysis materials made it possible to study the specific features of connection of various aspects of integral training of gymnasts with their sport and technical skills. The 20-order matrix was analyzed by the method of principal components, which includes individual indicators describing the training process of 12-17-year-old young gymnasts.

Key words: model, correlation analysis, factor analysis, physical development, test, physical training, technical training, control test, sport-technical skill.

КОРРЕЛЯЦИОННЫЙ АНАЛИЗ ИНТЕГРАЛЬНОЙ ПОДГОТОВКИ ГИМНАСТОК 12-17 ЛЕТ

Аннотация: Материалы корреляционного анализа позволили изучить особенности связи различных аспектов интегральной подготовки гимнасток с их спортивно-техническим мастерством. Матрица 20-го порядка анализировалась методом главных компонент, включающим индивидуальные показатели, характеризующие тренировочный процесс юных гимнасток 12-17 лет.

Ключевые слова: модель, корреляционный анализ, факторный анализ, физическое развитие, тест, физическая подготовка, техническая подготовка, контрольный тест, спортивно-техническое мастерство.

INTRODUCTION

In recent years, the modeling of the main aspects of skills and training methods has become widespread in the training control system of athletes. L.Y.Arkayev (1), Y.K.Gaverdovsky (2), V.N.Platonov (3) at the modern stage of development of high-performance sport models in the optimization of the training process believe that the time has come to develop graded interval patterns and training exposure programs in skilled athletes (5,7,8).

A model is a set of key indicators (4,7) that determine the achievement of a certain sports skill and predictable results. Individual indicators included in the model are considered as model features (5,7). Qualitative and quantitative indicators necessary for modeling are obtained through experience, testing, various experiences, expert assessments of experts, (5,6). Depending on the purpose of control, the following types of models are distinguished: basic, prospective, theoretical and mathematical. The basic model is a requirement that corresponds to the training of athletes for a certain period of time. A probabilistic model is a prediction of the possible outcomes of prize winners or winners. A theoretical model is a system of knowledge that describes and explains the generality of the phenomena of some aspects of physical training of athletes from a single point of view. A mathematical model is an equation, graph, etc. They are mainly based on the results of correlation, factor, regression and depression analyses (4,6).

In the research, a mathematical model of correlation and factor analysis of the physical fitness of promising young gymnasts is considered.

MATERIALS AND METHODS

1. Determining the preparation factor composition of qualified young gymnasts of

different ages. 2. To determine the influence of various aspects of preparation on the success of gymnasts' competition.

Organization of research. The study focused on training with 13-18-year-old candidate for a Master of Sport (CMS) and Master of Sport (MS) athletes who were promising and pre-Olympic competitors and in the stage of sport improvement was held in the form of Gymnasts were divided into three age groups: 13-14, 15-16 and 17-18. The test set includes exercises and tests describing physical, technical training, physical development and loads recommended by Y.K. Gaverdsky and co-authors (2).

In the first phase, the behavioral tests were checked for information, objectivity and reliability. The inspection showed their authenticity (quality). All special physical (MJT) and technical (TT) training tests have good to excellent levels of objectivity and reliability. Correlation coefficients range from 0.910 to 0.990.

The validity of individual indicators and tests of gymnasts by types of training varies significantly in different age periods. At the same time, the correlation between sports and technical results in gymnastics, which reflect their specific characteristics, is higher than in wrestling. Relative strength, physical and technical training and integral indicators of training loads are the most informative, and in general, it is said that a comprehensive approach is in favor of evaluating any physical fitness of gymnasts (Table 1).

Table 1 **Integral indicators of physical fitness assessment of gymnasts**

Intermediate indicators	Sport-technical results		
	13-14 years old	15-16 years old	17-18 years old
Relative strength	0,630	0,719	0,684
Physical preparation	0,946	0,518	0,873
Technical preparation	0,783	0,867	0,807
Training loads	0,661	0,715	0,767

Empirical (calculated) informativeness of the tests we used to evaluate physical and technical training complements meaningful (logical) informativeness, because they are part of the exercises included in gymnasts' competition programs, that is, the movements performed by the athlete in competitions.

