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THE NEGATIVE EFFECT OF ROTATIONAL MOVEMENT LOADING ON THE TYPES OF LEADING FORCES IN BELT WRESTLING AND THE POSSIBILITY OF THEIR STABILIZATION

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ABOUT ARTICLE

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Abstract: The competitive process in belt wrestling, where the hands of the opponents are "locked" to each other's belts, creates a high demand for the stable demonstration of maximum and explosive types of strength, which are of leading importance in ensuring the effectiveness of technical and tactical actions. It is the maximum and explosive strength of the muscles of the "locked" arms that serves as a decisive factor in the execution of the elements of pressing the opponent down, throwing him off balance, lifting, twisting or turning. However, the results of visual observation of the competitions held in this type of wrestling show that even highly polished types of strength do not always give useful results when using the methods of lifting the opponent. tends to turn and rotate in order to get out of balance. Such technical elements, which are repeated many times, directly affect the vestibular analyzer and create a state of confusion, as a result of which this state of equilibrium maintenance stagnation leads to derailment of the technique and its coordination. There is no doubt that the maximum and explosive strength indicators used to apply such twisting and turning movements are negatively affected.

INTRODUCTION

The purpose of the study is to experimentally determine the effect of short-term rotational movement load on strength types and the possibility of stabilizing them using vestibulokinetic exercises in skilled belt wrestlers.

Qualified belt wrestlers belonging to control and experimental groups of 8x2=16 people each were involved in the (10-month) pedagogical experience held in September 2021 and June 2022. In the control group (NG), training was conducted based on a program with traditional content. In the experimental group, every day in the morning, at the end of the training, the maximum and explosive power of the muscles of the arms and legs consists of various rotational movements (turning the head to the left and right sides in a sitting and standing position, bending the body forward 90o, turning the body to the left and right sides, this exercise by bending the body back and x.) set of exercises was used regularly. As a short-term rotational movement, the exercise of bending the body forward 90 degrees and turning the body 15 times in a comfortable direction is prescribed.

The research used the following methods and tests: right and left hand dynamometry (at the same time), stationary dynamometry, turnstile

gravity, vestibulochronometry, pedagogical experience and mathematical stochastic methods.

MATERIALS AND METHODS

Research results and their comparative analysis It was found out from the results of the conducted research that the maximum strength of the right wrist-paw muscles in NG, who continued to engage in traditional training during the experiment, was 40.20±3.05 kg before the experiment. by the end of the experiment, this indicator is 42.1±2.97 kg. (r>0.05) or its relative growth rate was equal to 4.73% (Table 1). The maximum strength of the left hand wrist-paw muscles in this group is 37.80±2.48 kg during this period. from 39.3±2.43 kg. (r>0.05) or its growth rate was 3.97% (right and left hand strength was determined simultaneously). The asymmetric difference between the maximum strength of the right and left hand wrist-paw muscles was 2.40 kg at the beginning of the experiment. increased to. At the beginning of the experiment, TG, who also practiced special exercises recommended by us during the experiment, including the gym, had 39.60±3.14 kg. expressed by, by the end of the experiment, this indicator is 44.20±3.25 kg. (r<0.001) or its growth rate was 11.62%. Left hand wrist-paw strength in this group was 37.60±3.52 kg during the experiment. from 43.50±3.75 kg. (r<0.001) or the growth rate of left hand strength was equal to 15.69%. Between the right and left hand wrist-paw force is initially 2.00 kg. if there is an asymmetric difference equal to , at the end of the experiment this difference is 0.70 kg. was observed to decrease.

The right hand wrist-paw force under the influence of 15 turns of the body with the trunk bent forward at 90o is 36.40±2.17 kg before the experiment. ha, at the end of the experiment this indicator was 37.7±2.03 kg. (r>0.05) or its growth rate was 3.57%. Left hand wrist-paw strength is 35.30±1.44 and 36.2±1.32 kg, respectively. (r>0.05) or its growth rate is expressed as 2.55%.

