Research in Physical Education, Sport and Health
2020, Vol. 9, No. 1, pp.119-124
ISSN(Print):1857-8152; ISSN(Online):1857-8160

SUCESSFUL PERFORMANCE OF THE GYMNASTICS ELEMENT HIP CIRCLE BWD (HIPS TOUCHING BAR) ON THE HORIZONTAL BAR IN RELATION TO THE ANTHROPOMETRIS, MOTOR AND PSYCHOLOGICAL FACTORS

DOI: https://doi.org/10.46733/PESH20119124pg
(Original scientific paper)

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Abstract

For the purpose of this study, we have conducted a comprehensive research on 143 male students from the Faculty of Physical Education, Sport and Health in Skopje, N. Macedonia. Through 17 anthropometric measures, 29 motor tests and 8 helping tests to recognize the psychological characteristics, the structure of three subspaces is analyzed and their relations to the successful technical performance of the element - hip circle bwd (hips touching bar) on the horizontal bar. There are three anthropometric dimensions, eight motor factors and five psychological factors with analysis of the motor placement. A regressive analysis is used to define the relations between the isolated factors. From the used regressive analysis where the anthropometric system, system of motor factors and the system of psychological factors are used as predictors. The main criterion is the performance of the gymnastic element hip circle bwd (hips touching bar) on the horizontal bar while the predictors show important influence on the criterion. Many isolated factors of the three subspaces: morphological, motor and psychological influence the criterion.

Key Words*: sports-gymnastics, three subspaces, regressive, factor analysis*

Introduction

Sports gymnastics is a sport in which gymnastic elements are performed with a complex structure. From the analysis of the previous researches, one can notice that in the researches in sports gymnastics, the problem of determining the structure and the relations between the elements in one or two subspaces is most often treated between the motor abilities and anthropometric characteristics (Mitevski O.1984 and 2000, Pop Petrovski V. 1998, Spasovska K. 2008 and 2013,2016).

In some gymnastic elements, the success rate is determined by certain motor skills, which is confirmed in the research of Babiak J.1981, Mitevski 2005 and 2007, Pop Petrovski B.1997, Todorovski D.1997, as well as in the research of Spasovska K.2012,2013,2016,2020. Other gymnastic elements are greatly influenced by anthropometric variables (Pop Petrovski V.2005, Mitevski O. 2000, Spasovska K.2013).

In addition to the above factors, the cognitive and conative characteristics have a great influence on these more complex gymnastic elements with their structure (Petković, D. 1989, Madić, D. 2000, Todorovski D.2010, 2011, Lopes, GO, & Postigo, B. S 2013, Spasovska K. 2013,2020). Probably in many complex gymnastic elements, besides the influence of factors from the subgroups mentioned earlier, other abilities and human qualities will have an impact, keeping in mind that the factors that impact success in sports gymnastics are in mutual interrelationship and as such they would have impact of the results in sports gymnastics.

From the mentioned researches who deal with sports gymnastics, it can be noticed that a different number of measures and tests have been applied in a sample of respondents of different age and gender. Depending on this, a different number of latent factors are obtained that determine the latent structure in these three subspaces.

The purpose of this research is to determine the impact of the applied systems and the isolated and defined latent dimensions in the morphological, motor and psychological space of the successful technical performance of the gymnastic element hip circle bwd (hips touching bar) on the horizontal bar.

Material & methods

Example of variables and respondents

For the purpose of this study, we have conducted a comprehensive research on 143 male students from the first year of the Faculty of Physical Education, Sport and Health in Skopje, N. Macedonia at the age of 18 years +/- 6 months. The sample of variables are 17 anthropometric measures, 29 motor variables for the estimation of the right motor abilities, 8 tests for measuring of the psychological properties and the evaluation of the technical performance of the gymnastic element hip circle bwd (hips touching bar) on the horizontal bar.

Variables for Measuring the Anthropometric Characteristics

By the suggestions of the international biological program, many measurements have been done on the anthropometric measures which cover the hypothetical four-dimensional morphological space (Kurelik et al. 1975).

The following anthropometric variables are applied: appraisal of the longitudinal dimensionality of the body – 3 variables, appraisal of the transverse dimensionality of the body – 6 variables, appraisal of the circular dimensionality of the body – 5 variables and 3 variables for appraisal of the subcutaneous fatty tissue.

Variables for the Assessment of the Motor skills

When choosing the measuring instruments, the age of the respondents is taken into account just as the results of the past research and the recommendations from the authors who have researched this problem among respondents from the same or similar age to this research.

The tests for assessment of coordination: 3 variables for evaluating the coordination of the entire body, coordination of rapid complex movements and reorganization of the dynamical stereotype.

The test for assessment of explosive power: 3 variables for estimating the type of leaps and the type of ejection.

