

BASIC INDICATORS OF THE MOTOR SKILL SITUATION WITH FEMALES AGED 17 AND 18

Original scientific paper

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Abstract

The study included 410 female respondents. A number of 210 were aged 17 and 202 respondents aged 18. The study treated 7 motor tests. In realization of the study goal was applied the factor analysis method with calculation of the principal components method. Following transformation of the principal components in parallel projections of the promax factors with 17 year old respondents, three factors have been isolated. First factor was integrated with the skills assessment in: rhythmic structure, explosive strength, elasticity and general strength. Second factor was integrated with the balance and segment speed skill. Third factor represents the skill in coordinated body movements. With female respondents aged 18 were isolated two factor. First factor was defined as skills in balance, segment speed, explosive strength and flexibility. Second factor was integrated with the skills in rhythmic movements structure, general strength and body movements coordination. For full meaningful and clearer definition of the factor structure with respondents from both age categories, further more concrete study results need to be provided.

Keywords: *female, motor tests, promax factors, motor coordination*

INTRODUCTION

Skills and characteristics of the anthropological status of entities which, among the other, have been defined first of all by their motor skills, were conditioned by genetic factors, and in this context by sex and age differences, as well as by the impact of the environmental factors including physical activities and training process activities.

In this regard, the situation and motor skills transformations, besides the genetic factors, was also determined by those activities. In parallel, among the other, the motor skills situation is important for achieving good results in a great number of body movements. Therefore, acquirement of new knowledge in motor skills situation is necessary with entities from different sex and age. The higher knowledge level allows more efficient programming of sports body movements and better results in their transformation, as well as achievement of better sports results.

Accordingly, realization of better sports results is a result of successful diagnostics of the motor skills situation with certain sex and age characteristics of the entities. In this respect, it can be mentioned as an example that entities of same sex, but different age, can be characterized with different quantitative development level. At the same time, they can be characterized with different latent structure of their motor characteristics.

Such differences can also be present among entities from different ethnic, geographical and socio-economic environments, and they can depend on the kind and size of the samples of respondents, the training process impact, etc.

Therefore, information acquirement is justified concerning the latent structure of respondents, whose samples stem from different environments and are defined by different characteristics and conditions related to those environments.

PREVIOUS STUDIES

There are a great number of previous studies connected with analysis of the motor skills situation with students. Among them, the following authors have conducted such studies:

Gredelj and associates (1973) conducted a study with 42 students included in regular physical education classes, aimed for the measurement characteristics assessment in certain tests, with assessment of the hypothetical motor factor – reorganization of the movement stereotype. For that purpose, he applied six specially designed motor

tests. The comprehensive statistical data processing suggested that the measurement characteristics of the applied tests were different.

With a similar sample of respondents and variables, Viskic – Stalec and associates (1973) determined the measurement characteristics for measuring one motor latent dimension. The study was conducted with 46 students, both males and females, in the first year of studies included in regular physical education classes. It dealt with analysis of the measurement characteristics in six tests for assessment of the topological motor latent dimension in leg coordination. Thereby, it was concluded that, as a wider battery, all applied tests can be used for common subject measurement, interpreted for coordinated performance of complex motor tasks with predominant leg engagement.

One of the most important studies in this field was realized by Momirovic and associates (1970). The study was conducted with a sample of 445 students, 194 males and 251 females aged 15 to 18, with application of 14 tests for the motor skills assessment. Thereafter, it was concluded that most of the tests were of a satisfactory reliability. Besides, different reliability was determined with certain same tests between males and females which points out its significance.

Coordination motor factor was studied with population of male high school students by Hosek and associated (1973), not in general sense, but its segment – rhythm coordination. For that purpose a sample of 41 third year high school students was used. The analysis included measurement characteristics of six tests. Application of the statistical methods in data processing in the reliability and factorization domain, suggested that all six tests had a high degree of satisfactory measurement characteristics. In this context, it was suggested that five of the applied tests should be used for the latent dimension – rhythm coordination measurement.