Table 1

Indicators of changes in the level of stable maintenance of hand grip strength to rotational movement load in belt wrestlers belonging to the control and experimental groups at the end of the pedagogical experiment - NG - n=8x2=16; TG – n=8x2=16 ($\bar{X} \pm \sigma$)

Tests, TG		Group	Before experiment			After experiment			Relative %	t	p
			$\bar{x}$	σ	V, %	$\bar{x}$	σ	V, %			
1.Right hand power		НГ	40,20	3,05	7,59	42,1	2,97	7,05	4,73	1,79	>0,05
		ТГ	39,60	3,14	7,93	44,20	3,25	7,35	11,62	4,07	<0,001
2. Left hand power		НГ	37,80	2,49	6,59	39,3	2,43	6,18	3,97	1,72	>0,05
		ТГ	37,60	3,57	9,36	43,50	3,75	8,62	15,69	4,59	<0,001
Right and left hand asymmetry		НГ	2,40			2,80			16,67		
		ТГ	2,00			0,70			65,00		
Under the influence of rotational movement: - right arm strength		НГ	35,40	2,17	5,96	37,7	2,03	5,38	3,57	1.75	>0,05
		ТГ	36,40	2,41	6,67	40,30	2,44	6,05	10,71	4,55	<0,001
- Left hand power		НГ	35,30	1,44	4,08	36,2	1,32	3,65	2,55	1,84	>0,05
		ТГ	34,80	3,03	8,71	39,80	3,23	8,12	14,37	4,52	<0,001
Right and left hand asymmetry		НГ	1,10			1,50			36,36		
		ТГ	1,60			0,50			68,75		
5. Hand-body power		НГ	173,9	4,87	2,80	176,8	4,08	2,31	1,67	1,83	>0,05
		ТГ	173,5	6,85	3,95	178,8	5,54	3,10	3,05	2,41	<0,05
6. Under the influence of rotational motion		НГ	171,3	4,33	2,53	173,7	3,61	2,08	1,40	1,70	>0,05
		ТГ	170,5	7,84	4,60	176,7	7,12	4,03	3,64	2,34	<0,05
Change difference		НГ	2,60			3,10			19,23		
		ТГ	3,00			2,10			30,00		

Note:

- the power of the right and left hand is determined in parallel;

- hand grip strength is determined on a dynamometer;

- circular movement - consisted of rotating the body 15 times in a 90o bent position.

In TG, these indicators correspond to: right hand - 36.4±2.41 kg.; 40.30±2.44 kg. (r<0.001) or increased by 10.71%; left hand – 34.80±3.03 kg.; 39.80±3.23 kg. (r<0.001) or increased by 14.37%.

