COORDINATION TRAINING OF SPORTSMEN, SPECIALIZING IN SPORT KINDS OF GYMNASTIC

Tereshchenko I.A., Otsupok A.P., Krupenya S.V., Liauchuk T.M., Boloban V.N.
National University of Physical Education and Sport of Ukraine

Abstract. *Purpose:* experimental substantiation of effectiveness of coordination training program, worked out for sportsmen, specializing in sport kinds of gymnastic. *Material:* In the research first year students (21 persons: 14 girls and 7 boys of age 17-18 years) participated. All they specialized in sport kinds of gymnastic. From them there were 15 masters of sports and 6 candidate masters of sports. *Results:* students' sensor motor coordination was confidently increased by means of realization of program of exercises for perfection of static-dynamic and static-kinetic stability. *Conclusions:* we recommend new direction of specific exercises' realization; exercise, developing and improving static-dynamic and static-kinetic body balance. Coordination training of sportsmen, specializing in sport gymnastic shall take one of priority places in system of physical education and sport training means.
Key words: student, physical education, gymnastic, sensor motor, coordination, tests, practice.

Introduction

Trainees of sport gymnastic, calisthenics, sport acrobatic, jumping on trampoline, jumping on acrobatic track (i.e. sport kinds of gymnastic) fulfill exercises in complex conditions of static-dynamic and static-kinetic (vestibular) balance (in complex conditions of sensor-motor coordination). In process of exercises' fulfillment sportsmen execute motor tasks of body postures' control, body positions, coordination accuracy of motor actions in phase structure of sport exercises. As practical experience [3, 4, 10, 16] and scientific-methodic researches show sensor-motor coordination is not sufficiently effective in sportsmen's demonstration of gymnastic, acrobatic exercises in training and competitions' conditions [1, 5, 8]. It is manifested as body imbalance, disordering of space-time orientation on support and without support, temp-rhythm, differentiation of motor parameters, practically all elements of motor coordination structure [7].

Purpose, tasks of the work, material and methods

The purpose: experimental substantiation of effectiveness of coordination training program, worked out for sportsmen, specializing in sport kinds of gymnastic.

The tasks: 1. Research level of first year students' (NUPESU), who specialize in sport kinds of gymnastic, sensor motor coordination.

2. To work out coordination training program for first year students, specializing in sport kinds of gymnastic as well as to test its effectiveness in practical training.

Material, methods and organization of the researches: In the research first year students (21 persons: 14 girls and 7 boys of age 17-18 years) participated. All they were from NUPESU and specialized in sport kinds of gymnastic. From them there were 15 masters of sports and 6 candidate masters of sports.

The methods: analysis of literature sources (theoretical-methodic review of literature, devoted to this problem); pedagogic testing; successive pedagogic experiment, fulfilled with technique of one group; experts' assessment. The researches' results were processed by method s of mathematical statistic (MO Excel, Statistika).

Pedagogic testing (detail description of tests is given in works [1, 2, 8, 9]:

Test1 – balance on one leg: assessment of static balance on one leg, other is bent aside with sole placed on thigh of supporting leg, arms are at level and width of shoulders; fingers are parted. Time – 5 seconds with open eyes and 15 seconds with closed eyes. Marks: "very good", if the tested keeps balance with closed eyes during 14-15 seconds. "Good" – balance is kept during period from 11 to 13 seconds; 8-10 seconds – "satisfactory".

Test 2 – Biriuk's test: assessment of body static balance when standing on tip toes with closed eyes.

Test 3 – Barany's test: assessment of static-dynamic body stability after 10 rotations in Barany's armchair.

Test 4 – five forward rolls in tuck: assessment of static-kinetic body balance after loading of vestibular analyzer.

Test 5 – coordination: assessment of coordination in complex conditions.

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Test 6 – hanging on bent legs: assessment of proprioceptive sensitivity in changed conditions of haemo-dynamic and irritation of otolith analyzer (hanging with head downward press dynamometer with hand of convenient arm with strength of 200 N for boys and 100 N for girls).

Test 7 – travel along perimeter of polygon: assessment of dynamic balance with passing of polygon's five perimeters for 20 seconds. Coefficients of tests' reliability are 0.490−0.990 [1, 7].

Testing was conducted in three stages. At fist stage (September 2014) we measured level of sensor-motor coordination of first year students, specializing in sport kinds of gymnastic (initial measurements of successive pedagogic experiment) At second stage (October-December 2014) students fulfilled practical material from program on specialization and on general gymnastic in compliance with curriculum (three times a week) as well as exercises from the worked out by us coordination training program.

At the end of the second stage (December 2014) we carried out intermediate study for assessment of offered by us exercises' effectiveness, oriented on development of sensor-motor coordination (intermediate measurements of successive pedagogic experiment). At third stage (duration – five months: January – May 2015) students fulfilled exercises with objects for general development, vaults, acrobatic exercises, hanging and pressing up exercises as well as improved (after intermediate measurements) exercises of coordination training program. At the end of the third stage we conducted final measurements of indicators of successive pedagogic experiment.

Results of the researches

Initial indicators of first year students, specializing in sport kinds of gymnastic, sensor-motor coordination are given in tables 1-3.