Babiak (1983) studied measurement characteristics of the measurement characteristics of tests for two latent motor dimensions assessment. The study was conducted with a sample of 120 respondents from both sexes aged 15 to 17. The sample was divided into four sub-samples each consisting of 30 respondents. Two sub-samples were composed of male and the other two of female respondents. It was established that the measurement characteristics of the applied tests were satisfactory in both sexes and ages of respondents, which is a result of their tasks modification.

Sturm (1980) studied a sample of 100 male students of physical culture aged 19 to 24, and analyzed the measurement characteristics of 106 composite tests for assessment of six segments of motor skills that were defined according to the phenomenological criterion. Hence it was established that dynamo metric tests have better measurement characteristics for the body strength examination than those for measurement of the prolonged muscle strain both of dynamic and static type. Also, it was concluded that flexibility measurement tests have the best measurement characteristics, better than those for the coordination assessment. Considerably worse characteristics were established in tests for speed measurement, and the worst characteristics of a problematic satisfactory level were established with the motor skill – balance.

Bala (2002) examined construction and application of the following certain factor assessment tests with a different samples of respondents. For the whole body coordination: mobility on the floor (KOKRETLU) and coordination with a bat (KKOPALIC); for balance: transversal one leg standing on a bench with open eyes (R1POPOTV), alongside one leg standing on a bench with open eyes (RIUZDOTV); for hand movement frequency: hand tapping (TTAPRUKA); for strength, 20 meter sprint (ESPRIN20), for general strength: pull-up hanging (SVISZGIB).

Naumovski and Georgiev (2000) conducted a study aimed for measurement characteristics determination in certain tests for the motor factor – explosive muscle strength assessment with normal population respondents and with respondents who had practiced sport and recreation activities for a long period of time. The established measurement characteristics were conducted between the two respondent groups which resulted with significant comparative information. They stemmed from the results obtained with a sample of 163 respondents, both male and female, aged 19 to 25. The first sample was divided into two sub-samples – 85 respondents, defined as normal population, and 78 respondents - athletes who had practiced continual sport and recreation activities for 5-6 years. Thereby, the measurement characteristics for assessment of the motor factor – explosive strength were determined (throwing a medicine ball from a supine position MBML; 20-meter running from a standing start – M20V; long jump off point – MDM). All applied tests showed satisfactory measurement characteristics for assessment of the motor factor explosive strengths in both groups of respondents; in the group of respondents who had practiced sport and recreation activities best measurement characteristics were established in the MBML test, and in the group defined as normal population best results were provided in the MDM test.

SUBJECT, GOAL AND HYPOTHESIS OF THE STUDY

Subject of the study

Based on the review in the introductory part and results provided in so far studies, subject of the study is to scrutinize basic motor skill indicators (latent dimensions, that is the factor structure) with females aged 17 and 18.

Goal of the study

Basic goal of the study is to determine and make comparison the factor structure situation in certain motor tests with females aged 17 and 18. This goal arises the following special goals:

- Number determination of the isolated factors according to the respondents' age.
- Saturation determination of each motor test in the structure of each motor factor, particularly with females aged 17 and 18.
- Determination of the meaningfulness and differentiation degree

of isolated motor factors according to respondents' age.

- Determination of the correlation between isolated motor factors with respondents according to their age.
- Comparison of the similar structure of isolated motor factors among respondents aged 17 and 18.

Hypothesis of the study

H1: Factor structure of the motor skills among females aged 17 and 18, will vary.

H2: Number of the isolated factors with different age respondents, will be different.

H3: Differentiation degree of isolated motor factors with different age respondents, will be different.

H4: Correlation between isolated motor factors with different age respondents, will be high.

METHODS

Sample of respondents

This study included a total of 410 female respondents, 210 of whom aged 17 and 202 aged 18. All respondents attend regular physical education classes.

