

Battery of tests for evaluation level of motor abilities in high advanced wrestlers from perspective of 32 years of using in practice

Authors' Contribution:

- ☑ **A** Study Design
- ☑ **B** Data Collection
- ☑ **C** Statistical Analysis
- ☑ **D** Manuscript Preparation
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Abstract

Background & Study Aim:

Level of motor abilities is the foundation of all kinds of training preparation wrestlers to competition. The low level of motor abilities may be cause of an imperfect technique, and this may results in an ineffective tactic. Therefore, generally aim of the work is a scientific argumentation justifying the use of recommended battery of tests in practice of wrestling training.

Material & Methods:

Material was collected during 18 investigations 3 days sessions on 524 high advanced wrestlers (freestyle and Greco-Roman) of all weight categories and level of sport class. In all this investigations the method was own authors W. Starosta and J. Tracewski battery of 23 tests for an evaluation in points of the level of each motor abilities.

Results:

A "T" scale enabling the transfer into points of results collected in different measuring units (kg, cm, s, degrees, number of repetitions) was elaborated. The use of this method for many years in the training of wrestlers of various levels of advancement, made it possible to work out standard indexes allowing for an evaluation in points of the level of each motor ability. Level of coordination had a considerable share (in seniors 28.6%, in juniors and cadets 52.2%).

Conclusions:

Applying a battery of tests as an objective method enabled an evaluation of the level of each particular motor ability of the national team wrestlers in freestyle and Greco-Roman style in their long-term training cycle, as well as at various training periods.

Key words:

coordination motor abilities • freestyle • Greco-Roman style • Polish national team • station method

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Motor preparation of athletes – consist from two parts: physical abilities and coordination abilities. In many international tests was only the first which give only part information about level of athletes preparation. In this paper is presented a battery of tests which give a possibilities to control both part of level full motor preparation of junior and senior wrestlers and a new way for elaboration a battery of test for different sports.

Abilities (motor abilities) – Stable, enduring traits that, for the most part, are genetically determined and that underlie a person's skill in a variety of tasks. People differ with respect to their patterns of strong and weak abilities, resulting in differences in their levels of skill [24].

Coordination motor abilities – psychomotor properties that define the readiness to control and regulate motor activities in an optimal way.

Wrestling – sport in which two contestants fight by gripping each other using special holds, each trying to force the other's shoulders onto a mat [25].

Freestyle wrestling – is a style of amateur wrestling that is practiced throughout the world. Along with **Greco-Roman**, it is one of the two styles of wrestling contested in the Olympic games.

Supples – specific throw in wrestling, when the attacker first down on his back.

INTRODUCTION

The level of motor abilities is the foundation of all kinds of training preparation wrestlers to competition. An inadequate foundation causes rocking of the whole “*edifice*” of the athletes preparation. Then, at a certain stage of the competitor's training, his technical, tactical, psychological and other preparation, may be “*shaken*”. The low level of motor abilities may be cause of an imperfect technique, and this may results in an ineffective tactic. Hence, neglect on one of the floors of the “*edifice*” results in the lowering of the level on higher floors. Though all these preparations are interdependent as far condition are concerned, **the importance of the level of motor abilities is outstanding in the long-term preparation of the athlete, regardless of the sport discipline.**

The fact was admitted many years ago, thus so much attention was devoted to various component of the wrestler's motor abilities [1]. In the vast majority of the publications, as well as during the training, much more attention was devoted to physical abilities rather than to coordination ones. This was disclosed when establishing methods of evaluation wrestlers' motor abilities. Out of the many hitherto presented propositions, only few of them have been put into practice so far. There were used to evaluate the changes in the level of motor abilities. The special record holder in this field was the battery of tests of attempts of own invention which has assisted coaches for over 32 years.

There is a small number of batteries of tests for wrestling which have tradition in use of over 32 years, and special which are included coordination abilities as one of most important tests for achieving success in wrestling. Former investigations [2, 3], are not accepted big important of coordination abilities for success in wrestling, **so this batteries of tests had in this time, revolution principles.** Such a long tradition of using the battery of tests, and the subsequent success of Polish wrestlers (and in last 5 years of Croatian wrestlers, lead us to conclusion that the Polish battery of test confirmed its validity in practice which was not find in wrestling until now.