The tests for the assessment of repetitive power: 4 variables

To assess flexibility: 3 variables

The tests for the estimation of frequency of movements: 4 variables

The assessment of rhythmic movements: 3 variables

Variables for Assessing the Psychological Characteristics

Variables for examining the cognitive (intellectual) abilities

For the assessment of general intellectual abilities, the following variables are applied: 1. D 48, 2. PM

For the study of specific intellectual abilities, the following variables are applied: 3. F1, 4. F2, 5. S1

Variables for examining the cognitive (emotional) abilities

6. TAI – anxiety, 7. MOP - the test of the motive for general achievement and 8. EPQ - a modified version of the previous personality tests that measure every dimension of the personality with three scales (psychosis, extroversion, neuroticism).

Results

To determine the latent structure of the applied variables from the researched subspaces, a transformation of data with coefficients of correlation and factor analysis was made (the results of the factor analysis are kept by the author).

From the analysis of these methods in the motor space, three anthropometric dimensions have been examined and determined: 1. Subcutaneous adipose tissue factor, 2. Factor for transversal and circular dimensionality and 3. Factor of longitudinal dimensionality.

Eight motor factors are isolated and defined in the motor space: 1. Factor for performing fast and coordinated movements, 2. Explosive power factor – type of ejection, 3. Factor of repetitive power on the front of the trunk, 4. Factor of rhythmic movements, 5. Flexibility factor, 6. Explosive power factor – type of jumps, 7. Factor of frequency of movements, and 8. Factor for performing rapid and explosive movements in a certain rhythm.

Five psychological factors are isolated and defined in the psychological space: 1. factor of motive for general achievement, 2. factor of neuroticism or emotional instability mended by anxiety changes and significant negative emotional engagement in conditions of general achievement, 3. extroversion factor

accompanied by a low degree of social acceptability of the environment or dissemination, 4. factor of positive emotional engagement in conditions of general attainment accompanied by reactions to doubts, 5. factor of general and specific intellectual abilities or factor of the congenital psychological space.

According to the results of the regressive analysis (Table 1), it can be noted that the prediction system of the anthropometric characteristics is statistically and significantly related to the criterion, the hip circle bwd (hips touching bar) on the horizontal bar. Significantly, the negative and low individual influence of -23 on the criterion of the hip circle bwd (hips touching bar) on the horizontal bar switch was determined by the isolated anthropometric factor 1 (subcutaneous adipose tissue), as well as from -28 with the isolated factor 2 (transversal and circular dimensionality), while significant, low and positive .15 is related to the anthropometric factor 3 (longitudinal dimensionality).

Table 1 Regressive analysis of the anthropometric system and isolated anthropometric factors with the latent gymnastic criterion - hip circle bwd (hips touching bar) on the horizontal bar

	Beta	**Part-R**	**Tolerance**	**t(139)**	**p-level**
AFAK1	**-,23**	-,24	1,00	-2,96	**,00**
AFAK2	**-,28**	-,29	1,00	-3,56	**,00**
AFAK3	**,15**	,16	1,00	1,93	**,05**

Delta	**RO**	**DF1**	**DF2**	**F**	**Q**
.13	.39	3	139	8.38	.00

The system of motor factors is significantly and moderately related to the criterion variable (RO. 47). The 17% predictor system explains the variability of the criterion. The applied predictor system can predict the success of the criterion (Table 2). It can be noticed that in the regression analysis the motor factors MFAK 5 (flexibility) and MFAK 7 (frequency of movements) have a positive impact. While the latent motor factor 6 (explosive power factor-type of jumps) is on the threshold of importance. With these factors, it is possible to predict the successful performance of the gymnastic element – hip circle bwd (hips touching bar) on the horizontal bar.

Table 2 Regressive analysis of the motor system and isolated motor factors with the latent gymnastic criterion - hip circle bwd (hips touching bar) on the horizontal bar

	Beta	**Part-R**	**Tolerance**	**t(134)**	**p-level**
MFAK1	-,03	-,03	1,00	-,33	,74
MFAK2	,00	,00	1,00	,00	,99
MFAK3	,07	,08	1,00	,90	,36
MFAK4	,07	,08	1,00	,90	,37
MFAK5	,20	,22	1,00	2,60	,01
MFAK6	-,14	-,16	1,00	-1,88	,06
MFAK7	,36	,38	1,00	4,75	,00
MFAK8	-,14	-,15	1,00	-1,80	,07

Delta	**RO**	**DF1**	**DF2**	**F**	**Q**
.17	.47	8	134	4.73	.00

From the review of the regression analysis in Table 3, it can be seen that the predictor system of psychological factors is statistically significantly related to the criterion - hip circle bwd (hips touching bar) on the horizontal bar. Significant and low coefficient of partial regression of .23 criterion has with the latent psychological factor PFAK 5 (factor for general and specific intellectual abilities or factor of cognitive psychological space), while significant negative and low limit coefficient with partial regression from -18 criterion has with the latent psychological factor PFAK 2 (factor of neuroticism or emotional instability mended by anxiety changes and significant negative emotional engagement in conditions of general achievement). Based on these two psychological factors, the success of the criterion variable can be predicted.

