# LATENT STRUCTURE OF MOTOR ABILITIES IN KARATE

**Blerim Sulejmani, Agron Ademi, Dardan Dehari and Kastriot Shaqiri**

*University of Tetovo, Faculty of Physical Education, Macedonia*

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***Abstract***
*The aim of this study is the verification of some motor skills as latent motor dimensions. The sample of entities: The sample of this study included 104 male students aged 15-16 that have taken up karate lessons in Tetovo, Gostivar and Skopje, apart from their regular physical activities in the schools where they attend their lessons. The sample of variables: 18 variables have been used to evaluate the motor characteristics. The values of Skewness and Kurtosis also show that there is no significant statistical deviation from the normal values of the population. The highest oscillations between minimal and maximal values are to be found at the variables of push-ups and weight lifting. A big number of correlations of motor variables have been conducted by using the Pearson correlation. Seven latent motor factors have been obtained by the factor analysis: 1) the factor of explosive force of legs and body flexibility; 2) the factor of explosive force of legs, the repetitive force of arms and the static force of arms; 3) the factor of explosive force of legs, coordination and repetitive force of legs; 4) the factor of explosive force of legs and repetitive force of arms; 5) the factor of explosive force of arms and repetitive force of the body; 6) the factor of coordination and the static force of the arms; 7) the factor of handling a ball, the repetitive force of arms and flexibility. The outcome of this study is expected to bring out a model of a quality karate fighter, more precisely the process of evaluation of motors skills of a top karate fighter model.*

***Key words:*** *Karate, motor, schools and club students, ages 15-16, male.*

## Introduction

Karate is part of the acyclic poly structural group of sports, dominated by acyclic moves, where the end result often represents a binary variable (loss or win), with moves executed directly toward the opponent in order to his/her symbolic destruction (Murati, 1996) . This sport is well known for the anaerobic work of sub maximal intensity. Modern day karate requires a very high technical and tactical preparation since the dynamics in matches is enormous with every second registering some action, where very high speed and skill are applied in technical move of attack. At the same time technical moves of defense also require a great vigilance (Kules, 2004).

The assessment of morphological characteristics and motor skills is an integral part of the training process within the framework of each and every sport. The tracking and analysis of these results with the yet to be challenged perfection of the best sport results gives us an extremely high importance in conducting such research (Boas,1982). This all helps the concept of individualizing the training process, and to evaluate the realized program content with results in the anthropometric and motor space.

## Methods

*Entity sample*
This study will involve 104 male students aged 15-16 (+/- 6 months), who apart from their regular physical education classes at school have also taken up karate lessons in Tetovo, Gostivar and Skopje.

*Motor skills assessment variables*

- In order to assess the explosive force the following parameters have been considered: Distance jump from a standing position (MDJSP), High jump from a standing position (MHJSP), Medicine Ball throw in distance (MMBTH), 20 meter sprint from a static standing start (MRU20m), Triple jump from a standing position (MTJSP).

- In order to assess the repetitive force the following parameters were considered: Pull up bar body lift max (MPUBL), Push ups (MPU), Maximum increase - decrease (MMID), Abdominal muscles within 20 seconds. (MAM20sek).

- In order to assess the static force the following parameters were considered: Standing on folded arm (MSFA), Standing on pushed arm (MSPA), Standing on two folded arms (MSTFA).

- In order to assess the flexibility the following parameters were considered: Sideways (MSW), Deep bending on chair (MDBC), Deep bending in sitting position, legs aside (MDBSP).

- In order to assess the movement coordinate the following parameters were considered: Side steps (MSS), Running in eights (MRE), Leading a ball by hand (MLBH).

During the tests the students are required a maximal performance of giving tasks.

*Methods of processing the results*

The data collected for this paper have been processed with statistical program package SPSS 12.0. In order to have an adequate interpretation of the results, the following methods have been applied: Standard methods to calculate basic statistical parameters: (arithmetic average, standard deviation, minimum and maximum score, skewness and kurtosis). To define the structure of the manifest and latent space the following will be applied: The key component method, The size of communalities - h2 method, The method of parallel projections and amplitude of the structure, The extent of correlation factors method.

