Exercises and sets of exercises diagnosing the ability to optimally use muscle strength – part I: lower limbs

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

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Received: 03 December 2021; **Accepted:** 14 December 2021; **Published online:** 23 December 2021

AoBID: 15740

Abstract

The phenomenon of ability to optimally use the muscle strength (AOUMS) has not been explored in either human motor science or other specialized sports science. The aim of this paper is to recommend a simple set of exercises for diagnosing lower limb AUOMS.

Diagnosis of lower limb AOUMS (non-apparatus version): standing jumps. Identical patterns of force use in diagnosing upper and lower limbs were used (the first exercise with eyes open, the second exercise eyes covered and then alternated). The minimum set of diagnostic exercises for alternating eyes open – eyes covered must consist of six exercises, respectively one jump with the use of force according to the model: first jump 50% of the sense of maximum strength open eyes; second jump between 5% to 45% of the feeling of this force covered eyes; 65% to 95% – open eyes; 50% – covered eyes; 5% to 45% – eyes open; 65% to 95% – covered eyes. The series of six exercises ended with three trials with eyes open, each at 100% (the farthest jump was the frame of reference for measuring the conformity of each score to the model expressed in %). Other model compilations are possible. However, when only the open eyes version is used, a series of jumps each at 100% must be preceded by a minimum pattern of five jumps with less use of the leg muscles (again first 50%, then alternating 5% to 45%, 65% to 95% etc.). Important elements of AOUMS diagnostics are estimating motivation before and during the implementation of a given model, as well as measuring HR (especially if the given model is repeated in a long training session).

Keywords: innovative agonology • motivation • training session

Conflict of interest: Author has declared that no competing interest exists

Ethical approval: Not required

Provenance & peer review: Not commissioned; externally peer reviewed

Source of support: Departmental sources

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APA – Adapted Physical Activity.

Contextual definition – *noun* a definition in which the meaning of a word, expression, or symbol is partly or wholly determined by defining the meaning of a larger expression containing the definiendum (as a definition of ***legal right*** by the statement «X has a ***legal right*** to ***y*** = X has a claim upon somebody for possession of ***y*** which the courts will sustain») → contrasted with ***explicit definition*** [29].

Technique– *noun* a way of performing an action [30].

Training session – *noun* a period of time during which an athlete trains, either alone, with a trainer or with their team [30].

Proprioception – sensory information that comes primarily from sources in the muscles and joints and from bodily movements [8].

Non-apparatus test – that motoric test (exercise endurance test) of the required reliability (accurate and reliable), which use does not require even the simplest instruments [31].

Quasi-apparatus test – can be conducted with simple instruments (a stopwatch, a ruler, a measuring tape, etc.) [31].

INTRODUCTION

The phenomenon of the ability to optimally use muscle strength (AUOMS) has not been explored either in the research field or in the practice of sports training or in any other area of human activity where the improvement of motor skills is a major element of expected performance (music, pantomime, theatre arts, arts and crafts, operation of production or military equipment and installations, etc.). The author has not come across such a name or research results. Some similarities can be drawn with the phenomenon of kinesthesia (feeling of movement), but only a few [1-3]. The study of the AUOMS phenomenon is closer to the idea of Tadeusz Stefaniak [4], who measured „reproducing the given force" (in a free translation from Polish, after all the author in the English-language summary of his monograph calls this phenomenon either „precision in recreation of the set power", or „limbs power precision". However, it is a term – in fact terms – belonging to coaching jargon and it is difficult to draw an analogy. It is most reasonable, in the author's opinion, to consider AUOMS as an essential element, or rather an individual case, of the phenomenon of kinesthetic differentiation ability [5-7], and is related to proprioception [8].