Table 3 Regression analysis of the psychological system and isolated psychological factors with the latent gymnastics criterion - hip circle bwd (hips touching bar) on the horizontal bar

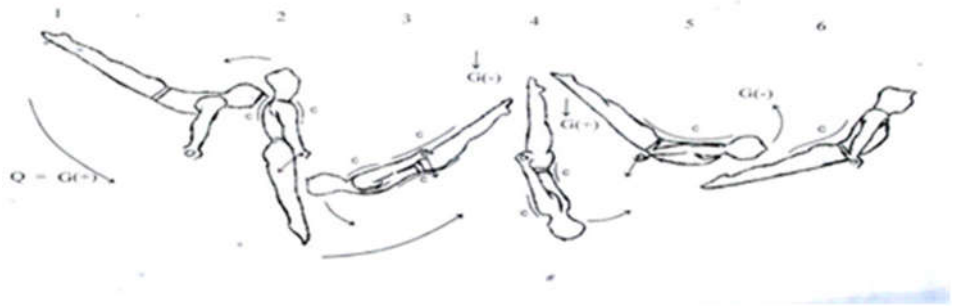
	Beta	**Part-R**	**Tolerance**	**t(137)**	**p-level**
PFAK1	,12	,12	1,00	1,46	,14
PFAK2	**-,18**	-,19	1,00	-2,24	**,02**
PFAK3	,01	,01	1,00	,10	,92
PFAK4	,08	,09	1,00	1,01	,31
PFAK5	**,23**	,23	1,00	2,79	**,00**

Delta	**RO**	**DF1**	**DF2**	**F**	**Q**
.07	.32	5	137	3.19	.00

Discussion

Hip circle bwd (hips touching bar) on the horizontal bar (Fig 1) is gymnastic element which can be applied in elementary and high schools, because the technique is relatively simple and does not require intermediate motor skills, which was confirmed in our research. For the eight isolated motor factors, only two MFAK 5 and MFAK 7 can make prediction on successful performance on the gymnastics element - hip circle bwd (hips touching bar) on the horizontal bar.

Fig 1 hip circle bwd (hips touching bar) on the horizontal bar



That can be also noticed in the Table 4 where the results from the frequency of the grades are shown. Expectedly, the majority of the grades are higher grades. Even 44 respondents were graded from 9.00 to 10.00, but the percentage of 24.47% is equal to the respondents graded with 7.00 to 8.00, that is from 8.00 to 9.00.

Table 4 hip circle bwd (hips touching bar) on the horizontal bar

Grades	**F**	**%**	**Cumulative %**
= 5.0000	2	1.39	1.39
5.0000 < x <= 6.0000	10	6.99	8.39
6.0000 < x <= 7.0000	17	11.88	20.27
7.0000 < x <= 8.0000	35	24.47	44.75
8.0000 < x <= 9.0000	35	24.47	69.23
9.0000 < x <= 10.000	**44**	30.76	100.00

To show the partial impact of the motor predictor which have important impact on the technical performance, we will try to analyze the technique on the performance of the element.

From the initial position of the forearm with the activation of the muscle flexors in the pelvic joint with the legs swinging forward to the forearm in the prone position, the moment when the fifth factor MFAK 5 - flexibility has its positive significant impact. In that position, the extensor muscles in the hip joint are stretched and ready to allow the legs to swing backwards, bringing the body to a position of high stiffness and leaning with the shoulders forward in front of the vertical. From that position with the positive impact of the earth's gravity, the legs and torso move rapidly downwards by turning around the shoulder axis. At the same time, the shoulders cross the vertical and follow the movement of the torso and legs. The body is straightened, the arms are outstretched, and the head is swinging backwards. In this position, the grip is touched with the hips and the body begins to rotate around the gait backwards. In fact, this is the moment when the seventh factor МФАК 7-frequency of movements has its positive significant impact. It is

interesting to note that in defining this factor, in addition to the tests for estimating the frequency of movements (height and number of tests), have and both tests had a reorganization of dynamic stereotype: long-distance jump MRSDNA and climbing and descending the Swedish stairs backwards MRKSSN, which has been shown to have a positive effect, as this element is performed by moving backwards.