Table 1

Initial indicators of sensor-motor coordination of first year girl students (NUPESU), specializing in calisthenics (n=7)

The tested	Sport grade	Motor tests							
		Test 1 – balance	Test 2-Biriuk's text	Test 3-Barany's test	Test 4- test 5 forward rolls	Test 5-Coordination test	Test 6-hanging on bent legs	Test 7-walking along perimeter	
								Quantity of walked facets	Spent time
B - a	M/S	12	12	31	25	9.5	13	4	26
D - ch	M/S	14	12	35	20	9.6	13	2	10
Zh - o	M/S	11	14	28	25	9.5	12	3	18
I - a	CMS	14	9	27	25	9.1	13	2	22
S - k	CMS	13	8	25	18	9.2	14	1.5	11
S - a	M/S	15	14	30	21	9.7	11	1.5	11
Sh - a	M/S	14	14	30	25	9.3	13	2	15
$\overline{x}$		13.29	11.86	29.43	22.71	9.41	12.71	2.29	16.14
S		1.38	2.48	3.21	2.98	0,22	0.95	0.91	6.15
m		0.56	1.01	1.30	1.21	0.09	0.38	0.37	2.51
V%		10.39	20.90	10.90	13.14	2.33	7.48	39.65	38.09

Notes: MS – master of sports; CMS – candidate master of sports.

Table 2

Initial indicators of sensor-motor coordination of first year girl students (NUPESU), specializing in sport gymnastic (n=7)

The tested	Sport grade	Motor tests							
		Test 1 – balance	Test 2-Biriuk's text	Test 3-Barani's test	Test 4- test 5 forward rolls	Test 5-Coordination test	Test 6-hanging on bent legs	Test 7-walking along perimeter	
								Quantity of walked facets	Spent time
Z - a	M/S	13	10	35	20	9.5	11	4	25
S - o	M/S	11	9	35	22	9.4	13	5	28
B - a	M/S	12	10	21	17	9.5	12	4	23
V - a	M/S	15	12	25	21	9.8	12	5	28
K - a	CMS	10	7	30	25	9.0	13	5	27
K - va	M/S	14	9	25	16	9.3	11	5	25
A - o	CMS	12	8	35	20	9.0	13	5	30
$\bar{x}$		12.43	9.29	29.43	20.14	9.36	12.14	4.71	26.57
S		1.72	1.60	5.83	3.02	0.29	0.90	0.49	2.37
m		0.70	0.65	2.37	1.23	0.11	0.36	0.19	0.96
V%		13.82	17.27	19.80	15.01	3.08	7.41	10.35	8.92

Table 3

Initial indicators of sensor-motor coordination of first year students (NUPESU), specializing in sport gymnastic (n=7)

The tested	Sport grade	Motor tests							
		Test 1 – balance	Test 2-Biriuk's text	Test 3-Barany's test	Test 4- test 5 forward rolls	Test 5-Coordination test	Test 6-hanging on bent legs	Test 7-walking along perimeter	
								Quantity of walked facets	Spent time
L - к	M/S	10	8	20	20	9.0	30	4	23
P - o	M/S	13	11	15	25	8.5	22	5	20
P - к	M/S	10	11	30	20	9.5	24	5	33
R – y	M/S	12	9	27	23	9.2	22	5	25
Ye – n	M/S	15	7	16	18	9.0	26	5	23
L - a	CMS	12	10	35	18	9.1	23	4	25
K - r	CMS	13	8	30	30	8.9	29	5	35

$\bar{x}$	12.14	9.14	24.71	22.0	9.03	25.14	4.71	26.29
S	1.77	1.57	7.74	4.36	0.30	3.29	0.49	5.56
m	0.72	0.64	3.16	1.78	0.12	1.34	0.19	2.27
V%	14.60	17.21	31.32	19.81	3.27	13.08	10.35	21.15

Fulfillment of test balancing on one leg (test 1) showed: most of the tested (14 persons− 66%) demonstrated trembling of arms, oscillations of body and lost of balance (shifting from spot of supporting leg) on 10th second, after closing eyes. Girl-students, specializing in calisthenics demonstrated a little better results ($\bar{x}$ =13.29; 1.38 sec.).

In Biriuk's test (test 2) the tested keep static body balance insufficiently. Their motor skill was formed with technical mistakes. In the test they keep balance with the help of arms' movements, make body movements and keep balance insufficient time (especially girl students, specializing in sport gymnastic) (11.86; 2.48 sec.). It is explained by the fact that position "standing on half tip toes" is their main working posture when fulfilling sport exercises.

Results of vestibular balance research by indicators of dynamic balance (Barany's test, test 3) witness that after rotations in Barany's armchair 12 tested (57.1%) demonstrated weakened coordination of vertical body position from axial line by 20 − 35 cm. After one or two steps some of the tested demonstrated rough loss of balance. The better indicators belonged to girl students (24.71; 7.74 cm).

Vestibular load – five forward rolls for 5 sec. (test 4) significantly worsened dynamic stability of body. It resulted in the fact that after rolls part of the tested (8 persons - 38%) could not fulfill 10 jumps in the center of graduated circle, jumping out of its limits. The worst indicators were registered in those, who specialized in calisthenics (22.71; 2.98 cm.) and in students, specializing in sport gymnastic (22. 0; 4.35 cm).