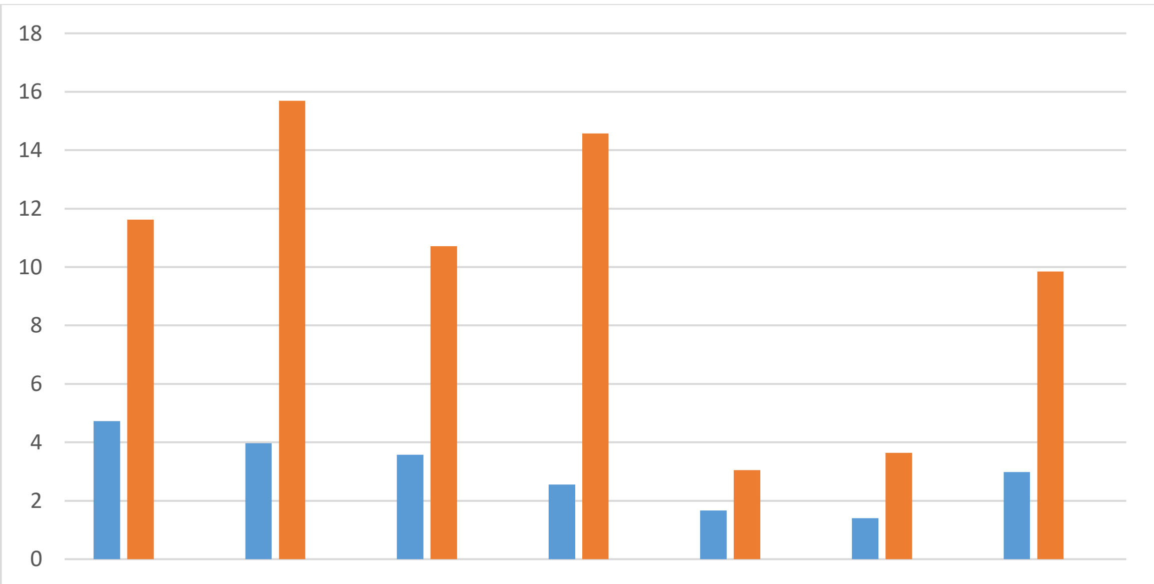
1.10 kg before the experiment, 1.50 kg after the experiment. an asymmetric difference equal to In TG, these indicators are 1.60 and 0.50 kg, respectively. was found to be equal to Therefore, the asymmetric difference indicators in the TG who performed the experimental meaningful exercises during the experiment decreased to 65.0 and 68.7% by the end of the experiment, respectively, or changed to the symmetrical side. In NG, these indicators were 16.67 and 14.34%.

The maximum strength of arm muscles, which is important for ensuring the efficiency of lifting the opponent during the competition, was 173.90±4.87 kg before the experiment in NG according to the stanodynamometer device. of 176.80±4.08 kg at the end of the experiment. was (r>0.05) or its growth rate was expressed as 1.67%. In TG, these indicators are correspondingly: 173.50±6.85 kg. and 178.80±5.54 kg. (r<0.05) or its growth rate was 3.05%.

Under the influence of rotational movement load, hand grip strength in NG was 171.30±4.33 kg at the beginning of the experiment, and 173.7±3.61 kg at the end of the experiment. (r>0.05) or increased by only 1.40%. At the end of the experiment, the hand-grip strength was 170.50±7.84 kg. from 176.70±7.12 kg. (r<0.05) or its growth rate was equal to 3.64%. It can be seen that the handgrip force recorded in the NG in the unloaded condition is 2.60 kg at the beginning of the experiment under the influence of the rotational motion load. ha, at the end of the experiment 3.10 kg. dropped to 19.23%. In TG, these indicators are correspondingly: 3.00 kg.; 2.10 kg.; was equal to 30.0%. Therefore, the handgrip strength demonstrated in this group in the unloaded state was close to the initially recorded index under the influence of rotational movement load.

Figure 1. Comparative results of the relative growth (%) of the average arithmetic values of the indicators of the degree of stability of arm strength of the belt wrestlers of the control and experimental groups during the pedagogical experience.

The diagrams shown in Figure 1 show the relative growth indicators of handgrip strength observed in the control and experimental groups and its growth rate under the influence of rotational movement load during the pedagogical experience.



1 2 3 4 5 6 7

Control group Experimental group

RESULTS AND DISCUSSIONS

Based on the comparative analysis of the results of the research conducted in this direction, it can be recognized that, firstly, the indicators recorded before the experiment showed that the studied muscle strength was not sufficiently developed in both groups. Second, handgrip strength was differentiated by the fact that TG, who performed the experimentally meaningful exercises recommended by us every morning, increased rapidly during their training and at the end of the experiment. Thirdly, it can be said that the asymmetric differences between the right and left hand wrist-paw strength in this group decreased or changed to the symmetrical side by the end of the experiment. Fourthly, it was determined that the strength indicators displayed in the TG under the influence of rotational motion loading are close to the real (original) level.

