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METHODOLOGICAL JOURNAL**<http://mentaljournal-jspu.uz/index.php/mesmj/index>**TRAINING OF THE VESTIBULAR ANALYZER IN VOLLEYBALL PLAYERS AS A
MEANS OF INCREASING THE STABILITY OF BALL PASSES FOR ACCURACY IN
CONDITIONS OF AFTEREFFECT OF ANGULAR ACCELERATIONS****Utkurjon Rejapov***Doctoral student of the institute of scientific research of physical education and sports**Scientific research institute of physical culture and sports**e-mail: rejapovutkir@gmail.com**Tashkent, Uzbekistan***ABOUT ARTICLE**

Key words: young volleyball players, training, passing, accuracy, angular acceleration, vestibular analyzer, stability, technique, physical qualities, physical education.

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Abstract: The article describes the results of an experimental study using young volleyball players aged 13-14 years as an example, which demonstrates the importance of regular training of the vestibular analyzer to improve the stability of accurate ball passes under the conditions of the aftereffect of angular accelerations in the form of rotational movements of the body. During the experiment, special training exercises aimed at developing the vestibular system were incorporated into the athletes' training process. The findings demonstrated that regular vestibular training significantly enhances balance, spatial orientation, and coordination, enabling players to maintain precision in technical actions even after performing rotational movements. This is especially important in volleyball, where quick reactions and accurate ball control are essential for successful performance.

Introduction. One of the healing features of competitive volleyball games is the repeated execution of multidirectional high-speed movements with turns and rotations for timely approach to the ball to implement appropriate technical and tactical actions, including falls to receive the ball, which is performed preferably in the angular acceleration mode. It is known that each series or total volume of such anaerobic loads, affecting the receptors of the

vestibular analyzer, can lead to latent “motion sickness” and loss of balance, resulting in discoordination of movements and their target accuracy, hence the aiming accuracy of the ball in volleyball [В.И. Лях, 2006, с. 133-142; Л.Д. Назаренко, 2015, с. 99-101; А.С. Назаренко, А.С. Чинкин, 2015, с. 78-85; А.А. Пулатов, 2025, с. 9-27].

We suggest that regular training of the vestibular analyzer using multidirectional and multi-planar rotational exercises in the form of angular accelerations, improving the function of maintaining dynamic balance in volleyball players, will help increase the stability of ball passes for accuracy.

The purpose of this study is to experimentally substantiate the possibility of increasing the stability of ball passes for accuracy in volleyball players by systematically training the vestibular analyzer using multidirectional and multi-plane rotational exercises in the form of angular accelerations.

Materials and Methods. To achieve this research goal, a 10-month pedagogical experiment was organized, which involved two groups of volleyball players aged 13-14, one of whom participated as a control group (KG-14 people), and the other as an experimental group (EG-14 people).

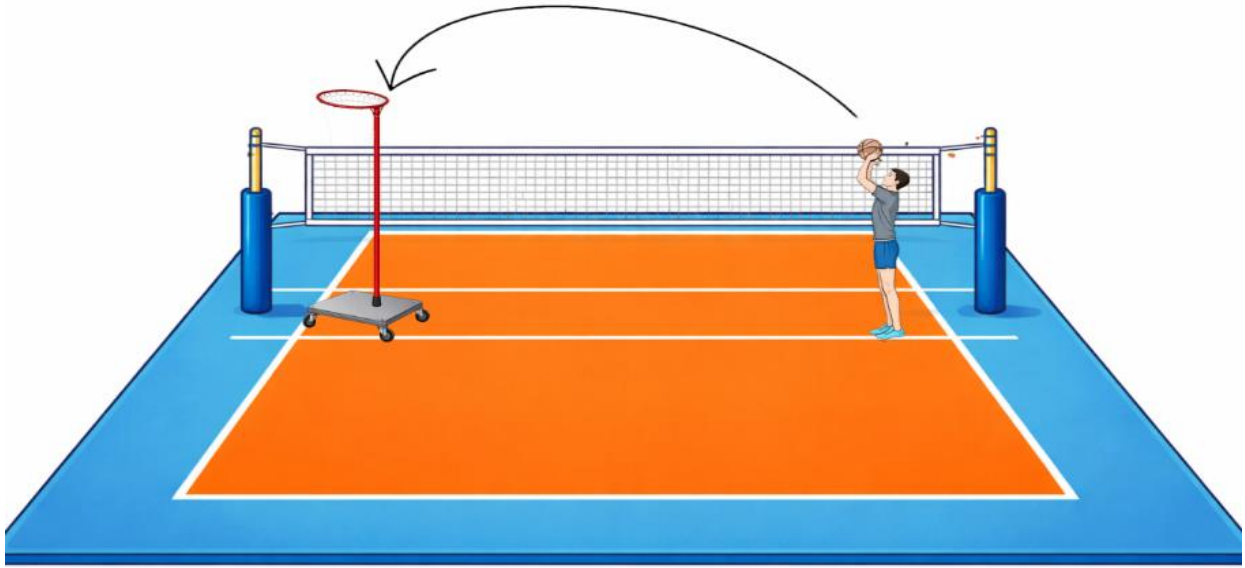
During the experiment, the KG continued to train according to the current program.