Coordination (test 5): was tested with jumps on both legs with successive movements of arms: on waist, to shoulders, upward and back-downward. The test was easy for those, who specialized in sport kinds of gymnastic and did not show any differences in indicators. In this connection we replaced it with more difficult, videlicet: initial position (IP) stance – legs apart, arms directed to sides.

1. Turn to the left in stand on left leg, right one is back on tip toe, right arm is directed by arch forward-downward, left arm is directed backward.

2. Forward wave of right leg, right arm – backward, left arm – forward.

3. Forward wave of right leg, right arm –forward, left leg – backward on tip toe.

4. Turn to the right in stand – legs apart, right leg goes by arch downwards; arms are directed to sides (IP).

5 – 8. The same but with turn to the right.

Coordination level of the tested (fulfilling complicated test for coordination) is characterized as middle and above middle. It coincides with results of Polish specialists' researches [10]. Marks for test's fulfillment were 9.0; 0.29 – 9.36; 0.28 points. Better coordination was registered in girl students, specializing in calisthenics (9.41; 0.21 points).

Indicators of proprioceptive sensitivity in changed conditions of haemo-dynamic and irritation of otlith analyzer (test 6) witness that the tested in most cases demonstrated muscular efforts with over estimation or under estimation of the required value. For example among girl students over estimation of muscular efforts was 2.71; 0.95 N. Boy students demonstrated over estimation of 5.14; 3.28 from initial values (100 N; 200 N). Better results were registered in students, specializing in sport gymnastic (2.14; 0.90 N).

Assessment of dynamic body balance with passing of polygon's facets in conditions of restricted support (test 7) witnesses the tested have not got sufficient dynamic balance. For example, from the planned fives travels along polygon's perimeter for 20 seconds the tested passed in average 2.5 – 4.5 of perimeter for 26.57; 2.37 sec. The worst results of dynamic balance were registered in girl-students, specializing in calisthenics (2.29; 0.9 of perimeter for 16.14; 6.14 sec.).

On the base of the received results we can say that sensor-motor coordination of persons, specialized in sport gymnastic has certain reserve for perfection. In this connection we worked out coordination training program for persons, specializing in sport kinds of gymnastic. It consists of two parts, structurally and functionally interconnected. Part 1 – Training of static-dynamic balance. Part 2 – Vestibular training.

When training of the program's exercises and fulfilling them it is extremely important to master required elements of working posture. Working posture shall become a firm skill. It permits to control sensing of body postures,

body positions on support and without support. Yu.K. Gaverdovskiy [4], S.V. Veldiayev [3], Yu.A. Maximova [6] conventionally mark out types of postures in positions: lying, standing, hanging, rest.

1. *Closed posture* – head is bent with chin touching chest, insignificant bending in shoulder and hip joints. It is convenient for fulfillment of exercises on bar, rings, at the beginning of downward-backward declines. Also it can be used as mean, which helps to sense possibilities of movements' control.

2. *Half-closed posture* head is between arms, shoulders are clamped. It is close by characteristics to previous one, but also is convenient for keeping strictly upright body position.

3. *Half open posture* – head is half raised above arms. It leaves possibility for rather convenient keeping of straightened, stretched position with good visual control, but does not exclude possibility of sportsman's body bending.

4. *Open posture* – head is raised. Angle in shoulder joints is possible. It is used rather rarely because it is connected with ostentatiously tensed movements in shoulder joints and danger of too strong body bending.

5. *Bent posture* – head is slightly bent downward to chest, body is in bent position, angle between axes of torso front and legs is within 35 − 45°. Specificity of physical and sport exercises and resulting from them solved motor tasks determine also other borders. For example, when jumping in water (body position – bent in fulfillment of double forward rotation) – it is dense fold of body (example from gymnastic is also possible).

6. *Posture in half tuck* – vertical position of body with legs, bent in knee and hip joints with drawn out toes, bent and pressed to body arms; head is insignificantly dropped on chest.

7. *Posture in tuck* is a position, in which torso is maximally rounded with head dropped to chest; arms embrace shins in the middle; elbows are pressed to torso.

8. *Dynamic posture* – is multiplication of postures and body positions in phase structure of sport exercise. For example "working posture in tuck" and its multiplication in double back flip in tuck are regarded as dynamic posture [1].

For fulfillment of exercises from our program's parts we applied up-to-date pedagogic technologies of their mastering and perfection: functional pedagogic equation (FPE), which has the following form (V.N. Boloban) [1]):

$$P \rightarrow DP \rightarrow DR \rightarrow MT \rightarrow MTr \rightarrow MFOT \rightarrow RC \leftrightarrows RT,$$

Where:

P – purpose and tasks;

DP – didactic principles (individualization, strength, conjugated impact);

DR – didactic rules (train energetically, go from simple to complex, from easy to difficult, compare, repeat, consolidate, perfect coordination, strive for balance);

MT – methods of training (practical, programming, competitions);

MTr – means of training – exercises from parts of coordination training program;

MFOT – methods and forms of organization of trainees (frontal, group, individual);

RC –regulation and control of training process (quantity of training sessions, exercises, repetitions, time of program's fulfillment, control tests;

RT – result of training (fulfillment of control tests with high marks of static-dynamic and static-kinetic body balance).