Sample of variables

The study included 7 motor variables such as:

- Flamingo (FLA),
- Hand tapping (TPA),
- Non-rhythmic tapping (NEUR),
- Long jump from a spot (SKD),
- Deep forward bend on a bench (PRET),
- Knuckle hang up (VIS)
- Ground mobility (PTLO)

Measurement technique

The applied motor tests are aimed for the following motor skills assessment: Flamingo (for balance), Hand tapping (movement frequency assessment), Non-rhythmic tapping (rhythmic structure assessment), Long jump from a spot (lower limb explosive strength assessment), Deep forward bend on a bench (flexibility assessment), Knuckle hang up (VIS) and Ground mobility (coordination assessment).

Data processing methods

In order to implement the assigned tasks, as well as to confirm formulated hypothesis and obtain relevant results and conclusions, the following statistical methods have been applied:

- Descriptive statistical indicators.
- Inter-correlation between motor tests results with females aged 17, and particularly with females aged 18.
- Within the factor analysis the method of principle components was calculated, then the characteristic roots (λ) and the valid variance assessment.
- Transformation was carried out of principle components into varimax factors.
- Principle components after varimax positions were transformed into oblique promax factors.
- Promax factors were rotated into parallel and orthogonal projections.
- Inter-correlation of the isolated promax factors.

RESULTS AND DISCUSSION

Table 1. Inter-correlation of the motor tests results with females aged 17

Tests	FLA	TRA	NEUR	SKD	PRET	VIS	PTLO
FLA	1,000	-,349	,103	-,099	-,262	,019	-,040
TRA	-,349	1,000	-,232	,032	,108	-,069	,098
NEUR	,103	-,232	1,000	,226	,118	,206	-,173
SKD	-,099	,032	,226	1,000	,350	,213	-,006
PRET	-,262	,108	,118	,350	1,000	,062	-,064
VIS	,019	-,069	,206	,213	,062	1,000	,072
PTLO	-,040	,098	-,173	-,006	-,064	,072	1,000

In Table 1, it is evident that a smaller number of coefficients are statistically significant at the level of 5%. All correlation coefficients valued over .14 are statistically significant at that level. Half of them are with negative, and the other half are with positive omen. These inter-correlation coefficient characteristics lead to the conclusion that it is real to expect that females aged 17 will extract different motor factors.

Table 2. Characteristic roots (λ) and percent (%) of the valid principle components variance with females aged 17

Components	Lambda (λ)	Variance percent	Cumulative percent
1	1,648	23,50	23,540
2	1,582	22,63	46,143
3	1,085	15,53	61,646
4	,793	11,34	72,981
5	,675	9,642	82,623
6	,652	9,319	91,941
7	,564	8,059	100,000

In Table 2 isolation of three statistically significant components is evident. It stems from the values of the first three characteristic roots (λ) that are bigger than 1.00. The first component valid variance percent (23,540) is relatively similar to the valid variance percent in the second principle component (22,603), whereas the third principle component gas a sharp drop, that is a quite lower coefficient.

Table 3. Significant principle component communalities (h^2) for females aged 17

Tests	Components			
	H1	H2	N3	h ²
FLA	-,425	,633	,121	,596
TRA	,183	-,741	,009	,583
NEUR	,413	,630	-,103	,579
SKD	,747	,128	,114	,587
PRET	,730	-,151	-,216	,602
VIS	,405	,325	,586	,613
PTLO	-,090	-,300	,811	,755

In Table 3, isolated principle components have high saturations, ranging from 0,630 to 0,811. All three principle components can be interpreted meaningfully. Communalities (h^2) have similar values, and the ground mobility test (PTLO) has higher value (.755) than the others. Therefore this test is one of the most valid in the system of other treated tests.

Varimax factors have not been presented in the text of this study because they, as orthogonal projections, refer only to the correlations between tests of the isolated latent dimensions, and not to the impact of the tests on those dimensions, such as the case with the parallel projections of the oblique factor analysis rotations. The varimax factor tables can be found with the author of this study.