**Results and discussion**

Table 1. Basic statistical motor parameters.

| | N | Min. | Max. | Mean | Std. Dev. | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| MDJSP | 105 | 145 | 205 | 172.81 | 13.349 | .034 | -.005 |
| MHJSP | 105 | 234 | 296 | 264.46 | 15.936 | .111 | -.497 |
| MMBTH | 105 | 510 | 662 | 576.00 | 33.495 | .052 | .550 |
| MRU20m | 105 | 3.69 | 4.98 | 4.2509 | .28048 | .792 | .702 |
| MTJSP | 105 | 4.63 | 7.21 | 5.6845 | .67386 | .611 | -.414 |
| MPUBL | 105 | 1 | 6 | 3.48 | 1.238 | -.113 | -.517 |
| MPU | 105 | 2 | 21 | 7.72 | 3.333 | 1.787 | 4.872 |
| MMID | 105 | 34 | 87 | 49.47 | 10.402 | .693 | 1.414 |
| MAM20sek | 105 | 10 | 22 | 15.57 | 2.957 | -.072 | -.521 |
| MSFA | 105 | 10.99 | 32.78 | 18.0183 | 5.61071 | .663 | -.617 |
| MSPA | 105 | 15.24 | 45.00 | 18.8877 | 4.56893 | 3.861 | 18.727 |
| MSTFA | 105 | 10.99 | 16.00 | 13.6177 | 1.64756 | -.070 | -1.267 |
| MSW | 105 | 133 | 169 | 153.13 | 8.615 | -.280 | -.220 |
| MDBC | 105 | 26 | 39 | 33.34 | 3.615 | -.152 | -1.284 |
| MDBSP | 105 | 22 | 37 | 29.30 | 3.735 | -.036 | -.509 |
| MSS | 105 | 18.7 | 29.0 | 23.343 | 2.7667 | .288 | -.532 |
| MRE | 105 | 11.71 | 19.36 | 15.4690 | 2.16628 | .000 | -1.070 |
| MLBH | 105 | 8.99 | 15.26 | 12.2427 | 1.71216 | -.159 | -.896 |

Table no. 1 shows that the basic statistical parameters are in line with the relevant age values.

Even the values of skewness and kurtosis show that there are no significant statistical deviations from the normal population values.

The highest oscillations between minimal and maximal values can be found at push ups and pull up bar body lift. Furthermore, the value of the skewness for the push ups variable exceeds the amount 3, which means that there is a slight deviation from normality.

*The factorization of the motor area*

Table 2. Main characteristic roots.

| | Total | % of Variance | Cumulative % | Total |
|---|---|---|---|---|
| 1 | 4.060 | 21.366 | 21.366 | 2.589 |
| 2 | 2.654 | 13.969 | 35.335 | 2.627 |
| 3 | 1.958 | 10.304 | 45.638 | 1.901 |
| 4 | 1.799 | 9.466 | 55.104 | 2.219 |
| 5 | 1.615 | 8.500 | 63.605 | 2.178 |
| 6 | 1.304 | 6.861 | 70.465 | 2.791 |
| 7 | 1.194 | 6.284 | 76.750 | 1.524 |
| 8 | .959 | 5.049 | 81.799 | |
| 9 | .856 | 4.506 | 86.306 | |
| 10 | .767 | 4.038 | 90.344 | |
| 11 | .595 | 3.134 | 93.477 | |
| 12 | .366 | 1.927 | 95.404 | |
| 13 | .253 | 1.329 | 96.734 | |
| 14 | .203 | 1.071 | 97.805 | |
| 15 | .169 | .889 | 98.694 | |
| 16 | .101 | .529 | 99.224 | |
| 17 | .076 | .398 | 99.621 | |
| 18 | .056 | .297 | 99.918 | |

Table no. 2 shows characteristic roots (LAMBDA) and the partial (%) and cumulative contribution to explain the overall variability. According to the Hotteling method and the GK (Gutman-Kaiser) method, seven main components were extracted, which account for 76.75 % of the total variability. The first characteristic root explains 21.36% of the total variability of the system. The second root explains 13.96% of the total variability. 10.30% of the total varaibility of the system is explained through the third characteristic root. The fourth characteristic root explains 9.46% of the total variability, whereas the fifth one explains 8.50%. The sixth characteristic root explains 6.86%, whereas the seventh root although with the smallest value of 6.28% remains statistically valuable in explaining a part of the common variability of the of variables system.