General algorithm of functional pedagogic equation's action is as follows: as per planned result of sportsmen's training to exercise (in formula – it is right part of equation, RT,, which is a pedagogic directive – to teach to sport exercise, i.e. to achieve the desired result) didactic programming is carried out as well as structuring of knowledge formation's process, motor skills of the trained exercise. I.e. the most adequate and effective didactic elements are selected (in formula – it is left part of equation).

Functional pedagogic equation is mentioned in connection with dynamic character of training and teaching process, creative search of the most effective elements of training, where main condition is level of sportsmen's fitness. It pre-determined formulation of the tasks of program material's mastering, means of trainees' organization, elements of regulation, control and correction with the help of biological feedback.

Table 4

Exercises of program "Coordination training" of first year students of NUPESU, specializing in sport gymnastic

Part 1 Training of static-dynamic balance Task: perfection of static and dynamic balances with fulfillment of exercises for dynamic posture and durable keeping of balance (4–32 sec.) in different positions of body and in motion. Control: Biriuk's test (fixing of position for 15−20 sec.)		
№	**Description of exercises, regulation**	**Methodic recommendations**
Exercises for perfection of skill in keeping dynamic balance on support		
1	Initial position (i.p.): lying on back, arms directed upward. Insignificant bent in hip joints (closed posture). Keep position 3-5 seconds, then turn to the left in position lying on abdomen, straightened (open posture) and keep this position again 3-5 seconds. Repeat exercise 4-8 times, making turns to the left – to the right. The same do with closed eyes.	During turning bend slightly hip joints as in half-open position
2	I.p. lying on back, arms directed upward. 1. Sit in angle (bent posture). Unbending torso 2-4 times quickly turn to the left by 360° in initial position. Repeat exercise 3-4 times to both sides.	When unbending, in turn try to keep vertical position of body with closed legs and arms above
3	I.p. lying on back, arms directed upward. 1. Sit in angle (bent posture). Unbending torso 2-4 times quickly turn to the left by 360° in position of sitting in angle with bent torso. Repeat exercise 3-4 times to both sides.	When unbending, in turn try to keep vertical position of body with closed legs
4	I.p. lying on abdomen (open posture). 1 – 2. Turn to the left by 360°. 3 − 4. Turn to the left by 180°. 5. Sit in angle, arms directed forward (bent posture). 6 – 7 unbending torso make quick turn to the left by 360° in position sitting in angle, bending. 8. I.p. repeat exercise 2-4 times to both sides.	When unbending, in turn (body is elastic-rigid) try to keep vertical position of body with closed legs
5	I.p. lying. 1. Turn to the left to rest on arm, lying by left side; right arm is raised upward. 2 − 3. Keep this position. 4. But with turn by I.p. Repeat exercise 2 − 4 times by right and left sides. The same exercise but with turn by 180° into back rest on arms and again in front rest on arms.	При поворотах сохранять полуоткрытую осанку
Exercises for perfection of skill of dynamic posture keeping in unsupported position		
1	Jumping from height of 1 meter 20 cm (jumping table). I.p. main stance – with waving arms – jump forward-upward, straightening (half-closed posture); arms go upward-outside, then balanced landing in position of half-squat, with arms forward-downward (position of pre-jump). Fulfill 2-3 times.	Accent is on straightened position of body in upper point of jump and on balanced landing
2	I.p. – main stance - with waving arms – jump forward-upward, touching chest with knees; head is dropped on chest; arms directed forward-downward – outside (half-tuck posture). Then legs actively unbend and balance landing occurs in position of pre-jump. Fulfill 2-3 times.	Attention to half-tuck in upper point of jump and on balanced landing
3	I.p. main stance - with waving arms – jump forward-upward, in tuck (tuck posture), followed by active straightening of torso and steady landing in position of pre-jump. Fulfill 2-3 times.	Active tuck in upper point of jump and balanced landing
4	I.p. main stance - with waving arms – jump forward-upward, bending with legs apart, arms forward-outside (bending posture), followed by active unbending and balanced landing in pre-jump position. Fulfill 3-4times.	Accent of fulfillment of fold only in ascending part and balanced landing
5	I.p. main stance - with waving arms – jump forward-upward, straightening with turn by 180 degrees; arms go upward-outside (half-open posture), followed by landing in balanced position of pre-jump. Fulfill 2-3 times with turn to both sides.	Accurate turn in ascending part of jump and balanced landing

