

DEPENDENCE OF STRENGTH, MUSCULAR ENDURANCE OF GRIP OF PROFESSIONAL MASS WRESTLERS ON HAND AND FOREARM ANTHROPOMETRIC CHARACTERISTICS

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Introduction. As pointed by many specialists, professional mass wrestlers need to develop strength and endurance of grip [1, 2, 5]. Thus, according to P.I. Krivoschapkin, with the development of mass wrestling as a sport and improvement of athletes' skills strength, endurance of bar grip will play a major, decisive role in a bout [5].

The ability to perform a reliable grip during the fight depends primarily on the level of development of strength and special endurance of the hands and forearms muscles. The bar grip technique is also important [2, 4, 5]. In the specialized literature devoted to the study of grip strength, specialists note a direct relationship of grip strength and hand anthropometric characteristics [7]. In this regard, the key prerequisite of this work was the assumption that the size of the hand and forearm of professional mass wrestlers has a certain positive relationship with the strength and muscular endurance of the grip. Hence, the purpose of the present study was to determine the degree of correlation between the grip strength, muscular endurance and anthropometric characteristics of hands and forearms of professional mass wrestlers.

Materials and methods. In order to confirm the hypothesis and to obtain the goal of the study the anthropometric characteristics of hand circumference and forearm girth were measured and muscle strength and endurance of hands and forearms of professional mass wrestlers were tested.

Anthropometric characteristics of hands were examined according to the parameters of the right hand: hand length, palm length, palm width, finger length. The girth of the left and right forearms were measured at rest. Hand muscle strength was measured using carpal dynamometry (CD), endurance of the hand and forearm muscles - using a special test "Hang on a special spinning bar" (HOSSB). During the HOSSB test exercise a tested athlete performed a standard-grip hang with both hands on the spinning bar, the duration of the hang was measured in seconds. The informative value of the HOSSB test exercises for evaluation and monitoring of the endurance of hand and forearm muscles in mass-wrestlers has been confirmed in the earlier studies [3].

The study involved 22 athletes actively engaged in mass-wrestling. They athletic qualification corresponded to the level of CMS, I, II, III sports categories. The average age at the time of the study was $19,8 \pm 1,3$ years, height - $171,57 \pm 4,65$ cm, weight - $70,84 \pm 5,63$ kg, the mass-wrestling experience of each athlete was more than 2 years. A statistical processing of the results was used to find the mean value

and standard deviation. The Bravais-Pearson correlation coefficient was used to show the correlation of anthropometric characteristics of hand, forearm, grip strength and muscular endurance. The correlation was considered weak, if $0 \leq r \leq 0,3$, average – if $0,3 \leq r \leq 0,7$, close – if $0,7 \leq r \leq 1,0$ [6].

To clarify the anthropometric characteristics of hand, forearm girth, strength and muscular endurance of grip in athletes with different levels of sports skills the obtained data on the subjects was divided into three groups according to the sports category of the athletes involved in mass-wrestling. Group 1 included data on the athletes who had a sports category of the Candidate for the Master of Sports of the Republic of Sakha (Yakutia) (n=8) at the time of the study, Group 2 included parameters of the athletes with sports category I (n=7), group 3 - the athletes with II and III sports categories (n=7). Assessment of the differences in the values between the groups was performed using the Student's t-test for independent samples.

Results and discussion. The correlation analysis revealed a close correlation in 16 cases out of 105 in the examined group of athletes (n = 22).

Indicators characterizing the main parameters of the athletes such as height and weight, have a close positive correlation with the length of the ring finger ($r = 0,7497$ and $r = 0,7225$), body weight - with the girth of the right ($r = 0,7505$) and the left ($r = 0,7774$) forearms.

The height and weight of the athletes is weakly correlated with the palm width; there is an average correlation between other parameters characterizing the hand size. There has also been found an average correlation of the height and weight of the athletes with the grip strength (CD). The height of the athletes has an average correlation with muscular endurance of the grip. ($r=0,344$), and a weak correlation with the athletes' weight ($r=0,186$).

Strength indices of the right and left hands have a direct interconnected correlation ($r = 0,8682$). An average correlation of the muscle strength of the hand is found with the indices of the girth of both forearms, the length of the fingers and of the endurance of the hand and forearm muscles. There is a weak correlation of hand length, palm length and palm width with strength of the hand muscles. Our findings are not consistent with those of other authors [7], which point to the dependence of the hand strength on its anthropometric characteristics: hand strength indices are higher when hands are longer and wider. This is attributed to the fact that our study was carried out among active athletes.