It is known that in order to use technical-tactical methods in belt wrestling, the fighter first pulls the opponent to himself, then shakes him down and tries to unbalance him, and only then uses the method by twisting or turning him while lifting the opponent. The ability to effectively perform such technical elements depends on the strength of the muscles that flex the arms quickly and with maximum force. Therefore, in the practice of wrestling, it is customary to use a tourniquet to train and evaluate such strength. The studies conducted in this regard showed that the time of 10 pull-ups on the horizontal bar in qualified belt wrestlers was 14.39±1.34 s at the beginning of the training year in NG. ni, at the end of which 13.61±1.22 s. was ($r>0.05$) or the difference in the shortening of the drawing time was equal to 5.42% (Table 2). In TG, these indicators are correspondingly: 14.50±1.34 s.; 13.00±1.18 s.; $r<0.05$; represented by 10.34%. However, it was observed that the 10-fold pull-up time on the turnstile was significantly prolonged under the influence of rotational motion loading. For example, in NG, this indicator is 16.90±1.37 s at the beginning of the academic year. until, at the end of it 16.1±1.27 s. ($r>0.05$) or the time of pulling on the turnstile was prolonged up to 4.73% by the end of the academic year. The time of 10 pull-ups on the turnstile in TG is initially 16.90±1.37 s under the influence of rotational movement load. at the end of the academic year, 14.20 ± 1.30 s. decreased to ($r<0.001$), the reduction rate of 10 times of pulling time was equal to 14.46%. 10 s on the turnstile. if the number of withdrawals in NG was initially expressed as 9.10±1.01 times, by the end of the academic year, this indicator was 8.80±0.85 times ($p<0.05$) or its growth rate was 7.69 is equal to %. In TG, this indicator was equal to 9.40±1.22 times at the beginning of the training year, and it was 11.50±1.39 times at the end of the experiment ($r<0.001$), or its rate of increase was 22.34%.