6	I.p. main stance - with waving arms – jump forward-upward, straightening with turn by 360, and 540 degrees; arms go upward-outside (half-open posture), followed by landing in balanced position of pre-jump. Fulfill 2-3 times with turn to both sides.	Vertical posture without twisting in hip joints
Exercises for static dynamic balance in different positions of body		
1	I.p. – hands are on waist. Walking on tip toes with turns by 360° to the left and to the right, followed by stops and fixation of vertical posture with arms upward. Fix posture for 4 seconds. Fulfill the same with turns by 90° in jumps. Repeat exercise 3 – 4 times to both sides.	Attention to keeping of vertical posture without twisting in hip joints; jumps shall be fulfilled with waving arms
2	I.p. – closed stance with hands on waist. 1. Bent with arching – arms are directed outside. 2. Back bent with arms upward – outside. 3. High balance on left leg – right one is directed backward; left arm – upward – right arm is directed to side. 4 – 7.Keep posture. 8. I.p. Repeat exercise 3 – 4 times on left and right legs. The same in stance on tip toes with closed eyes.	High balance shall be fulfilled on half tip toes, with head kept straight; body shall be rigid-elastic and maximally
3	I.p. Stance on right leg with left one directed aside on tip toe. 1 – 2. Wave to the left, wave to the right. 3 – 4. Side balance on right leg, left one – aside with right arm directed upward and left one – behind the back. 5 – 7. Keep posture. 8. I.p. The same on left leg. Repeat exercise 4 – 6 times. The same on tip toe with closed eyes.	When waving stand on tip toes keeping balance. Attention to functioning of torso and legs' muscles.
4	I.p. Stance on tip-toes with hands directed aside. 1. Bend to the left, arms – upward. 2. I.p. 3. Bend to the right, arms – upward. 4. I.p. 5. Back step with right leg; back balance on right leg, left one is directed forward-upward; arms – upward-aside. 6 – 7. Keep the posture. 8. I.p. Fulfill exercise 2 times on left and 2 times on right legs. Repeat exercise, increasing time of posture's keeping up to 6-8 sec.	Keep balance on high half tip toes; the same with closed eyes. Pay attention to functioning of legs and torso's muscles.
5	I.p. Stance on tip-toes with hands directed aside. 1. Jump on left leg, forward wave with right leg; left arm goes forward, right one – backward. 2. I.p. 3. Jump on right leg, forward wave with left leg; right arm goes forward, left one – backward. 4. I.p. 5. Jump on left leg in high balance by "ring" of right leg; arms are directed upward-outside. 6 – 7. Keep position. 8. I.p. Fulfill exercise 2 times on both legs, keeping balance by "ring" up to 8 – 10sec. Do the same with closed eyes.	Attention to ability to keep position of leap in flight and balance in high balance by "ring".
6	I.p. Stance on tip toes; arms are directed aside. 1. Wave with right leg forward-upward; left arm is directed forward, right arm – backward. 2. I.p. 3. Wave with right leg backward; left arm is directed backward, right – forward; forward bend in position balanced split with capture of shin by hands. 4 – 7. Keep the posture. 8. I.p. Do the same with left leg with closed eyes. Repeat exercise 2 – 4 times, keeping balance in split 6 – 8 sec.	Keep balance when fulfilling waves forward-backward and in balanced split.
Exercises for dynamic balance (moving on low and standard balance beam)		
1	I.p. Stance on tip toes at end of low balance beam. Walking on tip toes with arms aside – walking with back forward and arms aside; walking with crossed steps (left step – right step) with arms aside; jumps on both legs with arms upward; run by "gallop" from left (right" legs; run on tip toes to the end of balance beam and dismount downward in straighten position of torso. Repeat combination 1 – 2 times.	Accent on tension of muscles and vertical carriage on high half tip toes; on change of kinds of movement at the end of balance beam
2	I.p. Main stance at the end of balance beam. Back balance (keep 3-3 sec.); then two "gallop" steps from left leg and two – from right leg with unlike circles made by arms inside; turn by 360 degrees on left (right) leg with right leg bent forward and arms directed upward; turn by 180 degrees on both legs with arms – upward; jumps on both legs with arms aside; the same with changing of legs (arms – aside); run up to the end of balance beam with arms aside and dismount straightening. Repeat combination 1-2 times.	When turning exclude any torso movements. When jumping keep vertical posture; change of kinds of movements shall be at the end of balance beam.
3	I.p. Main stance at the end of balance beam. Walking on tip toes, waving legs forward-upward at every step with arms aside; turn by 180 degrees by left	When waving and jumping pay attention to