Muscular endurance of the grip, according to the HOSSB test results, had no close connection with other studied parameters. There is an average correlation with hand length ($r=0,3162$), palm length ($r=0,3694$), fingers length, as well as with CD of the right ($r=0,3477$) and left ($r=0,3954$) arms. There has been found a weak correlation between palm width ($r=0,0580$) and girth of both forearms ($r=0,0400$, $r=0,0515$).

Table 1. *Anthropometric measurements of hand, forearms girth, indices of strength and muscular endurance of the grip*

Measurements	Group № 1 (CMS)	Group № 2 (I category)	Group № 3 (II-III categories)	Total
<i>Hand length, mm</i>	175,25 ± 9,50	171,43 ± 7,18	172,83 ± 6,62	173,29 ± 7,80
<i>Palm length, mm</i>	107,88 ± 5,96	107,71 ± 4,75	110,17 ± 8,06	108,48 ± 6,05
<i>Palm width, mm</i>	86,75 ± 2,92	85,00 ± 8,12	84,17 ± 4,62	85,43 ± 5,42
<i>Length of the 1st finger, mm</i>	64,38 ± 5,10	65,29 ± 2,75	63,83 ± 3,19	64,52 ± 3,78
<i>Length of the 2nd finger, mm</i>	92,00 ± 7,21	93,43 ± 3,69	92,33 ± 6,38	92,57 ± 5,73
<i>Length of the 3rd finger, mm</i>	106,63 ± 6,84	106,14 ± 5,43	105,67 ± 6,15	106,19 ± 5,90
<i>Length of the 4th finger, mm</i>	100,38 ± 6,65	100,43 ± 4,54	99,67 ± 5,61	100,19 ± 5,45
<i>Length of the 5th finger, mm</i>	77,25 ± 5,20	75,71 ± 3,50	79,67 ± 9,61	77,43 ± 6,23
<i>Right forearm girth</i>	288,75 ± 13,26	277,00 ± 12,22	277,43 ± 11,76	281,41 ± 13,16
<i>Left forearm girth</i>	287,00 ± 13,23	273,29 ± 10,93	274,00 ± 13,67	278,50 ± 13,76
<i>CD of the right arm</i>	58,19 ± 6,47	56,36 ± 9,46	58,50 ± 9,08	57,67 ± 7,94
<i>CD of the left arm</i>	57,50 ± 8,22	55,93 ± 8,29	55,92 ± 7,34	56,52 ± 7,64
<i>Hang on a special spinning crossbar</i>	67,00 ± 8,68	68,57 ± 11,03	65,14 ± 8,95	66,91 ± 9,21

Anthropometric measurements of the hand, forearm and the grip strength indices of mass wrestlers of different qualifications. There were found no significant differences in the indices of hand length, palm length, palm width and length of fingers of three studied groups (with $p > 0,05$); the indices of the right forearm girth did not vary (with $p > 0,05$); left forearm girth indices of the 1st and 2nd groups tended to differ (with $p < 0,05$); There were no significant differences in the indices of strength and muscular endurance of the grip between the three groups. (with $p > 0,05$) (Table 1).

The findings showed no significant differences in the analyzed anthropometric measurements of the hand between the groups of athletes of different qualifications (with $p > 0,05$). Tendencies to differentiation in the left forearm girth between the groups have been found. The indices of the group 1 were higher than those of the athletes of the 2nd group (with $p \leq 0,05$). The average indices of the right forearm girth of the group 1 were higher than those of the 2nd and 3rd groups, however, the differences were insignificant ($p > 0,05$).

In previous studies we noted significant differences in the indices of strength and muscular endurance of the grip between groups of highly skilled athletes (MS, CMS) and competitive athletes [4]. Comparative analysis of carpal dynamometry revealed no significant differences between the groups of athletes of various sports qualifications, with $p > 0,05$. The test results also showed no advantages of any of the

groups, with $p > 0,05$. Identical results of testing of the strength and muscular endurance of the grip in the studied groups of athletes of different qualifications can be explained by the fact that they have been training by one and the same method under the supervision of the same coaches.

Conclusion. The results of our study did not confirm the assumption that the size of the hand and forearm significantly affects the development of strength and muscular endurance of the grip in competitive athletes involved in mass-wrestling. At the same time it can be assumed that the relatively similar anthropometric measurements of the hand in the studied group of mass-wrestlers and the lack of significant differences in indices of the groups of athletes of different qualifications can be caused by natural attrition due to prolonged specialized mass-wrestling training sessions, where athletes with small hand size stop mass wrestling classes in the early phases of their sports training. The forearm muscle hypertrophy found in athletes of a higher class can also suggest that higher sport qualification of mass wrestlers promotes more clearly detected hypertrophy of other major muscle groups, which is the result of effective strength training and the key to achieving high results in mass-wrestling.

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