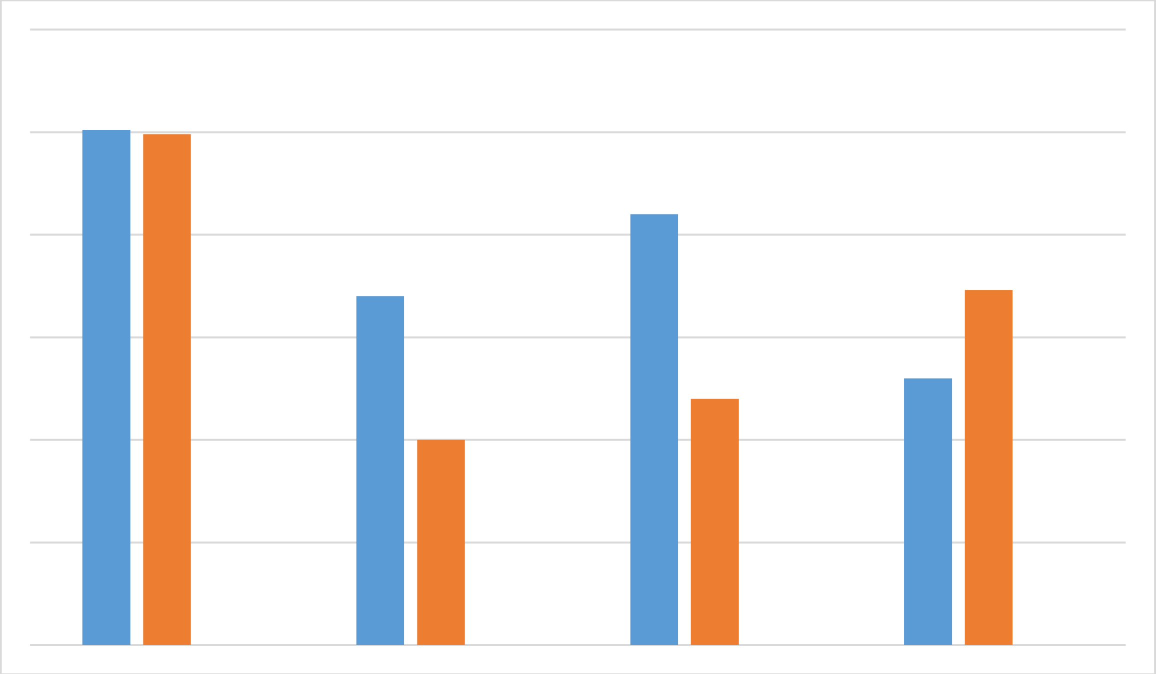
Table 2

Changes in arm flexor muscle strength in control and experimental groups under the influence of rotational movement and its growth rate at the end of the pedagogical experiment - NG - n=8x2=16;

TG – n=8x2=16 ($\overline{X} \pm \sigma$)

Tests	Group	Before experiment			After experiment			relative, %	t	p
		$\overline{x}$	σ	V, %	$\overline{x}$	σ	V, %			
1. Time for 10 pull-ups on the barbell, s.	НГ ТГ	1 4,39 14,50	1 ,34 1,42	9,31 9,79	13,61 13,00	1,22 1,18	8,96 9,08	5,42 10,34	1,72 3,25	>0,05 <0,01
2. The change in the time of 10 pull-ups on the turnstile under the influence of rotational movement, p.	НГ ТГ	16,90 16,60	1,37 1,63	8,11 9,82	16,1 14,20	1,27 1,30	7,89 9,15	4,73 14,46	1,71 4,60	>0,05 <0,001
3. 10 s on the turnstile. number of pulls in, times	НГ ТГ	9,10 9,40	1,01 1,22	11,10 12,98	8,80 11,50	0,89 1,39	9,08 12,09	7,69 22,34	2,08 4,54	<0,05 <0,001
4. 10 s on the turnstile. the change in the number of pulls under the influence of rotational movement, times	НГ ТГ	7,40 8,10	0,64 0,97	8,65 11,98	7,8 9,77	0,65 1,09	8,33 11,16	5,41 20,62	1,75 4,58	>0,05 <0,001

It is noteworthy that the number of maximal pull-ups in the tkrnik within the specified time was also significantly reduced under the influence of rotational movement loading, especially in NG. In particular, in NG, this indicator (number of seizures) was 7.40±0.64 times at the beginning, and 7.8±0.65 times at the end of the academic year (r>0.05) or up to 5.41% during this period. weakened. TG and 10 s on the turnstile. in the beginning, the number of withdrawals was equal to 8.10±0.97 times, by the end of the academic year, this indicator increased to 9.77±1.09 times (p<0.001), or the difference in its increase was 20.62%. It can be seen that the time of 10 pull-ups on the turnstile in NG is also 10 s. the maximum number of pull-ups also decreased significantly under the influence of rotational movement loading (Fig. 2). By the end of the academic year, these indicators have approached real indicators in TG.



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a b a b

Note:

1 – at the beginning of the academic year;

2 – at the end of the academic year;

a – the time of 10 pull-ups on the horizontal bar;

b – 10 sc in the turn. number of pulls;

A – NG;

B – TG;