With the help of the achieved acceleration to the vertical, the body continues to move backwards. At the same time, the muscles that pull the arms are activated in order to keep the body close to the point of rotation, that is bar. With the previously achieved acceleration, the hull passes the lower vertical. In this position, the muscles extending to the torso and pelvis are activated and the bending of the legs and torso is not allowed before reaching the position of the forearm.

Increased values of longitudinal measures (AFAK3) will have a positive impact in conditions when respondents have the necessary motor skills and the technique is mastered to a satisfactory level. In such conditions, the peripheral parts of the legs and torso will travel a longer distance, which will provide greater acceleration and the element will be performed with greater speed and amplitude of movement.

The negative sign of the significant coefficients of partial regression indicates that the performance of the applied gymnastic element of the bar will be better in reducing the values of the manifest anthropometric variables intended for estimating latent anthropometric factors with significant, negative, partial regressive coefficient of the criteria (AFAK1, AFAK2).

In conditions when the respondents don't have the needed developed level of the motor abilities and insufficiently mastered technique, the accessible values of the longitudinal forces that appear as announcements for reporting gymnasts for the elements. As an important condition for the presence of adipose tissue in the organism it appears as passive mass which even more disables the performance of the gymnastics element.

In a study by Smaic M. (1985) the negative significant association of skeletal dimensionality factor (isolated from significant projections of longitudinal and transversal variables) with the assessment of sports gymnastics is explained by the adverse biomechanical effect of long and thick muscle bones in single conditions, as well as with muscles that are longer and smaller in diameter and have a reduced chance of developing strength. In addition, bone length and thickness represent an inactive mass and oppose the active force of the muscles. Also, a significant negative association of subcutaneous adipose tissue indicates a negative impact on the performance of the technique of the elements of gymnastic apparatus. Our research also confirms the negative impact of adipose tissue assessment factor.

In the psychological space, a significant negative impact on the successful technical performance of this element is determined by the PFAK 2 factor of neuroticism or emotional instability accompanied by anxiety changes and significantly negative emotional engagement in conditions of general achievement. The review of previous research shows that athletes are more anxious than non-athletes, which means that in a situation of athlete's achievement they can experience anxiety, insecurity and make the athlete emotionally unstable with feelings of anxiety and lower self-esteem (Aleksovska Velickovska L. 2000). Knowing the sports gymnastics well and from my many years of practical experience, it is expected to have a significant and negative impact on the second factor in the performance of this element, because it causes insecurity and less self-confidence in students (movement is backwards and the device is high).

The results suggest that in the future these skills should be considered in the selection of young athletes, especially if it is known that in theoretical terms many authors define general and specific intellectual abilities as abilities that in 80% are genetically determined. Also, in many of the relevant empirical researches, they say that they are very important for the success or failure in sports or other different activities and situations, and in our case for the needs of the subject sports gymnastics.

From the previous scientific researches (Buđa, 1981, Sedić, 1982, Petrović, 1984, Bala, 1993, Mitevski O. 2000, Pop Petrovski V. 1998, Hmjelovjec, 2002, Spasovska K. 2013, Fulurija D.2017) and our results obtained in this way, confirmed that the realization of the quality of movements in sports gymnastics depends on several factors, among which the most important function have morphological characteristics, motor skills, cognitive abilities, cognitive characteristics.

Conclusions

Based on the results obtained and analyzed, it can be concluded that in the morphology of the first year of Faculty of Physical Education, Sport and Health in Skopje, three anthropometric dimensions were extracted and defined (1.Subcutaneous adipose tissue factor, 2. factor on transversal and circular dimensionality, and 3. factor on longitudinal dimensionality).

In the engine compartment, eight motor factors were isolated and defined (1st factor for performing fast and coordinated movements, 2nd factor of explosive power - type of ejection , 3rd repetitive power factor on the front of the trunk, 4th factor for rhythmic movements, 5th factor for flexibility, 6th factor for explosive power - type of jumps, 7th factor of frequency of movements and 8th factor for performing rapid and explosive movements in a certain rhythm.

In the psychological space, five psychological factors are isolated and defined (the first factor of the motive for general achievement, the second factor of neuroticism or emotional instability mended by anxiety changes and significant negative emotional engagement in conditions of general attainment, the third extroversion factor accompanied by a low degree of social acceptability of the environment or dissemination, the fourth factor of positive emotional engagement in conditions of general attainment accompanied by reactions to doubts and the fifth factor on the general and specific and intellectual abilities or factor of the cognitive psychological space).

The obtained results will enable proper guidance to the students, teachers and trainers in planning and preparing for the lesson or during the training process. In doing so, they will take into account the level of their motor skills, the anthropometric characteristics and psychological abilities and features when mastering this gymnastic element. As regards, the development of these motor skills and psychological characteristics which are most needed for the conformity of the technique of the gymnastic elements were applied in this research.

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