RESULTS AND DISCUSSION

A correlational analysis was conducted to study the correlation between different aspects of physical training (physical development, physical and technical training and training loads) of gymnasts with their sports and technical skills. The sport-technical skill (CM) of promising gymnasts was evaluated with two indicators or two components. The first part is sports results (scores in competitions); the second part - technical training, which was evaluated by the number of learned elements of the highest difficulty group, pole vaults and similar exercises included in free programs in competitions, that is, performed in competition combinations. Data on 67 indicators obtained during preliminary research on promising gymnasts served as material for correlational analysis.

Physical development, sport-technical skill. Correlation analysis showed that a reliable relationship between physical development data and sports results in gymnasts aged 12-17 years was determined only for some types of gymnastic wrestling: body length results in breaststroke at

12-13 years old (0.344), 14-15 years old result on a horse with a long body (0.367), with Broc sleepy (-0.390), 15-17 years old result on a horse with body weight (0.392). In connection with sports-technical results and physical development, there are periods of decrease and increase of the correlation coefficient due to age-related changes and the influence of gymnastics. The relationship between the physical development and technical training of gymnasts is the most important in terms of both the number of correlation coefficients and the level of significance (0.433 - 0.587) at the age of 13-14. With age, the intimacy of the relationship decreases.

Technical training - sport results. The analysis of the research materials showed that the number of studied elements of the highest complex group (the group of extremely complex elements was not taken into account in the analysis, since each gymnast has a small number of them literally one) is reliably correlated . Almost all results in the shot put (0.576-0.897) in all age groups, with the exception of the evaluation of the vault (0.127), there is a significant tendency to increase the correlation coefficient with the age and skill of gymnasts: at 12-13 years old - on the horizontal bar and pommel horse, 14-15 and At the age of 16-17 years - on turnstiles and hoops.

The number of elements of the highest complex group included in the combination is significantly related to the scores in free exercise, pommel horse and rings in all age groups, and the number of pole vaults included in the existing and competition programs is related only to the vault scores. All four types of indicators of technical training have a reliable correlation with the sum of points in the fight. A high relationship between the integral indicator of technical training was found both in wrestling and in individual shots, and with the age of gymnasts, these relationships become closer.

Thus, it was determined that the sports-technical result depends on the level of technical training, that is, on the number of complex elements of the highest complex group included in existing and competition combinations. This dependence can be considered as follows: the greater the complexity threshold of gymnasts, the better they perform in competitions, and the more complex the competition programs, the higher the competition results. However, the difficulties of young gymnasts often arise at the expense of the quality of activity, especially at the stage of the formation of sports skills, because young gymnasts must constantly increase the number of elements in combinations and increase their complexity. The complexity of competition combinations and the instability of the number of elements can be explained by the low correlation coefficients.

The integrated result is the only indicator that should be taken into account when determining the level of technical training of gymnasts.

Physical preparation - sport and technical skills. The analysis of the relationship between the results of control exercises (tests) and technical results of special physical training in separate types of wrestling and all-around gymnastics showed that the tests reflecting the specific characteristics of work on the projectile are more effective in this type of wrestling. with high correlation coefficients. Speed and strength tests (20-meter dash, rope climb, and standing long jump) depend on voluntary exercises, vaulting, and hoops. Tests with dynamic and static strength are related to rings, bruce and horse; flexibility (sum of errors in performing 7 exercises) - voluntary and horse exercises; special endurance (number of laps on the horse) - results on the horse.

Correlations of individual tests with total wrestling scores are somewhat lower, but for the most part these relationships tend to be reliable or reliable. The highest correlation coefficients

between the integral indicator of special physical training and the sum of wrestling scores at the age of 12-13 are 0.946; 14-15 years old - 0.918 and 16-17 years old - 0.873.

More than half of the tests used have reliable relationships that are included in the combination of elements of the studied and highest complex group. An integral indicator of special physical training is associated with high correlation coefficients included in the combination of elements of the studied and highest complex group.

Thus, the validity of individual tests, as a result, the types of gymnastics, the size of the elements of the highest complex group studied and included in the combination changes depending on age. It was very difficult to choose which test was at which age. All age groups are approximately the same in terms of the number of reliable correlations and their level, but the tendency to increase the importance of this correlation with increasing age is still present, especially in tests related to strength training of gymnasts.