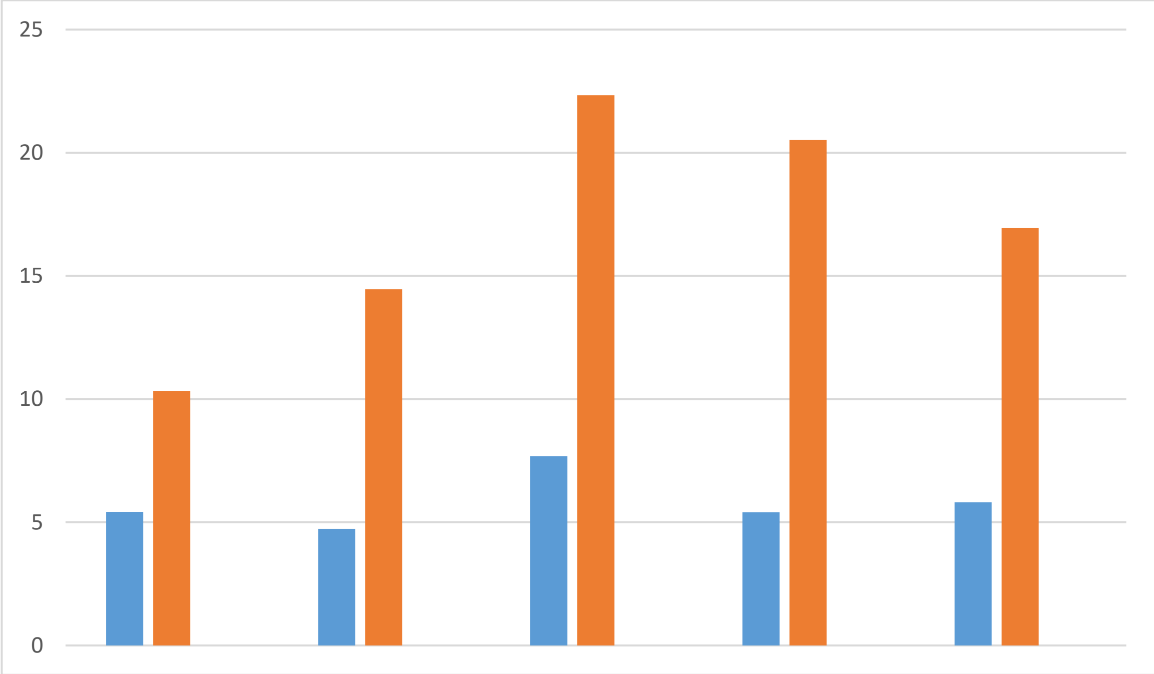
- pulling on the turnstile without rotation;

- is pulled on the tourniquet under the influence of the rotational movement

Figure 2. Diagrams showing the differences in the variation of the tensile indicators on the turnstile in the control and experimental groups without load and under the influence of rotational movement load

As can be seen from the graphs in this figure, NG's unloaded pull-up time continued at the end of the training year, while the number of pull-ups decreased. In TG, on the contrary, the time of pulling on the turnstile was reduced, and its number increased from 1.3 times to 1.73 times.

Figure 3 shows the differences in the growth of the test results during the pedagogical experience in the control and experimental groups in a comparative section.



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Control group Experimental group

Figure 3. Effects of no-load and rotational movement on the pull-up performance on the horizontal bar in the control and experimental groups diagrams representing growth differences over the course of the experiment

The comparative analysis of the results of the research shows that the indicators representing the maximum and quick strength of the arm muscles in NG, who continued to engage in traditional training during the experiment, were observed to grow very slowly even by the end of the experiment. Second, there was a noticeable asymmetric difference between the strength of the right and left hand wrist-paw muscles, which was expressed by a tendency to increase at the end of the experiment.

Thirdly, in this group, it was found that the strength indicators recorded under no-load conditions changed negatively under the influence of rotational movement load. During the experiment, TG, who regularly performed the sets of experimental meaningful exercises recommended by us, noted that all the studied indicators changed in a progressive direction by the end of the experiment. Therefore, it can be said that the blocks of exercises with experimental content developed and used in this group have an effective value.

From the results of the research discussed above, it was found that the movements of swinging, bending, writing, twisting, rotation, which are repeated many times during competitions, can have a negative effect on maximum and fast dynamic strength indicators as a vestibulokinetic load.

It is possible that if the vestibular analyzer and receptors that control (maintain) balance stability are functionally "weakly" formed in a wrestler, under the influence of the noted stato- and vestibulokinetic movements, the body sways, the balance is lost, as a result, not only physical capabilities decrease, but also there is no doubt that the effectiveness of technical-tactical methods also loses its value.