	(right) leg with other leg bent forward and arms directed upward; turn by180 degrees with forward waving of one leg; forward jumps from left to right legs (and vice versa), arms – aside; forward balance on left (right) leg; run up to the end of balance beam and dismount straightening. Repeat combination 1-2 times.	verticality of posture without extra body movements; change of kinds of movements shall be at the end of balance beam.
4	I.p. Stance on tip toes at end of balance beam, arms - aside. Moving forward with different combinations of two, three jumps; keep balance for 4 – 8 sec.; alternation of jumps, legs' waving and turns to different sides. Repeat exercise 3 – 4 times, without dismounting from the beam.	Increase amplitude of legs' waving, keep balance; change of kinds of movements shall be at the end of balance beam..
5	I.p. Stance on tip toes; arms are directed aside. Three steps, starting from left leg; back waving with right leg with turn around, arms are directed upward and stance on tip toes; turn around in i.p. Repeat combination 2 times from right and 2 time from left legs. Fulfill 3-4 attempts.	When turning keep steady balance and carriage; accurate position of arms, directed upward and aside.
6	I.p. squat with left leg ahead and arms – aside. Make three steps in squat position and turn by 180˚ to the right, the turn by 180˚ to the left. Repeat combination 2 times from right and 2 times from left legs. Fulfill 3-4 attempts.	When turning keep vertical posture and accurate position of arms, directed upward and aside.
Exercises for keeping of dynamic posture (jumps on trampoline)		
1	Fulfill 4-8 temp jumps.	Keep verticality of body with arms dropped down
2	3 – 4 temp jumps: make high jump in tuck (keeping carriage in tuck) with following quick opening in ascending part of jump and landing with stop. Repeat 2 – 4 times.	Attention to rounded back, dropped head, hands' capture of shins with elbows pressed to torso
3	2 – 3 temp jumps: jump on knees and jump upward with turn by 180° and landing with stop. Repeat combination 2 – 4 times with turning to both sides..	When landing on knees, do not admit any angle in hip joints
4	2 – 3 temp jumps: jump in sitting position and jump upward with turn by 180° and landing with stop. Repeat combination 2 – 4 times with turning o both sides.	When landing in sitting position pay attention to upright position of torso and head with arms bent back on support
5	3 – 4 temp jumps: jump upward with turn by 180°; jump upward with turn by 360° and landing with stop. с приземлением в остановку. Repeat combination 2 – 4 times with turning o both sides, also applying turns by 180º and 540°.	Turn shall be fulfilled in ascending part of jump, with vertical posture and arms pressed to body

Part 2. Vestibular training

The task: perfection of static-kinetic body balance with the help of exercises, oriented on progressing of stability and sensitivity of vestibular analyzer.

Control: Barany's test (deviation of body to the left-right from vertical line in passing of 5 meter' segment of width not more than 15-20 cm.

№	Description of exercises. Regulation	Methodic recommendations
Acrobatic exercises on track (mat) for static-kinetic balance		
1	I.p. Hands on floor in squat position. Forward roll; jump upward with turn by 360° with landing in squat (hands on floor; two back rolls, jump upward with landing in half squat position and arms forward-downward-aside (pre-jump position). Fulfill exercise 2 times in one attempt, keeping pre-jump position up to 5 sec. Repeat exercise 3-4 times.	Jump upward shall be fulfilled with energetic wave of arms upward; when turning keep vertical carriage; keep balance when landing

2	I.p. Main stance. Step with one leg; temp jump (valset); turnover with turn (rondat); jump with turn around and arms upward; jump with turn by 360° in pre jump position. Fulfill combination 2 times in one attempt. Repeat exercise 3-4 times, fulfilling turns to both sides.	When turning keep verticality of body; keep balance when landing
3	I.p. Hands on floor in squat position. Forward roll; long forward roll; temp jump and forward turnover on one; forward turnover on two with landing in pre-jump position. Fulfill combination 2 times. Repeat exercise 3-4 times, fulfilling turns to both sides.	Accent on straightened body in temp jump and keep balance when landing
4	I.p. Main stance. Step with one leg; temp jump; forward turnover on two; upward jump straightening; long forward roll; upward jump bending with legs apart and arms forward-aside; landing in pre-jump position. Fulfill combination 2 times. Repeat exercise 3 – 4 times.	Jump transition from turnover to roll; horizontal legs' position (bent posture) in jump
5	I.p. Main stance with arms directed upward. Step with left leg and back wave with right one; left overturn in stance with legs apart and arms aside; step with right leg with turn to the left in stance "legs apart"; turnover to the right. Fulfill combination 3 times. Fulfill 3-4 attempts.	Attention to keeping flatness when fulfilling turnovers
6	I.p. Arms are directed upward. Back roll, bending in front arms and turn by 180^{O} (front arms shall be kept 3 sec.) – forward roll bending and jump upward with turn by 360 degrees; landing in pre-jump position. ^{O} – приземление в положение доскока. Fulfill combination 2 times in one attempt. Repeat exercise 3 – 4 times turning to both sides.	Attention to straightened body when turning; do not admit more then two over stepping in front arms
Exercises on trampoline for static-kinetic balance		
1	Temp jumps; jump in sitting position; upward jump; jump on knees; upward jump with arms upward and turn around in sitting position; upward jump and turn around on knees; upward jump and landing with stop. Repeat combination 3-4 times with turning to both sides.	Attention to vertical position of body when ascending and in turns; in sitting positions arms are slightly bent behind the back. Knees are closed and tightly pressed to each other.
2	Temp jumps; jump in sitting position; upward jump with arms directed upward and turn to the left by 180 degrees in sitting position; upward jump and turn to the right by 180 degrees in sitting position; upward jump and landing with stop. Repeat combination 3-4 times with turning to both sides.	Attention to vertical body position when ascending and in turn
3	Temp jumps; upward jump with right turn by 180degrees in sitting position; jump on legs; back jump on back in tuck; upward jump with turn by 180degrees; upward jump and stop. Repeat combination 3-4 times with turning to both sides.	Attention to vertical body position when ascending and in turn
4	Temp jumps; jump on knees; jump on hands in kneeled position; upward jump with turn around in sitting position; upward jump with turn around in kneeled position, on hands; upward jump with turn by 360 degrees in kneeled position, on hands; upward jump and stop. Repeat combination 3-4 times.	Keep vertical body position when turning, legs shall be in close contact
5	Temp jumps; jump in kneeled position, on hands; forward jump, bending, on back; upward jump with turn by 360 degrees; jump and stop. Repeat combination 3-4 times to both sides.	Arms are dropped head is on chest (half closed posture). When unbending from bacl press arms tightly to torso
6	Temp jumps; back flip in tuck; forward flip bending with turn by 180 degrees; half jump and jump with stop. Repeat combination 3-4 times to both sides.	Attention to position of arms directed upward and half closed posture