Table 3. Main components and communalities.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | H2 |
|---|---|---|---|---|---|---|---|---|
| MDJSP | .011 | .837 | -.061 | .059 | .102 | .036 | .140 | .739 |
| MHJSP | -.216 | -.456 | -.298 | -.271 | -.188 | .524 | .034 | .728 |
| MMBTH | .251 | -.030 | -.483 | -.272 | .638 | .052 | .173 | .810 |
| MRU20m | -.161 | -.382 | .602 | .075 | .390 | .088 | -.279 | .777 |
| MTJSP | -.063 | .316 | .245 | .661 | -.157 | .407 | .169 | .820 |
| MPUBL | -.235 | .395 | -.118 | .173 | -.003 | -.142 | -.609 | .646 |
| MPU | .511 | .538 | .136 | -.085 | .390 | .390 | .041 | .882 |
| MMID | .692 | .304 | -.243 | -.173 | -.466 | -.051 | .023 | .881 |
| MAM20sek | .746 | -.032 | -.093 | .183 | .417 | .056 | -.163 | .803 |
| MSFA | .522 | .078 | .407 | -.119 | -.277 | -.326 | -.273 | .716 |
| MSPA | .467 | .597 | .143 | -.295 | -.173 | .223 | .043 | .763 |
| MSTFA | -.418 | .032 | -.037 | -.764 | .049 | .015 | .080 | .770 |
| MSW | .148 | -.241 | -.308 | .409 | .140 | -.202 | .394 | .558 |
| MDBC | -.656 | .360 | .082 | .178 | .391 | -.364 | .138 | .903 |
| MDBSP | .251 | .094 | .446 | .008 | -.047 | -.140 | .491 | .534 |
| MSS | -.528 | .198 | -.417 | .174 | -.355 | -.177 | .162 | .706 |
| MRE | -.697 | .141 | -.022 | .202 | -.074 | .527 | -.113 | .843 |
| MLBH | -.497 | .014 | .652 | -.303 | -.032 | .006 | .285 | .846 |

In the matrix of the main components their projections have been realized by motor variables, but the clearer and final projections can be seen in the matrix of parallel projections.

*Latent motor characteristics*

Table 4. The matrix of parallel projections of variables in factors.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| MDJSP | -.468 | .604 | -.307 | .064 | .045 | .078 | -.039 |
| MHJSP | .628 | -.120 | -.050 | -.255 | .027 | .560 | .002 |
| MMBTH | -.057 | .148 | -.016 | -.208 | .894 | .104 | .031 |
| MRU20m | -.057 | -.113 | .864 | .036 | -.074 | .009 | -.015 |
| MTJSP | -.073 | .310 | .002 | .682 | -.363 | .449 | .117 |
| MPUBL | -.290 | .050 | .006 | .078 | -.157 | -.110 | -.709 |
| MPU | -.029 | .876 | .153 | .116 | .341 | .063 | .054 |
| MMID | .378 | .341 | -.584 | .042 | -.042 | -.422 | -.004 |
| MAM20sek | .154 | .255 | .220 | .391 | .552 | -.266 | -.119 |
| MSFA | .121 | .114 | .081 | .013 | -.315 | -.757 | -.033 |
| MSPA | .132 | .778 | -.216 | -.104 | -.097 | -.162 | .080 |
| MSTFA | -.046 | .068 | -.033 | -.858 | .037 | .119 | .081 |
| MSW | -.111 | -.370 | -.217 | .397 | .354 | .032 | .265 |
| MDBC | -.909 | -.141 | .073 | -.082 | .040 | .118 | -.006 |
| MDBSP | -.153 | .158 | .003 | .073 | -.139 | -.224 | .626 |
| MSS | -.252 | -.313 | -.591 | -.011 | -.225 | .244 | -.102 |
| MRE | -.027 | .104 | .087 | .061 | -.310 | .786 | -.241 |
| MLBH | -.264 | .049 | .309 | -.424 | -.441 | .119 | .465 |

In order to get clearer and more complete information about the latent structure of the explored spaces, the main components have been transformed into slope solutions "OBLIMIN". As a result of such transformation, three matrixes have been acquired. The matrix of parallel projections that contains parallel projections of vectors and variables in factors, the matrix of orthogonal projections and the matrix of inter correlation among factors. The most important significance of explaining latent space is the matrix of parallel projections.

As it can be seen from table no 5, the first OBLIMIN factors has been defined by motor variables: high jumping from a standing position and deep bending in chair(.628-.909). Based on the projections realized in the first factor, this can be interpreted as: a factor of legs explosive force and the body flexibility. In the second factor significant projections have realized the variables: distance jump, push ups and static posture in push ups (.604-.87). Based on the projections achieved, this factor can be interpreted as: factor of explosive force of legs, repetitive force of arms and static force of arms. The third factor has projections of variables 20 m sprint from a static standing start, side steps and body increase-decrease(-.584-.864), so this factor can be interpreted as: factor of explosive force of legs in coordination with the repetitive force of legs. In the fourth factor the following variables have been projected: triple jump from a standing position and parallel standing with folded arms (682-.-,852). Based on the projections achieved, this factor can be interpreted as: factor of explosive force of legs and repetitive force of arms. The fifth motor factor contains projections of variables: medicine ball throw in distance and abdominal muscles (.552-.894), so this factor can be interpreted as: factor of explosive force of arms and repetitive force of the body. The sixth factor contains projections of variables: running in eights (tetshe) and pull up bar with arms (-.758-.786), so it can be defined as: factor of coordination of the static force of arms. The seventh factor contains projections of three motor variables: leading a ball by hand, bar pull up and deep bending in sitting position (.465-.709), so this factor can be interpreted as: factor of manipulation by ball, the repetitive force of arms and flexibility. While observing the matrix of the orthogonal projections (table no. 5) it can be seen that the projections of the variables in factor do not differ very much by the matrix of the parallel projection with folded arms. The inter correlative matrix proves that the factors are independent from one another (table no. 6), because no significant correlative value has been reached.