The importance of the motor abilities for success in wrestling were estimated in co-operation with the best coaches of wrestling in Poland, and according to them **movements coordination plays the most important role in wrestling** (for cadets and juniors 52.2%, and for seniors 28.6% of the total number of tests). Such a long tradition of using the battery of tests, and the

subsequent success of Polish wrestlers (in the most of medals: 5 Olympic medals in Atlanta 1996, 3 gold), lead us to the conclusion that the Polish battery of tests confirmed its validity in practice which was not find in wrestling until now. Only, from the perspective of the last 32 years, one can assess how important and valuable has this departure been. It is regrettable it applied in Poland and partially in some other countries (last 13 years in Croatia [4-8]) and only to wrestling!

Therefore, generally aim of the work is a scientific argumentation justifying the use of recommended battery of tests in practice of wrestling training.

MATERIAL AND METHODS

Participants

Material was collected during 18 investigations 3 days sessions on 524 high advanced wrestlers (freestyle and Greco-Roman) of all weight categories and level of sport class (cadets, juniors, seniors). The study was approved by the Ethics Committee.

Protocol

So generally worded aim implies the following research tasks: designation the principles of construction battery of tests; presentation the motor abilities battery of tests; evaluation and diagnostic-index of reliability tests of the battery; work out the a scale „T” for the battery of tests; metric characteristic of the battery; an abridged version of the battery.

In all this investigations the method was own authors W. Starosta and J. Tracewski [9] battery of 23 tests for an evaluation in points of the level of each motor abilities.

RESULTS

Principles of construction the battery tests

The preparation of the battery was preceded by an analysis of the hitherto national and international output in this field. The work concerned the theory of sport and wrestling, as well as experience acquired during the training of wrestlers. The work was carried out in close co-operation with the great number of the best coaches of wrestling in Poland [9]. Moreover, the work was the result of an initiative of the representatives of the Polish Wrestling Association (mainly of J. Tracewski – successful many years coach of national team). Next, the team elaborating the battery was given the task to prepare a list of motor abilities indispensable for the

wrestlers to achieve considerable success, and then to establish the hierarchy of their importance.

The list was not only confined to the accepted then [9] classical physical e.g. fitness abilities (strength, speed, endurance), but also included extensively movement coordination abilities [10-15]. At that time it was one of the major departure in the promoted theories of sport training. This kind of departure would not have been possible if not the high position of a group of experts and wrestlers, particularly those of Greco-Roman style, in the international arena. Only, from the perspective of the last 32 years, one can assess how important and valuable has this departure been. It is regrettable it applied only to wrestling! It might have had a crucial impact on the long-term and nearly continuous series of success of the wrestlers in the international arenas!

When creating the battery of tests it was established that the following conditions should be fulfilled:

1. It should reflect the specificity of wrestling, that is, it should comprise the evaluation of all motor abilities needed by the wrestlers in order to achieve considerable success.
2. It should include tests which have met the demands in the hitherto training, and which possess a high index of reliability (Table 1).
3. The number of tests evaluating the particular ability should be adequate to its importance in the hierarchy. The higher its position in the hierarchy, the more tests should evaluate it. From the methodological point of view it was a new approach towards **the construction of the battery of tests evaluating the level of motor abilities.**

Table 1. Analysis of the reliability of selected tests of battery for advanced classical style wrestlers (n=35).