So, instead of even a general definition of the AUOMS phenomenon (in fact, it would be a contextual definition – see glossary) I will use an assumption, based largely on intuitive presumptions, however well-founded. Well, not a few experienced practitioners with many years of experience of teaching various people motor activities use exercises and sets of exercises in the ongoing evaluation of the effectiveness of these activities. These are important motor activities (sometimes referred to as technique – see glossary) and experts who have the opportunity to frequently verify the effectiveness of the daily physical efforts of people who differ in many characteristics, including aptitude, ability, energy potential, motivation, etc. These activities are related either to a person's paid work, education or occasional activity of varying intensity (participation in sports competitions, physical recreation, etc.). On the other hand, I consider creative teachers of physical education, music and many other professions, entry-level military commanders, sports instructors, personal trainers, physiotherapists, surgeons, operators of various equipment, etc. to be experts. For a particular expert, just a certain proportion of observed motor activities related to professional or other activities has even a very significant diagnostic value, also in a prognostic sense. On a number of occasions, I have had the opportunity to discuss this issue with various specialists, in different parts of the world, and in certain circumstances to acquire knowledge by means of participatory observation.

The assumption: the phenomenon of AUOMS, although not yet observed either by clinical methods using standardised laboratory tests or investigated by means of so-called field tests, is intuitively perceived by many teachers of numerous varieties of motor skills as a multidimensional human disposition with an organic and mental basis that is subject to training (improvement), and the results of observation are in most cases part of the professional secret of the expert concerned.

In contrast to the motor testing paradigm, this formula of exercises and sets of exercises diagnosing the AOUMS is based on the principle of sensible freedom in the selection of exercises fulfilling the test (diagnostic) functions, their number and arrangement as a function of time. However, the other criteria of professional experimentation must be fulfilled, so that the results can be compared in relation to different diagnostic periods, to different people and to other still conditions. The primary criterion is the need to use identical sets of exercises as a function of time, while other circumstances may be altered for operational diagnostic purposes. For example, identical sets of exercises applied as a warm-up prior to the core tasks of a training session, then repeated mid-training and at the conclusion of the.

The freedom to use only one exercise for diagnostic purposes is already limited. It would be rather ludicrous to base a worm-up at any point in a training session is not subject to rigid rigour.

The aim of this work is to recommend a simple sets of exercises for diagnosing lower limb AUOMS.

Non-apparatus method of estimating AOUMS of the lower limbs

"Diagnostic Exercise Arrangement": model-exercise "2 × 160 UMS" (UMS – used muscle force). Assumption of this model is to use 160% of muscle force twice each, three times with eyes open, three times with eyes covered (6 exercises in total) in an order known only to the examiner, alternating

eyes open, eyes covered (**bold**). Estimation of maximum force is based on performing the last three jumps with eyes open with a sense of the greatest energy exposure (each jump separated by about a 20-second pause), with the longest just being the 100% criterion. The UMS model used: 50%; **25%**; 75%; **50%**; 35%; **85%**; three times 100%.

The subject is first verbally acquainted with the essence of the pending exercise system (long-distance jumps from a spot with a bipod), with a clear articulation that it is about his perceived energy potential at that moment, which will be estimated precisely by a series of these jumps. After declaring that she understands the tasks, she stands in front of the line in a slight stride (Photo 1) and, after the command "READY", performs the jumps in sequence according to the accepted model (but known only to the researcher).

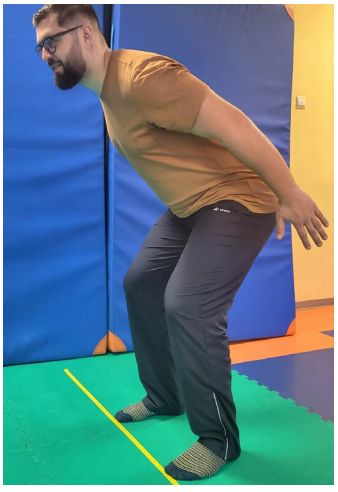

Photo 1. Starting posture during jumping in the AOUMS evaluation.

After making a jump in front of a fixed line, the test subject turns on the heel of the foot closer to the starting line (Photo 2ab), and the measure of distance is the number of feet (Photo 2c). If the last foot either crosses the starting line or does not make contact with it (Photo 2d), the distance should be subjectively estimated to the nearest 0.1 of the length of that foot (Photo 2e); the raw result should be recorded, e.g. 6.4.