Table 5

Algorithm of exercises' fulfillment o coordination training program for persons, specializing in sport kinds of gymnastic

№	Description of parts and number of exercise	Days of week		
		Monday	Tuesday	Friday
Part1. Training of static-dynamic balance on support				
1	Exercises for skill in keeping dynamic posture in lying position			

Exercises 1, 2, 3, 4, 5		3, 4	1, 2	5
2	Exercises for skill in keeping dynamic posture in unsupported position			
Exercises 1, 2, 3, 4, 5		3, 4	1, 2	5, 6
3	Exercises for static-dynamic balance in different positions of body			
Exercises 1, 2, 3, 4, 5,6		3, 4	1, 2	5, 6
4	Exercises for dynamic balance when moving on low ans standard balance beam			
Exercises 1, 2, 3, 4, 5,6		3, 6	1, 2	4, 5
5	Exercises for dynamic posture when jumping on trampoline			
Exercises 1, 2, 3, 4, 5		3, 4	1	5
Part 2. Vestibular training				
1	Acrobatic exercises on acrobatic track (mat) for static-kinetic balance			
Exercises 1, 2, 3, 4, 5,6		3, 4	1, 2	5, 6
2	Exercises on trampoline for static-kinetic balance			
Exercises 1, 2, 3, 4, 5,6		3, 4	1, 2	5, 6

At the end of the second stage of successive pedagogic experiment we conducted additional testing of static-dynamic and static-kinetic balance of persons, practicing sport kinds of gymnastic.

Results of the research witness that there are no confident differences between indicators of sensor motor coordination. We observed only tendency for improvement of tests' indicators. That is why we inserted some changes in our program. They concern, mainly, part 2 "Vestibular training". New variants of exercises are given in table 4.

The third stage (duration 5 months, January – May 2015) was characterized by fulfillment of curriculum exercises in course of general gymnastic. The latter envisaged mastering of applied, general, acrobatic exercises, exercises on gymnastic apparatuses, vaults. The trainees also fulfilled exercises from our program of improvement of body static-dynamic and static-kinetic balance. Final indicators are given in table 6-8.

Table 6

Final indicators of static-dynamic and static –kinetic balance of first year girl students of NUPESU, who specialize in calisthenics (n=7)

The tested	Sport grade	Motor tests							
		Test 1 – balance	Test 2-Biriuk's text	Test 3-Barani's test	Test 4- test 5 forward rolls	Test 5-Coordination test	Test 6-hanging on bent legs	Test 7-walking along perimeter	
								Quantity of walked facets	Spent time
B - a	M/S	14	22	20	17	9,6	12	4	27
D - ch	M/S	15	14	25	16	9,8	11	3	13
Zh - o	M/S	15	10	22	15	9,7	12	4	20
I - a	CMS	14	20	23	20	9,7	9	4	25
S - k	CMS	15	17	25	15	9,5	12	2	12
S - a	M/S	15	22	22	12	9,6	10	3	21
Sh - a	M/S	14	12	20	15	9,9	9	3	18
$\bar{x}$		14.57	16.71	22.43	15.71	9.69	10.71	3.29	19.43
S		0.53	4.86	2.07	2.43	0.13	1.38	0.76	5.62
m		0.21	1.98	0.84	0.99	0.05	0.56	0.30	2.29
V%		3.67	29.05	9.23	15.46	1.39	12.88	23.01	28.94
p		p<0.05	p<0.05	p<0.05	p<0.05	p<0.05	p<0.05	p>0.05	p>0.05

Table 7

Final indicators of sensor-motor coordination of first year girl students (NUPESU), specializing in sport gymnastic (n=7)

The tested	Sport grade	Motor tests							
		Test 1 – balance	Test 2-Biriuk's text	Test 3-Barani's test	Test 4- test 5 forward rolls	Test 5-Coordination test	Test 6-hanging on bent legs	Test 7-walking along perimeter	
								Quantity of walked facets	Spent time
Z - a	M/S	14	16	25	12	10	9	4	24
S - o	M/S	13	10	25	15	9,9	10	5	25
B - a	M/S	14	14	20	13	9,6	12	4	22
	A-a CMS	15	15	21	16	10	11	5	27
V - a	M/S	15	13	25	18	9,7	12	4	25
K - a	CMS	15	17	20	10	9,7	10	5	23
K - va	M/S	14	14	25	17	9,9	9	5	25
$\bar{x}$		14.29	14.14	23.0	14.43	9.83	10.43	4.57	24,43
S		0.76	2.27	2.52	2.88	0.16	1.27	0.53	1.62
m		0.30	0.92	1.02	1.17	0.06	0.51	0.21	0.66
V%		5.29	16.03	10.94	19.95	1.63	12.20	11.69	6.62
p		p<0.05	p<0.05	p<0.05	p<0.05	p<0.05	p<0.05	p>0.05	p<0.05