Name of test and references	N	SB	ac	Cra	Ecra	R	Eigenvalue	Cumul %
Maximum turn in jump (right + left) [4]	3	0.994	0.995	0.994	0.980	0.983	2.965	98.843
Maximum turn in jump – left [4]	3	0.990	0.990	0.989	0.968	0.970	2.939	97.976
Maximum turn in jump – right [4]	3	0.985	0.986	0.984	0.953	0.960	2.912	97.073
Zig –zag run, so-called envelope [4]	3	0.871	0.871	0.870	0.690	0.697	2.385	79.502
Run with turnover [4]	3	0.846	0.848	0.837	0.631	0.666	2.301	76.697
Maximum high jump with both feet [4]	4	0.960	0.960	0.959	0.921	0.860	3.574	89.351
20 m run from the flying start [4]	3	0.945	0.945	0.944	0.848	0.850	2.700	90.001
Trunk bending (back bench) [4]	4	0.983	0.982	0.988	0.965	0.940	3.801	95.073
Forward pass [5]	5	0.986	0.985	0.985	0.976	0.937	4.726	0.945
Forward somersault in squat position [5]	5	0.987	0.988	0.987	0.979	0.944	4.761	0.952
Backward somersault in squat position [5]	5	0.993	0.993	0.992	0.987	0.966	4.854	0.971
Backward pass [5]	3	0.921	0.923	0.903	0.862	0.816	2.595	0.865
Strive – so-called merry-go round [23]	3	0.969	0.969	0.968	0.857	0.918	2.823	0.941
Strive in right [23]	3	0.949	0.950	0.947	0.845	0.861	2.722	0.907
Strive in left [23]	3	0.945	0.945	0.942	0.909	0.859	2.704	0.901
Bridge from above upper, so-called bridge execution [23]	3	0.791	0.792	0.790	0.556	0.563	2.120	0.707
The catch (snatch) from the neck [23]	3	0.824	0.825	0.821	0.605	0.618	2.240	0.741
Bridge arrival (coming) [23]	3	0.854	0.859	0.847	0.648	0.671	2.325	0.775

Legend: **N** ordinal number of items (graders); **SB** Spearman-Brown coefficient of reliability; **ac** Kaiser-Caffry coefficient of reliability; **Cra** Cronbach's a coefficient of reliability; **Ecra** estimated Cronbach's a coefficient of reliability if two items are excluded; **R** Average Inter – Item Correlation; **Eigenvalue** absolute amplitude in characteristic values of the matrix of item correlation; **Cumul %** by percentage articulated cumulative part of characteristic values of the matrix of item correlation.

Table.2. Motor abilities required during the practise of a battery of tests of general and special physical fitness in advanced wrestlers [15].

Code	Name of test	Physical (fitness) abilities					Coordination					Abilities					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
General physical abilities tests																	
1	Maximum turn in jump					+	+	+	+	+	+	+					
2	Zig-zag run, so-called envelope	+					+	+	+	+	+	+	+	+			
3	Run with turnover	+					+	+	+	+	+	+	+				
4	Pull-ups	+	+	+						+		+		+	+		
5	Arm bending and stretching with Support on parallel bars	+	+	+						+		+		+	+		
6	Maximum load press in recumbent Position		+													+	
7	Forward lean with rotation (with load)	+	+	+						+		+		+			
8	Maximum load snatch	+	+			+				+	+	+				+	
9	Lift of maximum load on chest	+	+							+							
10	Squat with maximum load		+														
11	Maximum high jump with boot feet	+	+			+	+		+	+		+					
12	30 m run with flying start	+	+									+					
13	1000 m run (1500 m)			+						+							
14	Trunk bending (back bench)		+			+						+					
Special fitness tests																	
15	Forward pass	+				+	+	+	+	+	+	+				+	+
16	Backward pass	+				+	+	+	+	+	+	+				+	+
17	Forward somersault in squat position	+				+	+	+	+	+	+	+				+	+
18	Backward somersault in squat position	+				+	+	+	+	+	+	+				+	+
19	Strive - so-called merr-go-round (roundabout)	+	+			+			+	+	+	+				+	
20	Bridge from above upper, so-called bridge execution					+			+	+							
21	The catch (snatch) from the neck	+	+			+			+	+							
22	Bridge arrival (coming)	+				+			+	+							
23	Supples wrist with manikin	+	+	+	+	+	+	+	+	+	+	+	+	+			+

4. Attempts should be available for every wrestler regardless his age, weight category, sport advancement (class).

5. The battery should include tests not requiring special equipment, as a result, the ones that might be used in every club.