The estimated compliance or error (in %) is the result of, first, determining the UMS value during the evaluated test (dividing the raw result of that test by the raw maximum result), and then comparing the performance (that is, this result with the model). An error-free result is documented with an "x" symbol in a special test sheet (appendix: *long jump from standing posture*), while the use of excessive force is documented with a "+" symbol placed after the recorded result, and in the case of a force deficiency with a "–" symbol.

The index of the quality of muscle force use (AOUMS Index) in relation to the benchmark (model) value is the proportion of exercises whose error in relation to the model value is no greater than 5% to the number of exercises of a given diagnostic system. In the model used, there are 6 exercises in total (3 with eyes open and with eyes covered). Thus, the AOUMS Index for the 6 exercises (expressed by the ratio index): very high 1 or 0.83; high 0.667; average 0.50; low 0.33; very low 0.167; inadequate 0. Absolute conformity of the exercises performed to the model or with errors of less than one percent would indicate an outstanding level of AOUMS and is documented by the index 1P.

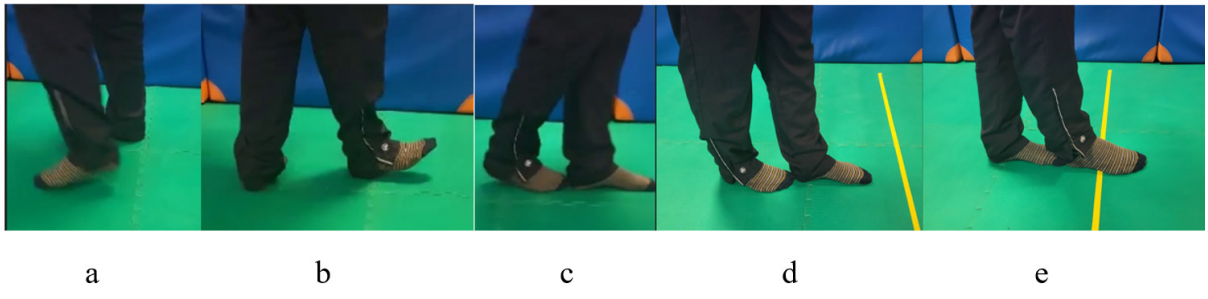

Photo 2. Stages of measuring stroke length.

METHODOLOGICAL NOTES, RECOMMENDATIONS, CONCLUSIONS

The AOUMS method is uninspired by Zuchora's Index [9], although the score of a long jump from a jump with both feet from a standing position (one of the six trials) is measured precisely by the number of one's own feet. The Zuchora test, like almost every other physical fitness category, is based on the principle of maximizing effort (whether short or longer in duration). Not surprisingly, the directive is to round the raw score either "up" (when the measurement is 6.5 feet, for example, then a score of 7 is documented) or "down" (less than ½ foot, such as 6.3, then a score of 6 is documented). The opposite of the AOUMS method, where measurement to the nearest 0.1 foot length (estimated subjectively by the researcher – intersubjective if there are at least two observers) is an indispensable criterion.

The author of AOUMS repeatedly used different compilations of jumps within different of exercises in educational practice and for the use of sports training, APA, etc. However, if a given sets of exercises was to be used at least twice for diagnostic purposes, it was repeated sets and documented in the same way with the greatest possible care. The fulfilment of this criterion is an indispensable condition for the applied sets of exercises to be assigned the value of a validated the motor test.

For example, a physiotherapy student, at the same time a soccer athlete of Polish fifth division league („IV Liga"), asked me to make a diagnosis of AOUMS after a gruelling Sunday game (but a sleepless night) – precisely on the basis of the "2 × 160 UMS" model recommended in this work. The result differed significantly (in a negative sense) from the one performed earlier, during an academic APA lesson. In both cases, this student/footballer was optimally motivated. This example, admittedly a one-off, illustrates the broad applicability of AOUMS. Moreover, it is an important presumption that its diagnostic capabilities therefore inspire confidence in the test subject, as he saw best that, despite his full commitment, he was unable to control his motor responses (to my commands) with similar precision as when he first applied the same program.