Throughout the experiment, EG performed the following vestibulokinetic exercises daily after morning exercises, at the beginning and at the end of each workout:

1. Sitting on the floor, circular movement of the head in a large amplitude – 15 times to the left and 15 times to the right with eyes closed – 2 episodes;
2. The same – standing, legs together.;
3. In the pose of bending the torso forward by 90 °, body rotation to the left – 15 times and to the right – 15 times – 2 series.;
4. The same – in bending the torso back;
5. Exercises 3 and 4 are performed in a standing position. The stability of maintaining dynamic equilibrium was assessed by the duration of the following test:

- inside the gymnastic hoop, in the position of bending the torso forward by 90°, the body rotates left and right (separately).

In addition, the young EG volleyball players passed the ball from above with two hands from zone 2 to the target set in zone 4 during 10 passes (Fig.). At the same time, the passing technique was evaluated by experts using a 10–point system with the involvement of 3 coaches, and the accuracy of the ball was evaluated by the number of hits on the target.



Picture. A schematic representation of the sequence of the test is the transfer of the ball from above with two hands from zone 2 to the target installed in zone 4.

Accuracy testing of ball transfers was carried out “at rest without load” to determine the actual level of skill development of this game skill and under the conditions of the aftereffect of a 15-fold rotation of the body from left to right in order to determine the level of stability of the manifestation of the targeted accuracy of ball transfers to the effects of angular acceleration, the result of which simultaneously assessed the degree of fitness of the vestibular analyzer regulating the function of maintaining dynamic balance.

Result and Discussion. An analysis of the results of an experimental study conducted within the framework of the proposed problem showed that the duration of maintaining dynamic balance against the background of body rotation to the left in a 90° forward tilt position for young KG volleyball players who trained according to traditional programs during the experiment was 8.65 ± 2.05 seconds before the start of the experiment, and by the end of the experiment The time to maintain this equilibrium increased to 10.24 ± 2.41 seconds ($P < 0.05$), or the relative stability of maintaining dynamic equilibrium was 18.38% (Table 1). And the time to maintain equilibrium when the body rotates to the right in a similar position in the same group before the experiment decreased to 5.46 ± 2.02 seconds, which increased to 7.02 ± 1.93 seconds at the end of the experiment ($P < 0.05$), where the relative difference in the lengthening of the equilibrium retention time was 25.38%.

Among the young EG volleyball players, who regularly performed the vestibulokinetic exercises recommended by us in the morning and at the end of the experiment, the duration of maintaining dynamic balance against the background of body rotation to the left in the forward

tilt position by 90 ° before the start of the experiment did not differ much from the indicator recorded in KG. It was 8.47 ± 2.79 seconds, but by the end of the experiment, this value had increased to 13.67 ± 4.39 seconds ($P < 0.001$) or its relative elongation was 61.39%. And when the body rotates to the right in the same position, the duration of maintaining dynamic equilibrium in this group increased from 5.46 ± 2.02 seconds during the experiment period. up to 10.34 ± 3.74 seconds ($P < 0.001$) or its relative elongation was 89.24 %.

Table 1.

Dynamics of changes in the indicators of the duration of maintaining dynamic balance in young volleyball players of the control and experimental groups during body rotation to the left and right by the end of the experiment ($\bar{X} \pm \sigma$)

Control Test	Group	Before the experiment	After the experiment	OVUR (%)	t	P
1	KG	$8,65 \pm 2,05$	$10,24 \pm 2,41$	18,38	2,30	<0,05
	EG	$8,47 \pm 2,79$	$13,67 \pm 4,39$	61,39	4,16	<0,00 1
2	KG	$5,59 \pm 1,55$	$7,02 \pm 1,93$	25,58	2,37	<0,05
	EG	$5,46 \pm 2,02$	$10,34 \pm 3,74$	89,24	4,54	<0,00 1

Note: 1-the duration of maintaining balance against the background of rapid rotation of the body to the left in the posture of tilting the body forward by 90 °; 2- Also against the background of rapid rotation of the body to the right (sec.); OVUR – relative increase in stability of balance.