Research conducted in this regard has confirmed that this possibility is real. From the obtained results, it was revealed that during the experiment, NG, who continued to engage in traditional training, had a balance time of 17.10 ± 2.33 s before the experiment. was 18.6 ± 2.44 s by the end of the experiment. equal to (r>0.05) or equilibration time increased by 8.07% only (Table 3).

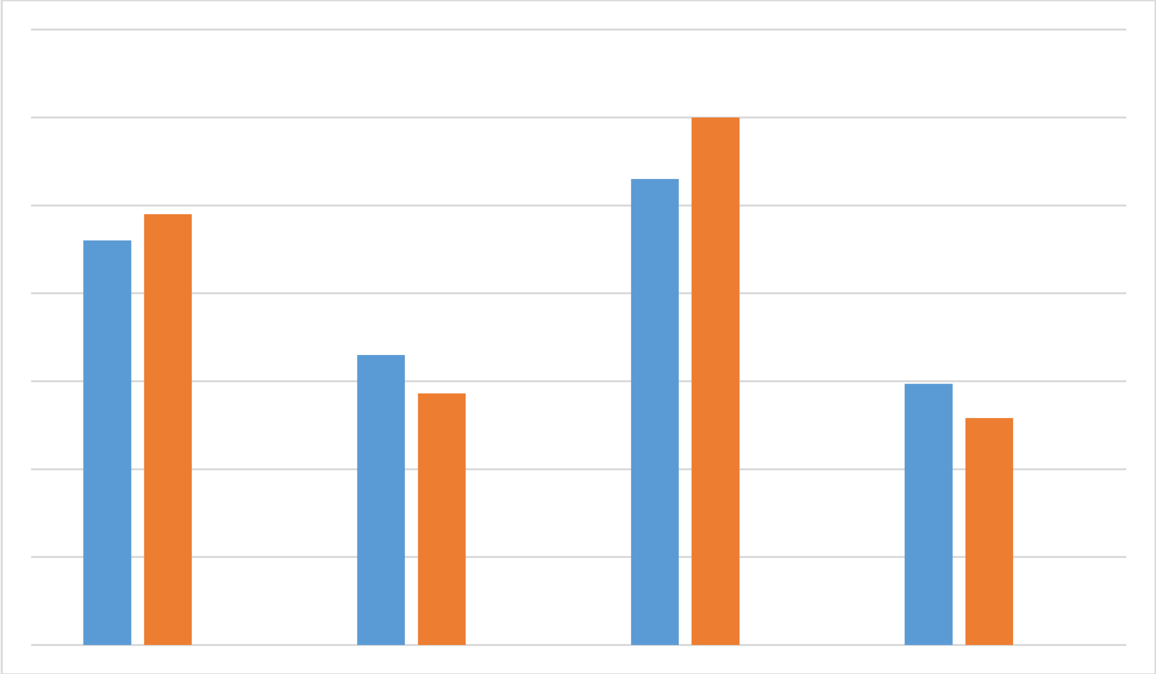
Table 3

The rate of growth of balance stability due to head and body rotation in belt wrestlers belonging to the control and experimental groups at the end of the pedagogical experiment

Tests, s	Group	Before experiment			After experiemnt			Relative, %	t	P
		$\bar{x}$	σ	V, %	$\bar{x}$	σ	V, %			
1. Maintaining balance by turning the head to the left in an upright position, p.	НГ / ТГ	17,10 / 17,60	2,33 / 2,46	13,6 / 13,9	18,6 / 21,90	2,44 / 2,89	13,12 / 13,20	8,77 / 24,43	1 ,78 / 4,53	>0,05 / <0,001
2. Maintaining balance by turning the head to the right in an upright position, p.	НГ / ТГ	12,50 / 12,30	1,83 / 1,96	14,6 / 15,9	13,7 / 15,90	1,95 / 2,44	14,23 / 15,35	9,60 / 29,27	1,79 / 4,60	>0,05 / <0,001
3. Balance by turning the body to the left in a 90o forward position, p.	НГ / ТГ	14,00 / 14,40	1,46 / 1,85	10,4 / 12,8	14,90 / 17,60	1,50 / 2,12	10,07 / 12,05	6,43 / 22,22	1,72 / 4,55	>0,05 / <0,001
4. Balance by turning the body to the left in a 90o forward position, p.	НГ / ТГ	10,70 / 11,43	1,59 / 1,94	14,8 / 16,9	12,04 / 15,02	1,71 / 2,45	14,20 / 16,31	12,52 / 31,41	2,30 / 4,60	>0,05 / <0,001

Note: - Eyes will be closed during test 1 and 2.