6. They should have at least two variants: for cadets, juniors and seniors. The first one should involve a considerable higher number of tests requiring the a demonstration coordination abilities (general and special coordination).

7. The battery should include a right proportion of tests evaluating physical and coordination abilities resulting from Gundlach’s concept [1].

8. The execution of certain attempts should be precisely regulated so that they could ensure the objective acquisition of results.

9. In order to standardise the way of executing the tests it should be necessary to elaborate a detailed instruction manual and to promote it among coaches of all the clubs.

Supplement to Table 2. Identification codes of particular physical and coordination abilities.

Physical (fitness) abilities		Coordination abilities			
code	abilities	code	abilities	code	abilities
1	speed	6	adequate speed reaction	11	movements connection
2	strength	7	balance preservation (maintenance)	12	adaptation (combination, transposition)
3	endurance	8	spatial orientation	13	muscles relaxation
4	flexibility	9	movement rhythmisation	14	movements symmetrisation
5	jumping ability	10	kinaesthetic movements differentiation	15	movements suggestiveness (expressiveness)
				16	cooperation

Characteristics battery of tests

The battery was composed of two parts (Table 2 with supplement): the first of it comprised general physical abilities tests (codes 1-14, each of them had its particular number), and the second – special fitness tests (codes 15-23). Its division was agreed upon and it served a better clarity of the battery. The battery involved 12 tests for evaluation coordination abilities (mainly of synthetic character, that is the coordination of the whole body), and 11 attempts involving physical abilities (strength of various muscle group, general and special speed, various kinds of endurance, jumping abilities and flexibility). In those times [1, 11] it was a novelty to expose coordination abilities in such way. Presently, it constitutes a modern formulation of proportions which should be included in the battery of tests evaluating the level of motor abilities.

The number of tests proposed to the wrestlers (seniors 15 tests), and particularly to juniors was quite big (up to 23), out of which 14 tests were for general fitness and 9 for special fitness. That is why the performance of the battery was divided into 3 days. The amplexness of the battery was justified because it was conducive to a more comprehensive preparation of the wrestlers, among others, the constant development of indispensable motor abilities and technical elements (tests of special fitness), a variation of the training content (e.g. through preparing to execute tests requiring acrobatic preparation). A complex approach to the preparation of the wrestler was applied by including tests which would evaluate abilities relevant to a wrestler. The amplexness of the battery was still more increased by the fact of including tests applied earlier in the training of wrestlers [16, p.137-136, 164-165], and by adding new tests – of own invention (global motor coordination and jumping ability test of Starosta [17-19], or the modified flexibility test). In the course of theoretical

consideration, and the analysis of practical experience it was difficult to decide which of the proposed tests would be the most diagnostic one. We assumed that the best way to evaluate each particular test would be through their execution. In this way, the value of the battery was subject to testing in a larger group of wrestlers, and the collected material was subject to statistical analysis.

The diagnostic value of the battery was risen due to the unification of the principles of the test performance. Within these principles an important part was played by the standardisation of the conditions, that is, the same part of the day when the tests were carried out, identical order of tests, a similar costume worn by the wrestlers, the same content of the warm-up, the same investigator, etc.

A crucial element of the standardisation was the identical order of the tests, different for the seniors, and for the juniors. The majority of the tests was conducted by a station method. The number of stations depended on the kind of tests, e.g. acrobatic tests for juniors did not require any stations at all. A reasonably equal division of load per day was also tested (number of tests). The increasing fatigue in the third day of tests was also taken into account, thus planning a fewer number of tests. At the same time certain rules concerning the attempt execution were considered, for example the necessity to assess the level of coordination abilities before attempts requiring endurance and strength. Jointly, because of organisational matters, some of the tests were grouped: acrobatic, special fitness, strength.