Since ideas in science and practice related to strengthening health and survival are limited only by the need to respect ethical norms, AOUMS can be used in any meaningful combination with other diagnostic tools (tests, motor simulations, etc Research projects combining AOUMS diagnosis, for example with BBDTS (the body balance disturbances tolerance skill). Litwiniuk et al. [10] used a quasi-apparatus version of the 'Rotational Test' (which measures the BBDTS phenomenon) before and after the completion of the basic skiing course lasted 10 days. It is clear that both phenomena (BBDTS and AOUMS) are related to the effects of initial skiing instruction and to the quality of later practice.

The student/footballer example aside, it's interesting to note the major conclusions of Andrzej Tomczak's long-standing studies (by himself and in research teams) on survival, in which he consistently used a non-apparatus version of the 'Rotational Test' [11-18]. The researchers proved that BBDTS is most effectively lowered by especially increasing exercise, sleep deprivation, or a combination of both this factors.

Many recommendations of physical fitness tests are available, such as the work of C. Ashok [19], and there is already extensive knowledge about motor learning and performance [8], however, I see the effective future of expanding this knowledge primarily in complementary approach in the sense of research and education. The example of Andrzej Tomczak's research is not isolated. Notable among the latest reports is the ingenuity, but especially the cognitive value of the innovative projects of Chodała and Gąsienica Walczak [20], Gąsienica Walczak et al. [21], as well as research by other authors, including the application of the still untapped potential of Chinese health exercises that also enhance personal safety [22-24]. Most of the references are to works by authors who enrich the cognitive-behavioural components of innovative agonology [25-27], which mission takes on particular importance in the revival of the bloody spectacles of the gladiatorial era [28].

ACKNOWLEDGMENT

The author thanks Bartlomiej Gasienica Walczak for sharing his image to demonstrate the essential elements of AOUMS testing.

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Cite this article as: Kalina RM. Exercises and sets of exercises diagnosing the ability to optimally use muscle strength – part I: lower limbs. Arch Budo Sci Martial Art Extreme Sport 2021; 17: 183-188

The ability to optimally use the muscle strength of the lower limbs AOUMS (long jump from standing posture)
/basic system of diagnostic exercises: 2 x 3 alternately open and covered eyes/

Person ……..…… place ……...…… date …..…..… time: from ….. to ……

Model of using muscle strength as a function of time [%] (CE: covered eyes)										**Total results in lines [%]** without 100%
		CE		**CE**		**CE**	open eyes			
	50	25	75	50	35	85	**100**	**100**	**100**	
Results	**the raw result: number of feet** (incomplete length with an accuracy of 0.10 of the length)									
raw										
%										

Profile AOUMS [accuracy in %]												
Criteria for three ranges of use of muscle strength (UMS)	open eyes					covered eyes					**Index AOUMS[x]**	
	the range of UMS [%]					the range of UMS [%]					score 0.00 or difference model ↔ execution ≤1% or ≤5%	
	comparison		difference model ↔ execution			comparison		difference model ↔ execution				
	model	execution	+	−	0**	model	execution	+	−	0**	**open eyes (n)**	**covered eyes (n)**
5 to 45%	35					25						
50%	**50**					**50**						
55 to 95%	75					85						
Sum	**160**					**160**					$\frac{n+n}{6}=$	
Difference	*		sum of differences			*		sum of differences				
*put „+" *or* „–" after the result; **put an X in the appropriate line												

Model of using muscle strength as a function of time (×) and execution (○)

%	**50**	**25**	**75**	**50**	**35**	**85**	**100**	**100**	**100**	**%**
100							x	x	x	100
90										90
80										80
70										70
60										60
50	x			x						50
40										40
30										30
20										20
10										10
Difference [%]*										

HR 6 second									^	^^	^^^
Motivation 1 to 10 points	#						##		##	###	

HR ^immediately after the last 100% jump, ^^60 seconds later, ^^^120 seconds later (at the discretion of the researcher during the jumps)
Motivation: #before the first jump, ##before the first and third jump 100%, ###after the HR measurement after the last jump 100% (assuming the ability to continue jumping)

[x]**Index AOUMS:** perfect 1P (each score 0.00); very high 1 or 0.83; high 0.667; average 0.50; low 0.33; very low 0.167; insufficient 0

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