When this test is performed with the condition of turning the head to the right, the balance time before the experiment is 12.50±1.83 s. expressed by , at the end of the experiment 13.7±1.93 s. equal to (r>0.05) or increased by 9.60%. It can be seen that under the influence of turning the head to the right, the time of maintaining balance was sharply reduced both before the experiment (4.6 s.) and at the end of the experiment (4.9 s.) (Fig. 4).



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Note:

a - before the experiment;

b - after the experiment;

1 – turn the head;

2 – turn the body;

A – NG;

B – TG.

Figure 4. Diagrams representing the reduction in balance time by head and body rotation in the control and experimental groups

During the experiment, TG, who regularly followed the experimental meaningful exercises recommended by us during the experiment, had a balance time of 17.60±2.46 s before the experiment in the standing position under the influence of turning the head to the left. expressed by , after the experiment this indicator is 21.90±2.89 s. was equal to (r<0.001) or its elongation difference was 24.43%. As a result of turning the head to the right, the balance time in this group was 12.30±1.96 s before the experiment. 15.90±2.44 s after the experiment. was equal to (r<0.001) or its elongation difference was 29.27%. It can be seen that in this group, the balance time was reduced under the influence of head rotation, but the asymmetric difference between the balance time under the influence of head rotation to the left and right at the beginning of the experiment was significantly reduced.

The time to maintain dynamic balance under the influence of turning the body to the left in a 90o forward bend position was 14.0±1.46 s before the experiment in NG. was 14.9 ± 1.5 s by the end of the experiment. was equal to (r>0.05) or its elongation difference was 6.43%, but due to the effect of turning the body to the right, the balance time in this group was 10.7±1.59 s at the beginning of the experiment. was equal to, and at the end this indicator was 12.04±1.71 s. represented by (r<0.05) or the difference in the length of time for maintaining equilibrium was 12.52%. From the comparative analysis of these indicators, it can be seen that in NG there was a noticeable asymmetric difference between the time of maintaining dynamic balance under the influence of turning the body to the left and right (see Figure 4).

In TG, the time to maintain dynamic balance due to turning the body to the left with the body bent forward at 90o was 14.4±1.85 s before the experiment. was 17.6 ± 2.17 s by the end of the experiment. expressed by (r<0.001) or its (time) elongation difference was 22.22%. The time to maintain balance due to turning the body to the right in this position was 11.43±1.94 s before the experiment. was equal to , and at the end of it this indicator was 15.02±2.45 s. represented by (r<0.001) or the difference in the length of time of balancing was 31.41%. Separately, it should be noted that the asymmetric difference between the balance time caused by turning the body to the left and right before the experiment in TG was significantly reduced by the end of the experiment. The occurrence of such a positive situation indicates that the experimental exercises used in this group are effective.

CONCLUSION

Based on the results of the experimental research and their comparative analysis, it can be concluded that the jerking, turning and rotation movements repeated many times in belt wrestling competitions can not only have a negative effect on the stability of balance and movement coordination, but such vestibulokinetic movements are the maximum and explosive strength of the muscles of the arms. it was found that it has a negative effect on the strength. However, as a result of regular formation of the functional capacity of the vestibular analyzer over a long period of time with the help of special circular exercises, it is confirmed in the example of the experimental group that these types of strength, including balance stability, are demonstrated in a stable manner. no progressive changes were observed.

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