It can be seen that there is a pronounced asymmetry between the duration of maintaining equilibrium during body rotations to the left and right both before and after the experiment, which focuses on the need to symmetrize these time values of equilibrium. Otherwise, such a pronounced asymmetry can have a negative impact on the technique and accuracy of playing techniques performed after turning the body (or even after turning the body) to the right, which is inconvenient for right-sided volleyball players. This assumption was confirmed by the results of a study of the accuracy of ball passes under the conditions of the aftereffect of rotational movements of the body to the left and right.

This study was initially conducted in a state of “rest” without load (with the exception of a light warm-up) in order to assess the actual skill level of passing the ball from above with two hands for accuracy, then such skill was studied for “strength” under conditions of rapid rotation of the body to the left and right (separately) in a 90° forward tilt position.. The test results

showed that the accuracy of passing the ball “at rest” from zone 2 to the target set in zone 3 for young KG volleyball players before the start of the experiment was 4.73 ± 0.59 times out of 10 possible. By the end of the experiment, the transmission accuracy increased slightly and amounted to 5.15 ± 0.64 times ($P < 0.05$), where the relative increase in transmission accuracy was 8.88% (Table 2). In the EG, which systematically honed the accuracy of transmissions during the experiment against the background of the aftereffect of recommended vestibulokinetic exercises, the number of such transmissions before the experiment was 4.62 ± 1.25 times, and by the end of the experiment, the accuracy of this technique increased to 6.84 ± 1.79 times, with a relative increase in its level of 48.05%. The technique of passing the ball in this group also increased by the end of the experiment from 4.26 ± 1.11 points to 6.73 ± 1.69 points ($P < 0.001$), where its relative increase was 57.98%. And in EG, it increased in relative terms to 8.16%.

The number of precision transmissions from zone 2 to the target installed in zone 4 in KG increased from 4.12 ± 0.44 to 4.49 ± 0.47 times ($P < 0.05$) during the experiment period, or its relative increase was 8.98%. In EG, this value increased from 4.03 ± 1.09 to 6.64 ± 1.73 times ($P < 0.001$) during the experiment, or its relative increase was 64.76%.

The ball passing technique increased in KG from 4.15 ± 0.48 to 4.56 ± 0.52 points ($P < 0.05$), OVV – 10.98%, and in EG – from 4.07 ± 0.97 to 6.45 ± 1.49 points ($P < 0.001$), OVV – 58.5%.

According to the comparison of the above indicators, it can be seen that the aiming accuracy and technique of passing the ball from above with two hands, performed at rest without load, turned out to be relatively low in both groups of subjects and did not exceed even the 50% level of the established limits (10 attempts for passes and 10 points for technique).

Table 2

Dynamics of changes in the accuracy and technique of ball passing under the influence of vestibulokinetic loads during the experiment

Tests	groups	Before the experiment		After the experiment		OVV	t	P
		At rest of the load						
1	CG	4,73	0,59	5,15	0,64	8,88	1,73	>0,05
	EG	4,62	1,25	6,84	1,79	48,05	3,67	<0,01
2	CG	4,34	0,50	4,69	0,54	8,16	1,74	>0,05
	EG	4,26	1,11	6,73	1,69	57,98	4,41	<0,001
3	CG	4,12	0,44	4,49	0,47	8,98	2,09	<0,05