Table 4. Parallel promax factor projections with females aged 17

Tests	Promax factors		
	PF1	PF2	PF3
FLA	-,194	-,759	,015
TRA	-,050	,751	,135
NEUR	,568	-,409	-,215
SKD	,763	,156	,083
PRET	,615	,444	-,195
VIS	,566	-,211	,519
PTLO	-,060	,147	,854

Table 4 presents projections with females aged 17. Data in the table, that are methodologically most justified and meaningful interpretation of the isolated latent dimensions, lead to the conclusion that test saturation of the promax factors is different as compared with the isolated principle components for this age respondents. The first parallel projection has four remarkable statistically significant saturations in tests (Non-rhythmic tapping (NEUR), Long jump from a spot (SKD), Deep forward bend on a bench (PRET), and Knuckle hang up (VIS). This factor, according to the phenomenological approach for its definition, has been integrated with the skill assessment: rhythmic structure, explosive strength, elasticity and static strength.

This situation of integrated interpretation is probably a result of a small number of tests for clearer latent dimensions definition, which in other studies have been determined by more tests for hypothetical motor skills existence.

If this factor is interpreted according to the functional approach, it can have more meaningful existence. However, due to the fact that this approach is more convenient for scientific than for practical needs, it is not advisable to go into its interpretation.

The second factor has similar characteristics with the first one. However, it is different because of its saturation in two tests: Flamingo (FLA) and Hand tapping (TRA). According to these tests, this factor has been integrated with the balance and segment speed skills. It is difficult to interpret this factor, similar to the first factor, according to the phenomenological approach for the factor structure definition.

The third factor has also been saturated in two tests: Knuckle hang up (VIS) and Ground mobility (PTLO). The Knuckle hang up (VIS) position has not been sufficiently differentiated, and therefore it can be said that it is not quite clear because it has a statistically significant saturation in the first factor too. On the contrary, the position of the Ground mobility (PTLO) test has been evidently differentiated. Its saturation is considerably high (.86). It represents the skill in body movement coordination.

Table 5. Orthogonal projections of the promax factors with females aged 17

Tests	Promax factors		
	PF1	PF2	PF3
FLA	-,146	-,747	,056
TRA	-,109	,749	,112
NEUR	,611	-,439	-,244
SKD	,746	,103	,020
PRET	,601	,410	-,257
VIS	,541	-,267	,483
PTLO	-,134	,121	,854

Table 5 presents orthogonal projections of the promax factors. Their structure almost does not differ from the one in the parallel projections of the promax factors. Size of the statistically significant correlation coefficients between the orthogonal projections and tests have a pronounced similarity with corresponding parallel projection

coefficients of the promax factors and tests. It means that structure of the isolated factors has remained almost the same even after calculation of the orthogonal promax factors. More precisely, the situation between the parallel and orthogonal projections of the promax factors is mainly identical according to the number and size of the statistically significant saturations.

Table 6. Inter-correlation of the promax factors with females aged 17

Tests	PF1	PF2	PF3
PF 1	1,000	-,065	-,075
PF 2	-,065	1,000	-,035
PF 3	-,075	-,350	1,000

In Table 6, all inter-correlations with a negative omen are statistically significant. There is a higher inter-correlation between the first and second promax factors and between the first and third promax factor. Inter-correlation between the second and third promax factors is considerably lower.

Table 7. Inter-correlation of the motor test results with females aged 18

Tests	FLA	TRA	NEUR	SKD	PRET	VIS	PTLO
FLA	1,000	-,178	,079	-,163	-,302	-,004	-,195
TRA	-,178	1,000	,036	,133	,161	,061	,050
NEUR	,079	,036	1,000	-,019	,029	,064	-,148
SKD	-,163	,133	-,019	1,000	,248	,106	-,099
PRET	-,302	,161	,029	,248	1,000	,053	,173
VIS	-,004	,061	,064	,106	,053	1,000	-,141
PTLO	-,195	,050	-,148	-,099	,173	-,141	1,000

It is obvious in the Table 7 that more than a half of all correlation coefficients are statistically significant at the level of .05. Most of them are with a negative omen. Values of most of the coefficients are higher as compared to those with females aged 17. Besides, certain coefficient grouping is evident pointing to existence of a smaller number of motor latent dimensions.