Evaluation and diagnostic – index of reliability of the battery

Counting the points obtained in each of the particular tests enabled the picking up of the level and motor

abilities of each of the examined athlete. It enabled the affecting of the comparison of the wrestlers of the same and different weight categories, as well as of their level of abilities in various tests and various training periods. However, it was not of evaluating character. There was a lack of reference of the value of collected results to some sort of universal scale, e.g. a verbal definition of the value of each of the obtained result. Therefore, for results represented in the point scale „T” [11], basing on their arithmetical average and standard deviation, first five units of the motor abilities of the Polish population of wrestlers [13, 14] was defined, and further on the number of units was increased to 11.

Establishing a point scale „T”

With the help of tests forming a set, results in various measuring units were collected: in kilograms (in strength attempts), centimetres (in backward bends and maximum vertical jump), in the number of repetitions (in pulling up on a bar, in twists), in points (in acrobatic attempts), in degrees (in maximum turn in a jump). The variety of the applied units of measurement rendered it difficult to compare the level motor abilities in each of the performed tests. Therefore, the standardisation of these units, that is bringing it down to the common denominator and converting all the obtained results into points, became a necessity. It enabled the use of scale „T”. As a result, after carrying out a series of 18 tests with 524 wrestlers of the Polish national team in freestyle and Greco-Roman, during various training periods (preparation, starting), and various stages of sport training (cadets, juniors, seniors) a „T” scale was established for all the tests of the battery. The scale was identical for both wrestling styles, and for all the stages of sport training, as well as for different training periods.

The „T” scale allowed every value obtained in the attempts to be converted into points. In this way the level of every ability of the wrestler (the higher the level – the more points scored) was possible to be evaluated. Summing all the points for all the abilities it enabled a total evaluation of the wrestlers level of motor abilities. Basing on the comparable point values it was possible to define the individual ability structure, and within them, to establish the leading and the lagging behind abilities, e.g. the strong and the weak sides of their motor abilities. It allowed for an establishment of a further development of those abilities indispensable to the wrestler and to the steering of their progress, and moreover, it allowed for a technical and tactical preparation along with the

leading abilities. It enabled a real individualisation of the entire preparation of the wrestler together with the modelling of his adequate style of fight.

Using the „T” scale it was possible to define objectively the partial level of motor abilities (in an test or tests evaluating the same ability), and the entire level of all the wrestlers (the total of all the results of all the tests), and then to show the differences in points between wrestlers of the same and different weight categories. The scale „T” allowed, in an objective way, to distinguish the most fit wrestlers in the group (leaders). In addition it enabled the establishment of a composition of abilities which would “*guarantee*” success, that is, the model of a champion’s fitness in a particular weight category. Basing on long-term researches it was possible to define individual changes in the wrestlers’ fitness in view of their sport career, as well as the most rational level of development of every specific abilities in relation to others [20-23].

An abridged version of the battery

With the use of the factor analysis of the results collected after various researches [13,14] it was possible to establish tests that would provide the maximum information about the level of motor abilities of the wrestlers. An abridged version of the battery was created as a result of the tests. The version, though, differed for freestyle and Greco-Roman wrestlers, as well as for wrestlers at different stages of training (years of training experience, training period etc.). Some of the attempts took place in all cases. These tests were included into the abridged version. The battery involved: runs with rolls/tumbles, pull ups on a bar, bending and stretching of arms with a support on bars, maximum weight throws on the breast, 20 meters or 30 meters flying run, 1000 meters runs (after the change of the rules and the extension of the fight for another 5 mins. 1500 meters runs were introduced).

DISCUSSION

The fulfilment of such a number of conditions (see: *principles of construction the battery tests* – points 1 to 9) was not easy. It became possible thanks to the close co-operation between the representatives of theory and practice. The fact might have been decisive as far as the usefulness of the battery, and might have favourably affected its implementation in the training programmes of all the Polish clubs.

In the chapter “Results” we have presented the concept of Gundlach [1] and its modification, a hierarchy of motor abilities in wrestling was elaborated, in which coordination abilities occupied one of the leading positions [9, 11]. The fact was reflected in the battery of tests of general and special fitness of freestyle and Greco-Roman wrestlers, in which evaluating the level of coordination had a considerable “share” (in seniors 28.6%, in juniors 52.2%). This might have positively affected later successes of the Polish wrestlers – the best team in the world (among others the winning of 5 medals at the Olympic Games in Atlanta, including three gold ones).

