

GONIOMETRIC RESEARCHES OF ARMWRESTLING SPORTSMEN

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Abstract. It is analysed results of goniometry of sportsmen of armwrestling and persons that go in for sport on amateur level. Amplitude of motions is studied in radiocarpal, elbow and humeral joints. It was used results of inspection of 27 persons in age 19-21 year. Large amplitude of motions of sportsmen is confirmed, especially in a radiocarpal joint. Information is interpreted as proof of importance of development of brush for effectiveness in armwrestling. Application of method of cross-correlation matrices was set by more optimum state of sportsmen. The biomechanics features of armwrestling are marked importance of optimum corners of adduction in joints in a frontal plane. Plugging is recommended in the training process of exercises on adduction, bending and unbending of radiocarpal joint. The indicated motions are important with technical tactical positions, their implementation allows to provide the most advantageous position of fighter raceme and provides terms for winning in a fight.

Keywords: goniometry, armwrestling, amplitude, joint, biomechanics.

Introduction.

Rising of sportsmen effectiveness is ensured by studying of peculiarities of special properties and by optimization of their levels. The results of arm wrestlers' of different skills complex examination permitted to specify a number of factors, influencing of their successfulness [1]. Research of bio mechanical and ergonomic aspects of this kind of sports proved the appropriateness of specialized limbs muscles' development, mainly of forearm muscles and biceps, rising of joints functional reliability [2, 3, 8-10]. In connection with this it can be suggested that amplitude of movements in joints around possible axes should also be considered as an important for this kind of sports property. The main method of its studying is goniometry [4, 5]. The given method gives objective information about peculiarities of supporting motion system to a researcher; the obtained results are widely used as criteria for evaluation of physical preparedness, efficiency of the conducted rehabilitation [4, 5]. But, till present time goniometric researches have not been carried out in arm wrestling and this fact conditioned the urgency of the given work.

The work has been executed as per plan of scientific and research works of Kharkov national pedagogical university, named after G.S. Skovoroda.

Purpose, tasks of the work, material and methods.

The purpose of the work is goniometric research of movement amplitude in arm wrestlers' (professionals and amateurs) arms' joints.

As materials we used the results of examination of 27 (20, 22 ± 0.55 years old) persons. The examined were divided into two groups: experimental group (EG) – 12 arm wrestlers of 19.83 ± 0.67 years old with skill level from 3rd grade to master of sports and control group (CG) – 15 persons of 20.53 ± 0.84 years old – arm wrestlers- amateurs.

For achieving of the set purpose such methods as goniometric examination and statistical analysis of the obtained data were applied. With the help of standard goniometer we determined movement amplitudes in radiocarpal, elbow and shoulder joints; 2-3 measurements of each movement were carried out, maximal indicators were registered [4]. In radiocarpal and shoulder joints bending, unbending, abductions, adduction were evaluated; in elbow joints – bending and unbending. The obtained results were processed with the help of licensed batch of electronic Excel tables with determination of parametric (Student's criterion) and non parametric criteria (by Wilkoxson-Mann-Wittny) and indices of non parametric correlation of Pirson [6]. For analysis of correlation matrixes the indicators, offered in work [7], were used.

Results of researches.

The results, given in table 1, proved that comparison of mean values in groups with the help of Student's criterion, has not determined significant differences.

Table 1

Results of movement amplitude in arm joints study

Joint, movement (degrees)		The examined groups	
		EG	CG
Radiocarpal, right	Bending	68,92±2,68	68,40±1,80 ¹
	Unbending	51,92±2,37 ¹	55,27±2,32
	Abduction	42,50±2,52	43,07±2,34
	Adduction	31,17±1,64	28,27±1,56
Radiocarpal, left	Bending	66,50±2,75	62,87±2,02
	Unbending	59,17±1,58	55,13±2,58
	Abduction	43,67±2,93	42,33±2,38

	Adduction	33,25±1,34	29,73±1,82
Elbow right joint	Bending	127,50±3,10	126,93±2,35
	Unbending	21,58±1,53	18,27±1,08
Elbow left joint	Bending	129,42±2,90	129,73±2,06
	Unbending	21,17±1,38	21,07±1,32
Right shoulder joint	Bending	159,50±2,80	164,13±2,99
	Unbending	52,17±3,09	51,13±3,24
	Abduction	149,33±4,28	148,47±3,79
	Adduction	23,75±3,25	18,67±0,94
Left shoulder joint	Bending	160,33±2,96	163,27±3,61
	Unbending	51,92±2,99	48,80±3,43
	Abduction	148,00±4,18	146,20±3,39
	Adduction	25,83±2,95	21,67±1,73

Note. 1 – the difference from the left joint is authentic ($p < 0,05$).

Unbending amplitude values of right radiocarpal in EG and bending amplitudes in the same joint of CG are the exclusions. In these cases authentic ($p < 0,05$) difference from the left radiocarpal is confirmed that can be interpreted as an illustration of some skewness of muscular developments of the examined persons.