Table 8. Characteristic roots (λ) and percent (%) of the valid principle component variance with females aged 18

Components	Lambda (λ)	Variance percent	Cumulative percent
1	1,666	23,793	23,793
2	1,311	18,726	42,520
3	,971	13,869	56,388
4	,879	12,562	68,950
5	,858	12,263	81,214
6	,703	10,044	91,258
7	,612	8,742	100,000

Size and characteristic roots and percent of the valid variance of the first principal component (Table 8), are similar to those with female respondent aged 17. These indicators are noticeably lower in the second principle component in respect of the female respondents aged 17. Such difference is followed by the number of isolated principle components. In the group of female respondents aged 18 one less component was isolated, meaning that there were isolated two, and with female respondents aged 17 three principle components isolated.

This fact indicates that the group of females aged 18 has more clearly differentiated factor structure with two principle components. Besides, this is probably a result of the phenomenon of higher biological maturation and development degree in respect of the anthropological status, and motor latent dimensions with female respondents aged 18.

This stabilization of the factor motor structure in this group of

respondents can be noticed in the Table 9 data, as well as in corresponding data in other tables.

Table 9. Significant principle component communalities (h^2) with females aged 18

Tests	Components		h^2
	H1	H2	
FLA	-,703	,158	,518
TRA	,493	,186	,278
NEUR	-,110	,490	,252
SKD	,506	,431	,441
PRET	,723	,055	,525
VIS	,100	,600	,370
PTLO	,358	-,681	,592

Isolated principle components have high saturations ranging from 0.490 to -.703. The communalities have various values, therefore the Ground mobility (PTLO) test has the highest value in relation to the rest, and the tests Hand tapping (TRA), Non-rhythmic tapping (NEUR) and Knuckle hang up (VIS) have evident lower values. Accordingly, their validity can also be defined.

Table 10. Parallel promax factor projections with females aged 18

Tests	Promax factors	
	PF1	PF2
FLA	-,647	,272
TRA	,525	,102
NEUR	,009	,502
SKD	,595	,342
PRET	,717	-,065
VIS	,240	,577
PTLO	,187	-,733

Saturation values of the parallel projections in same tests, as well as in principal components with female respondents aged 18, are evidently similar (Table 10). It shows the stability of isolated factors, and permanence of the factor structure after the oblique promax transformation. The first factor is saturated in the tests Flamingo (FLA), Hand tapping (TRA), Long jump from a spot (SKD) and Deep forward bend on a bench (PRET). The second factor is saturated in tests: Non-rhythmic tapping (NEUR), Knuckle hang up (VIS) and Ground mobility (PTLO).

Table 11. Orthogonal promax factor projections with females aged 18

Tests	Promax factors	
	PF1	PF2
FLA	-,667	,320
TRA	,517	,063
NEUR	-,028	,502
SKD	,570	,298
PRET	,722	-,119
VIS	,197	,559
PTLO	,241	-,747

Data situation in Table 11 presenting orthogonal promax projections, also remained unchanged as compared with parallel projection data. It is yet another confirmation of the isolated stability of the motor latent dimensions with females aged 18. Constancy can also be noted from the values of the correlation tests with orthogonal projections of promax factors.

Table 12. Inter-correlation of the promax factors with females aged 18

Factors	PF1	PF2
PF 1	1,000	-,075
PF 2	-,075	1,000

Stability and independence of the two isolated factors with females aged 18 can also be noted in the correlation between the two isolated promax factors presented in the Table 12.

CONCLUSION

Based on the obtained results analysis, the following conclusions can be made:

- In both groups of respondents (females aged 17 and females aged 18) different number of factors have been isolated, that is three motor factors with females aged 17 and two factors with females aged 18. It is difficult to define their interpretation according to the phenomenological approach, and probably the number of manifest variables (tests) need to be increased for covering any hypothetical segment of the motor space.
- Saturation of certain anthropometric measures in corresponding isolated factors within defined age of respondents is almost identical with the principal components, parallel and orthogonal promax factors.
- In the group of females aged 18, clearer factor structure of the manifest motor variables has been isolated.
- Independence of the two isolated factors with females aged 18 is greater than with females aged 17.
- For clearer definition of the factor structure with females aged 17 probably further factorization will be necessary for obtaining higher rank factors.

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