	EG	4,03	1,09	6,64	1,73	64,76	4,60	<0,001
4	CG	4,15	0,48	4,56	0,52	9,88	2,09	<0,05
	EG	4,07	0,97	6,45	1,49	58,48	4,81	<0,001
Under the influence of a 15-fold rotation of the body to the left								
1	CG	2,35	0,39	2,76	0,45	17,45	2,47	<0,05
	EG	2,31	0,83	4,09	1,44	77,06	3,87	<0,001
2	CG	2,03	0,36	2,35	0,41	15,76	2,12	<0,05
	EG	1,98	0,73	3,74	1,31	88,89	4,22	<0,001
3	CG	1,56	0,27	1,83	0,32	17,31	2,31	<0,05
	EG	1,53	0,40	2,14	0,54	39,87	3,29	<0,01
4	CG	1,73	0,22	1,92	0,24	10,98	2,11	<0,05
	EG	1,69	0,25	2,07	0,29	22,49	3,54	<0,01
Under the influence of a 15-fold rotation of the body to the right								
1	CG	1,22	0,20	1,43	0,24	17,21	2,44	<0,05
	EG	1,26	0,47	2,39	0,86	89,68	4,16	<0,001
2	CG	1,73	0,39	1,25	0,28	27,75	3,59	<0,01
	EG	1,69	0,64	3,19	1,15	88,76	4,10	<0,001
3	CG	0,81	0,18	0,61	0,13	24,69	3,29	<0,01
	EG	0,79	0,28	1,45	0,55	83,54	3,87	<0,001
4	CG	1,52	0,33	1,07	0,23	29,61	4,03	<0,001
	EG	1,49	0,31	1,95	0,39	30,87	3,31	<0,01

Note: 1-transmission for accuracy from zone 2 to zone 3; 2-transmission technique; 3-transmission for accuracy from zone 2 to zone 4; 4-transmission technique; OVV – relative increase in values.

And by the end of the experiment, these readings in the EG, which was trained according to the experimental program, were characterized by a pronounced increase, whereas in the KG, these studied parameters of ball transfers did not differ in positive changes by the end of the experiment.

It is important to note that all the indicators of accuracy and technique of ball transfers studied in the relative rest mode turned out to be insufficiently stable under the influence of vestibulotic loads in the form of 15-fold rotation of the body to the left and right, in particular, the number of accurate ball transfers in zones 3 and 4 (targets) in both groups of subjects under the influence of 15-the multiple rotation of the body to the left before the start of the experiment decreased to 1.53 ± 0.40 – 2.35 times. The transmission technique decreased to 1.69 ± 0.25 –

2.03 ± 0.36 points. However, by the end of the experiment, the accuracy of the EG transmissions, which regularly performed the recommended vestibulokinetic exercises during the experiment, increased to 4.09 ± 1.44 – 2.14 ± 0.54 times out of 10 possible (transmission to zone 3 and 4, respectively). Transmission technique in the same group was up to 3.74 ± 1.31 – 2.07 ± 0.29 points (P<0.001), OVV was 88.9 – 22.5%. In KG, the transmission accuracy ratio was 17.45 – 17.31% (P<0.05), while the transmission technique ratio was 15.76 – 10.98%.

And under the influence of a 15-fold rotation of the body to the right, both the accuracy of gears and the technique of gears at the beginning of the experiment in both groups decreased even more and amounted to: accuracy – 1.22 ± 0.20 – 0.81 ± 0.18 times, technique – 1.73 ± 0.39 – 1.52 ± 0.33 points – this is in EG in KG, and in EG – Accuracy is 1.26 ± 0.47 – 0.79 ± 0.28 times: technique is 1.69 ± 0.64 – 1.49 ± 0.31 points. It is important to emphasize that in EG, by the end of the experiment, these indicators showed a marked increase in transmission accuracy (up to 2,39 ± 0,86 – 3,19 ± 1,15 – 1,95 ± 0,39 points). But in KG, there were no such positive changes in the manifestation of accuracy and transmission technique by the end of the experiment, and this result suggests that during the traditional attention to improving transmission technique and accuracy is minted against the background of the aftereffect of vestibulokinetic loads in the form of angular accelerations of rotational orientation.

Conclusion. Long-term observations of the organization of the reception of regulatory requirements for the physical, technical and tactical training of volleyball players involved in sports schools show that such an event or the so-called testing is carried out, as a rule, at a certain time in compliance with standard conditions and procedural rules. At the same time, special attention is paid to observing the principle of testing the level of development of the diagnosed qualities or playing skills without any loads (running, jumping, rotational loads), which allows an objective and “clean” assessment of the actual fitness of a volleyball player. This is absolutely correct. However, this “actual skill” during intensive training, and especially during competitive games, sooner or later decreases under the influence of appropriate loads, which was confirmed by the results of our research. Therefore, we believe that testing should be carried out not only “at rest without load”, but also under the conditions of the aftereffect of the most “relevant” loads, including under the influence of vestibulokinetic loads in the form of angular accelerations of rotational orientation. This approach to testing can make it possible to evaluate real “skill” both at rest and against the background of stress.

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