The battery for juniors (23 tests) included 12 tests evaluating coordination abilities, and 11 evaluating fitness abilities, whereas in the version for seniors out of the 15 – three dealt with first motor abilities. Such form of exposing coordination abilities in those times was a sort of novelty. Applying a battery of tests as an objective method enabled an evaluation of the level of each particular motor ability of the national team wrestlers in freestyle and Greco-Roman in their long-term training cycle, as well as at various training periods. The evaluation concerned wrestlers of various training stages (cadets, juniors, seniors).

The battery made it possible to define leading and non-leading motor abilities, both coordination as well as fitness, thus, the profile or composition of these abilities. Basing on the results of the researches individual training plans were worked out, and styles of fights were constructed. Basing on the material collected during 18 tests sessions carried out with 524 highly advanced wrestlers, a “T” scale enabling the transfer into points of results collected in different measuring units (kg, cm, s, degrees, number of repetitions) was elaborated. It enabled an evaluation of every motor ability of the wrestler, as well as their summary evaluation, and the distinction of his strong and weak sides.

The use of this method for many years in the training of wrestlers of various levels of advancement, made it possible to work out standard indexes allowing for an evaluation in points of the level of each motor ability, as well as to transfer points into an 11 degree marking scale (from the outstanding to the poor ones). It was a special scale prepared for the population of the Polish wrestlers. Long-term and systematic researches enabled Polish wrestlers an involvement in the training in which appropriate proportions between the development of physical and coordination abilities were applied. It meant many other correctly carried out elements of training, particularly in Greco-Roman style, which enabled achieving great success in the international arenas in the years 1981-2013.

Such unification of diagnostic procedures for assessment of basic and specific fitness abilities of wrestlers in different countries can make a lot of scientific, expert, organizational and material benefits. This is very important for countries which do not have a lot of quality wrestlers, and adequate scientific and material resources [7, 8].

CONCLUSIONS

Applying a battery of tests as an objective method enabled an evaluation of the level of each particular motor ability of the national team wrestlers in freestyle and Greco-Roman style in their long-term training cycle, as well as at various training periods.