It should also be noted that not all of the tests we used were completed, so it is somewhat difficult to compare gymnasts by age.

Thus, the technical skill of gymnasts largely depends on the general level of special physical training.

The relative strength of the muscles is a sport-technical skill. It was found that the sports-technical result is closely related to the relative strength indicators. The number of reliable correlation coefficients increases with increasing age and qualification. The most significant correlation coefficients were found between sports performance and the relative strength of the muscles (0.727) that carry loads specific to gymnastics (extensive shoulder, anterior shoulder, extensor hip and flexor soles). The significance level of these correlation coefficients also increases with age. This increase is probably due to the increasing influence of strength training on the technical skill level of gymnasts.

The strongest connection with the technical skill of gymnasts was determined by the relative and absolute strength of the muscles.

Training load - sport and technical skills. The total amount of training loads is significantly related to the results of all gymnastic wrestling equipment (0.575-0.889), except for the pole vault results, where the correlation did not reach a reliable level in all age groups. In turn, the sum of points in the fight in all age groups also has a reliable relationship with the value of the activity performed in individual shells. Pole vaulting is also an exception. It is characteristic that with the increase of age and skill, the level of correlation coefficients between the amount of training load and sports performance also increases, especially in power-based projectiles.

The high correlation coefficients performed in the wrestling type of gymnastics are between the load and the assessment of this type. An additive (average) correlation was also determined when loading performed on one projectile affected the outcome on another projectile.

Thus, the amount of loading performed on the bruce affects the result on horses and rings; in voluntary exercises - jumping on the support; on the turnstile - in the rings.

Volume of specific physical training (MJT) is reliably correlated with almost all outcomes, except for pull-ups and jumps. The most significant relationship was found between the training load and the sum of points in the fight (0.797).

The technical training of gymnasts aged 14-17 years (in terms of the number of elements of the highest complex group studied and included in combinations) mainly depends on the volume of training loads in shells such as rings (ages 12-13 years); hoops, bars and turnstiles (14-17 years

old). The number of pole vaults included in existing and competition programs depends only on the amount of loading of this type.

Factor analysis. The method of principal components was used with rotation of appropriate reference axes according to the varimax criterion. Initially, 17-19 factors were identified in each group, then according to the results of correlation analysis, existing and repeated indicators were excluded. Out of 67 indicators, only 20 are left in each age group. By the method of principal components, the matrix of the 20th order has been analyzed. The analysis showed that the morpho-movement structure of promising gymnasts can be represented by four orthogonal factors; that is, the correlation matrix with the leading factors was obtained.

These factors account for 74-78% of the total sample variance. Each age group and sports qualification is characterized by a specific morpho-movement structure with a certain relationship between physical and movement abilities and factors that are the sports-technical preparation of prospective gymnasts. Important indicators that should be taken into account in the field of sport and can be used in the development of model characteristics were identified (Table 2).

The first factor (technical skill or training) contributes 26.9% to the total variance sample of 13-14 year old gymnasts. It includes high factor weights of technical training indicators of gymnasts with significant relationships with strength training (studied and included in the combination of elements of the highest complex group and sports results in both wrestling and all-around).

The first factor for gymnasts aged 14-15 is what we call the relative strength factor. Its contribution to dispersion was 32.9%. Here, high-factor weights have indicators of relative strength of the main muscle groups, significant speed-power qualities (running for 20 meters, etc.) and loads for special physical training.

In 16-17-year-old athletes, the share of the first factor is 28.4%. This is the load or activity factor. In addition, this factor with a high correlation included indicators of physical development and absolute strength.

Table 2 **Factor composition of physical fitness of gymnasts aged 13-18**

Factor №	**Factors**	**Contribution of the factor to the variance**	**Overall contribution**
12-13 years old (Level I)			
I	Technical preparation	**26,9**	**75,0**
II	Physical development	**16,5**	
III	Training load	**16,4**	
IV	SPT (+ ebdurance, proportion)	**15,0**	
14-15 years old (CMS)			
I	Relative strength	**32,9**	74,1
II	Technical preparation	**20,4**	

II	Physical development	**11.3**	
IV	SPT (+ load, proportion)	**9,5**	
16-17 years old (MS)			
I	Training load	**28,4**	**77,7**
II	Technical preparation	**20,2**	
III	Relative strength	**14.9**	
IV	SPT (+ elasticity, proportion)	**14,4**	

Among gymnasts of the first category, the share of the second factor corresponds to 16.5%. This is a factor of physical development of gymnasts, the basis of which is weight and height indicators.