In this situation it is acceptable to use non parametric criteria of statistical processing, which permit to analyze the difference between samples independently on the character of data distribution [5]. For analyzing we used criterion of Wilkison-Mann-Wittny (U), as the most powerful in the given group. By a number of indices its calculation confirmed big amplitude of EG sportsmen's movements comparing with CG.

The differences in movements' amplitude of radiocarps were the most evident. In them exceeding by adduction in the right ($U=19,46$, $p < 0,01$), bending ($U=41,01$, $p < 0,01$), unbending ($U=17,48$, $p < 0,01$) and adduction ($U=32,32$, $p < 0,01$) was found. In shoulder joints the same dependence is confirmed by adduction both in the right ($U=31,45$, $p < 0,01$), and in the left ($U=31,82$, $p < 0,01$) joints. The obtained results give ground to regard movements' amplitude in arm joints as an important for effectiveness in arm wrestling property, and its increasing proves greater flexibility of the examined sportsmen in comparison with amateurs. In its turn it permits to broaden the arsenal of arm wrestling techniques and thus, to improve successfulness of competitions.

It is also interesting that the expressiveness of difference between groups reduces in line: radiocarpal – elbow joint- shoulder joint. The analysis of radiocarpal mobility, fulfilled by Ye.V. Safonenkova [4], permitted to make conclusion about significance of this indicator in many kinds of sports. Considering peculiarities of arm wrestling, the development of radiocarpal and hand shall be regarded as a significant factor, because just they take maximum load in the process of wrestling [2]. The data, obtained by us, give ground to recommend including of adduction, bending and unbending of radiocarpal exercise into training course for arm wrestlers. The mentioned movements are very important are important from the point of technique and tactic position, because their execution promotes the most favorable position of arm wrestler's hand, i.e., provides conditions for victory.

Less expressed differences between indices of elbow and shoulder joints reflects their function in arm wrestling – formation and holding of all kinetostatics line, as the main ergonomic conception of this kind of sports [2]. For these joints the developed force is more important than amplitude of movements. Kinetostatics line, which is formed limb is characterized by decrease of maximum force in direction fro shoulder joint to hand, i.e. opposite to increasing of flexibility and its goniometric indicators.

The determined differences of movements' amplitude in elbow and shoulder joints can be explained with the help of a number of assumptions. First of all prevailing of elbow joints unbending amplitude in EG can reflect sportsmen's orientation to development mainly bending muscles in comparison with amateurs whose muscles-antagonists take more even load. One more factor, increasing unbending amplitude, is wide application in arm wrestling such exercise as weight lifting by biceps of arm, resting on desk. In this position triceps tendons stretch and it, consequently, increases unbending amplitude.. Besides, such tactic technique as wrestling with maximally adducted shoulder promotes increasing load on triceps and stretching. For final analysis of the determined peculiarities goniometric data are insufficient, that is why these results will be supplemented by anthropometric and functional researches.

At the same time differences of shoulder joints goniometry are interpreted from the point of view of bio mechanical arm sports peculiarities in rather interesting way. Adduction is fulfilled in front surface, in which the fight itself takes place, i.e. amplitude's increasing in this position can prove both: specialized training of arm wrestlers and better successfulness of EG in comparison with CG.

For evaluation of sportsmen's state from position of systemic analysis, the method of correlation matrixes was applied. This method permits to provide quantitative characteristics of functional system, which depend on relationship of steady and unsteady links in it [6]. The obtained results are given in table 2.

Table 2

Data of correlation matrixes of goniometric indices

Group	Specific weight of authentic links (%)	Specific weight of important links (%)	Index of labialization/synchronization (%)	Average factor of correlation
OF	10,53	45,79	40,30	0,75
KF	13,16	43,16	36,74	0,66

The analysis shows prevailing of specific weight both authentic and important links in CG that, in our opinion, must be interpreted as illustration of tension of adaptation-compensatory capabilities in this group in comparison with steady state in EG. Functional system in the given state tries to preserve the current steadiness, creating new links. Considering the fact that correlation matrixes were formed by goniometric indices, this can be one more proof of less flexibility of arm wrestling amateurs.

One more proof of greater state steadiness in EG is exceeding of synchronization/labialization index, which illustrates reduction of functional tension. Significantly high values of correlation average factor in both groups prove again that system state shall be estimated as tension, but the tension, which does not go out the limits of functional capabilities. At the same time for EG this index attests about high degree of link and for CG – about dependence of average value. In our opinion, it must be estimated as the reflection of better balance and harmonicity of just sportsmen indicators' development. Thus, analysis of correlation matrixes proves that the sportsmen's state is more steady, and the level of their functional tension is lower than in control group.

Summary.

Goniometric research proved increment of amplitude of professional arm wrestlers arms joints' movement versus arm wrestlers-amateurs. This permits to regard this property as an important one for successfulness in this kind of sports. The differences in radiocarpals were the most expressed that illustrate the importance of their training for arm wrestling. The method of correlation matrixes proved that the sportsmen's state is more steady and functional tension lower than in control group.

The prospects of future researches in this direction shall be pointed at study of goniometric peculiarities of sportsmen of the highest qualification, at determination of interconnections between morphological-functional peculiarities and goniometric indicators.

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