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REFERENCES

- Gundlach H. O systemie zależności pomiędzy zdolnościami i umiejętnościami fizycznymi. In: Sympozjum teorii techniki sportowej. Sport i Turystyka, Warszawa, 1970, 185-194 [in Polish]
- Cabrić M. Struktura wybranych wskaźników somatycznych, motorycznych i funkcjonalnych u zapaśników wysokiej klasy. Sport Wyczynowy 1976, 12: 9-15 [in Polish]
- Tumanjan GS. Sportivnaja borba – otbor i planirovanje. Fizkultura i Sport. Moskwa; 1984 [in Russian]
- Marić J, Baić M, Sertić H et al. Metric characteristics of selected tests for the evaluation of basic training status in top level wrestlers. In: Milanović D, Prot F, editors. Kinesiology – New Perspectives. Opatija, Zagreb: Faculty of Kinesiology, 2005: 435-438
- Sertić H, Baić M, Segedi I. Metric characteristics of chosen acrobatic tests for advanced wrestlers. In: Sadowski J, editor. Coordination motor abilities in scientific research. Jozef Pilsudski Academy of Physical Education in Warsaw – Faculty of Physical Education in Biała Podlaska; 2005: 247-252
- Baić M, Sertić H, Cvetković Č. Differences in physical fitness levels of greek-roman wrestlers with varying degrees of success. Kinesiology Slovenica 2006; 12(2): 5-12
- Baić M, Sertić H, Milanović D et al. Diagnostics of physical abilities of wrestlers in Croatia. In: Cynarski WJ, Kalina RM, Obodyński K, editors. Proceedings of 1st World Scientific Congress of Combat Sports and Martial Arts, Rzeszow; 2006: 83-84
- Baić M, Karninčić H, Gluhak P. Unificiranje dijagnostičkih postupaka za procjenu opće i specifične kondicijske pripremljenosti hrvača (Unification of diagnostic procedures for assessment basic and specific condition preparations of wrestle). In: Findak V, editor. Zbornik radova 20. ljetne škole kineziologa Republike Hrvatske, Zagreb. Hrvatski kineziološki savez, 2011: 276-280 [in Croatian]
- Starosta W, Tracewski J. Zestaw prób sprawności ogólnej i specjalnej dla zaawansowanych zawodników zapasów (styl klasyczny i wolny). Instytut Sportu, Polski Związek Zapaśniczy. Warszawa; 1981 [in Polish]
- Starosta W. Movement coordination as an element in sport selection system. Biol Sport 1984; 1(2): 139-153
- Starosta W. Sprawność ogólna i specjalna zaawansowanych zapaśników (styl klasyczny i wolny) w świetle badań prowadzonych w latach 1981-1984. Instytut Sportu, Polski Związek Zapaśniczy. Warszawa; 1984 [in Polish]
- Starosta W, Głaz A, Tracewski J. Variation of selected agility (coordination) indices in young wrestlers during training. Biol Sport 1985; 2(2): 75-86
- Głaz A. Struktura sprawności fizycznej zaawansowanych zapaśników stylu klasycznego. Praca doktorska. AWF Warszawa, 1987 [in Polish]
- Głaz A, Starosta W. Struktur der motorischen Leistungsfähigkeit von Ringern unterschiedlicher Gewichtsklassen. In: Osiński W, Starosta W, editors. Proceedings Intern. Conf. „Sport Kinetics ‘93”. Academy of Physical Education in Poznań. Institute of Sport in Warsaw. Poznań-Warsaw; 1994: 611-620 [in German]
- Starosta W, Głaz A. Poszukiwanie modelu sprawności motorycznej mistrza zapasów. Roczniki Naukowe AWF w Warszawie 1998; Tom XXXVII: 175-189 [in Polish]
- Pilicz S. Wybrane zagadnienia selekcji w sporcie. Biblioteka Trenera, PKOl, Warszawa; 1971: 137-138, 164-165 [in Polish]
- Starosta W. Nowa metoda pomiaru tzw. skoczności. Monografie AWF Poznań 1978; 96: 351-355 [in Polish]
- Starosta W. Nowy sposób pomiaru i oceny koordynacji ruchowej. Monografie AWF Poznań; 1978; 96: 365-371 [in Polish]
- Starosta W, Radzińska M. Comparison of jumping ability measured by different methods in sportsmen. Biol Sport 2001; 18(3): 245-251
- Starosta W. Correlation between Co-ordination and Physical Abilities in the Theory and Practice of Sport Training. In: Blaser P, editor. Theories of human motor performance and their reflections in practice. Hamburg; 1997: 57-69
- Starosta W, Tracewski J. An objective method of assessing the level of motor abilities in advanced wrestlers. In: Sadowski J, W. Starosta W, editors. Movement Coordination in Team Sport Games and Martial Arts. Academy of Physical Education in Warsaw – Institute of Sport and Physical Education in Biała Podlaska, 1998: 249-254
- Starosta W. Obiektywne metody pomiaru i oceny poziomu zdolności motorycznych zaawansowanych zapaśników. International Association of Sport Kinetics, Institute of Sport in Warsaw – Polish Wrestling Federation, Warsaw; 2004:1-148 [in Polish]
- Starosta W, Baić M, Sertić H. Reliability of the chosen Polish test for evaluating specific training status in advanced wrestlers. In: Sadowski J, editor. Coordination motor abilities in scientific research. Jozef Pilsudski Academy of Physical Education in Warsaw – Faculty of Physical Education in Biała Podlaska, 2005: 144-149
- Schmidt RA, Wrisberg CA. Motor Learning and Performance. A Situation-Based Learning Approach. Fourth Edition. Human Kinetics; 2008
- Dictionary of Sport And Exercise Science. London: A. & C. Black; 2006

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