The second factor among candidates for master of sport is what we call the factor of technical preparation and skill. Its weight is 20.4%. As mentioned above, by technical skill we understand the volume of technically complex movement skills in all-around types and the number of vaults, as well as the sports results shown by gymnasts in all-around and its separate types.

The contribution of the second factor to the total difference between sports masters was 20.2%. The highest factor weights are also indicators of the technical skill of gymnasts, and this factor is similar to the second factor identified in the training of gymnasts aged 14-15 (candidates of master of sports).

The third factor, with a weight of 16.4 in the total sample of 13-13-year-old Class I gymnasts, is more related to training loads than all-around events and gymnasts' total load. In addition, it includes indicators that indirectly describe sports performance, such as the vital volume of the lungs, chest circumference, etc.

At the age of 14-15, the third factor is interpreted by us as physical development. Its contribution was 11.3%. Weight and height indicators and body proportions of gymnasts of this age. Here, it was found that physical fitness, that is, strength, flexibility and speed-power abilities have a significant relationship with the test indicators.

Uchinchi omilning sport ustalarining umumlashtirilgan namunasiga qo‘shgan hissasi 14,9% ni tashkil qiladi. Biz buni gimnastikachilarning nisbiy kuch omili deb atadik. Bunga barcha asosiy mushak guruhlarining nisbiy kuchi va integral mezoni bilan statistik jihatdan muhim korrelyatsiyalar (korrelyatsiya koeffitsiyentlari) kiradi.

I toifadagi gimnastikachilar orasida to‘rtinchi omilning ahamiyati 15,0% ni tashkil etdi. Bu qo‘llar va yelkaning chidamliligi va kuchiga moyil bo‘lgan maxsus jismoniy tayyorgarlikning umumlashtirilgan omilidir. Gimnastikachilar tanasining nisbati bilan muhim bog‘liqlik aniqlandi.

Among 14-15-year-old gymnasts, the share of candidates for sports mastery of the fourth factor is 9.5%. We summarized it as a special physical education factor, even though it was planned differently. However, it is dominated by endurance, body strength and training loads according to MJT. The body ratio indicators of athletes reach a significant level.

The contribution of the fourth factor to the total variance pattern in highly skilled gymnasts aged 16-17 years was 14.4%. This factor can be called a special fitness factor with the advantage of flexibility weight. There is also a significant relationship with body proportions.

Table 3 **Indispensable indicators of training in gymnasts**

Physical abilities	The factor numbers		
	12-13 years old (Level I)	14-15 years old (CMS)	16-17 years old (MS)
Absolute strength	**5**	**3**	**2**
Relative strength	**5**	**4**	**3**
Static strength	**4**	**1**	**1**
Dynamic strength	**1**	**1**	**3**
Instant strength	**3**	**3**	**4**
Flexibility, mobility in the joints	**4**	**2**	**4**
Endurance (special)	**3**	**2**	**1**

Similarly, when determining the factor structure of physical fitness of young gymnasts, their main content was strength training tests. The factor composition of the physical fitness of gymnasts aged 12-17 is presented in table 3.

As we can see, the fourth factor is common in three age groups of athletes of different skills. This is a factor of special fitness and body proportions. Secondly, it is known that the physical abilities of gymnasts affect the performance. The length of the arms and body is related to the strength of the gymnast.

Instead of factor weights, the table shows the movement of factor numbers (positions) or changes in the importance of each factor with age and skill of gymnasts.

Thus, the factor structure of physical fitness of 12-17-year-old gymnasts (category I, SUN, SU) is determined by the following set of main factors:

- The factor of physical development;
- Relative strength factor;
- Technical training factor;
- Physical preparation factor;
- Load factor (activity).

A specific "model" of the structure of morpho-movement (factor) of physical (strength) and general training and correlations of each age group and different qualifications of gymnasts were determined.

Using the analysis of this factor allows you to purposefully organize the process of training

in gymnastics.

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