Table 5. The matrix of orthogonal projections of variables in factors.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| MDJSP | -.509 | .623 | -.365 | .091 | -.030 | .043 | -.100 |
| MHJSP | .525 | -.263 | -.021 | -.323 | .044 | .502 | -.025 |
| MMBTH | .044 | .090 | -.062 | -.143 | .856 | .019 | .026 |
| MRU20m | -.032 | -.153 | .868 | -.009 | -.120 | .031 | .051 |
| MTJSP | -.192 | .281 | -.019 | .616 | -.375 | .334 | .106 |
| MPUBL | -.339 | .095 | -.059 | .031 | -.202 | .000 | -.718 |
| MPU | -.008 | .854 | .090 | .188 | .307 | -.159 | .069 |
| MMID | .415 | .443 | -.579 | .149 | .078 | -.548 | .010 |
| MAM20sek | .284 | .299 | .168 | .477 | .610 | -.450 | -.029 |
| MSFA | .212 | .261 | .105 | .102 | -.225 | -.768 | .038 |
| MSPA | .116 | .811 | -.233 | -.023 | -.080 | -.312 | .070 |
| MSTFA | -.083 | -.009 | -.008 | -.863 | -.046 | .226 | .010 |
| MSW | -.035 | -.349 | -.212 | .417 | .394 | .009 | .276 |
| MDBC | -.919 | -.143 | .043 | -.130 | -.109 | .317 | -.073 |
| MDBSP | -.095 | .210 | .048 | .141 | -.119 | -.277 | .635 |
| MSS | -.349 | -.314 | -.586 | -.077 | -.252 | .394 | -.192 |
| MRE | -.229 | -.035 | .062 | -.087 | -.406 | .815 | -.309 |
| MLBH | -.318 | .002 | .367 | -.458 | -.528 | .219 | .422 |

Table 6. Inter-correlations of factors.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1 | 1.000 | | | | | | |
| 2 | -.033 | 1.000 | | | | | |
| 3 | .040 | -.051 | 1.000 | | | | |
| 4 | .025 | .064 | -.032 | 1.000 | | | |
| 5 | .144 | -.030 | -.049 | .077 | 1.000 | | |
| 6 | -.183 | -.191 | -.016 | -.142 | -.106 | 1.000 | |
| 7 | .066 | -.007 | .081 | .065 | .027 | -.087 | 1.000 |

## Conclusion

The purpose of this paper was to verify the motor skills as latent driving dimensions. Based on the results from the basic statistical parameters of the motor variables it has been verified that the values achieved are in accordance with relevant age values. Even the skewness and kurtosis values confirm that there is no significant statistical deviations from the normal population values. The highest oscillation between minimal and maximal values can be found among the push ups and bar lift up variables. Even the value of skewness for the push up variable exceeds over 3, which means there is a slight deviation from the normal. Through Pearson's correlation a considerable number of correlations of motor variables have been realized. These correlations are best express in factorial analysis where certain sets of variables are grouped.

Through factorial analysis seven latent motor factors have been acquired: Factor of explosive force of legs and the body flexibility, Factor of explosive force of legs, repetitive force of arms and static force of arms, Factor of explosive force of legs, coordination and repetitive force of legs, Factor of explosive force of legs, repetitive force of arms, Factor of explosive force or arms and repetitive force of body, Factor of coordination of static force of arms, Factor of manipulation by ball, repetitive force of arms and flexibility. Through the results of this study I hope that we will find the model of a quality karateka, namely the process of evaluating the anthropological dimensions of a top karateka. Selection of karateka for competing teams or as team members. Orientation and selection of young people in different sport activities, depending on their predispositions.

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*Correspondence to:*
*Artan R. Kryeziu*
*University of Salerno, Italy*
*E-mail: artankryeziu88@hotmail.com*