Table 8

Initial indicators of sensor-motor coordination of first year students (NUPESU), specializing in sport gymnastic (n=7)

The tested	Sport grade	Motor tests							
		Test 1 – balance	Test 2-Biriuk's text	Test 3-Barani's test	Test 4- test 5 forward rolls	Test 5-Coordination test	Test 6-hanging on bent legs	Test 7-walking along perimeter	
								Quantity of walked facets	Spent time
L - к	M/S	15	15	12	15	9,5	21	4	22
P - o	M/S	15	19	15	10	9,8	22	5	19
P - к	M/S	14	17	20	16	9,7	21	5	23
R – y	M/S	12	10	20	17	9,5	19	5	24
Ye – n	M/S	15	10	15	18	9,5	22	5	22
L - a	CMS	13	11	25	15	9,6	23	4	21
K - r	CMS	14	9	20	15	9,4	22	5	25
$\bar{x}$		14.0	13.00	18.14	15.14	9.57	21.43	4.71	22.29
S		1.15	3.96	4.38	2.54	0.14	1.27	0.49	1.98

m	0.47	1.61	1.78	1.03	0.05	0.51	0.19	0.80
V%	8.25	30. 45	24.12	16.81	1.44	5.94	10.35	8.87
p	p<0.05	p<0.05	p>0.05	p<0.05	p<0.05	p<0.05	p>0.05	p>0.05

On finishing the course of general gymnastic and fulfilling program "Coordination training", designed for perfection of organism's sensor systems, we registered confident improvement of indicators of static-dynamic and static-kinetic body balance. For example in tests 1,2 the tested became confidently longer keep balance with closed eyes, standing on one keg and on high half tip toes, accordingly 14.57; 0.53 sec. and 16.71; 4.86 sec. ($p<0.05$). Vestibular balance, in passing 5 meters' segment (test 3) also improved. Deviations from axial line reduced and became more stable, being within admissible tolerance from 18.14; 4.37 cm for boy students and см up to 22.43; 2.07 cm for girl students ($p<0.05$). Quantity of tested, who fulfilled high jumps within graduated circle (test 4) increased. For example from 21 tested 13 persons (62%) yimproved their indicators in average by 5.5 cm, comparing with initial indicators and were 14.43; 2.87 cm of girl students and 15.14; 2.54 cm of boy students ($p<0.05$). Indicators of coordination in complicated conditions (test 5) increased up to 9.83; 0.16 points by the end of experiment. Indicators of space orientation and proprioceptive sensitivity (test 6) improved and reached to the set conditions: girl students: 10.57; 1.27 and boy students accordingly: 21.43; 1.27 N ($p<0.05$). Indicators of dynamic body balance in passing of polygon's perimeter (test 7) in conditions of restricted support improved, in average, by 3 sec., comparing with initial time. For example, boy students showed time of passing of five polygon's perimeters for 20 second – 22.29; 1.97sec.; girl students a little worse: 24.43; 1.61 sec.

Persons, specializing in calisthenics improved quantity of perimeters' passing up to 3.29; 0.75 perimeters.

Thus, as a result of realization of academic programs on specialization, on general gymnastic and as a result of fulfillment of coordination training exercises, considering variation coefficients, the tested confidently ($p<0.05$) increased static-dynamic and static-kinetic body balance, comparing with initial indicators. Results of the research agree with tendency of sport science and practice, in which great attention is paid to development and perfection of static-dynamic body balance. In the world [5, 7, 11, 12, 13, 14, 15] there are successfully worked out and realized local programs of exercises, video-materials with application of such new technical means as SportKat, step-platforms, Body – Balance (exercises on mobile platforms), semi-spheres BOSU Balance Training and other fitness systems (for example like Sokker) [www.soccer.pm4]. Sportsmen have opportunity to develop surface muscles and deep muscles. For this purpose they fulfill different by structure exercises: twisting and bends of torso, arching of body, supporting by ball; long fixation of balance on mobile, narrowed and high platforms; they can train vestibular sensor system.

The prospects: perfection of methods and means of coordination training of those, who practice sport kinds of gymnastic in training process at all stages of sport perfection.

Conclusions:

1. In process of practical training of general gymnastic we registered insufficient level of NUPESU first year students' sensor motor coordination (students specialized in sport kinds of gymnastic).

2. We worked out program of coordination training for persons, specializing in sport kinds of gymnastic. This program consists of two parts. The first part is training of static-dynamic balance; the second part – vestibular training. The implemented in academic process program of exercises confidently improved sensor-motor coordination of persons, specializing in sport kinds of gymnastic ($p<0,05$).

3. Coordination training of persons, specializing in sport kinds of gymnastic (as new direction of realization of specific and preparatory exercises, developing and improvinf static-dynamic and static-kinetic balance) shall take one of priority places in physical education system and sport training.

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Conflict of interests

The authors declare that there is no conflict of interests.

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Information about the authors:

Tereshchenko I.A: http://orcid.org/0000-0003-0823-7507; vanyatereschencko@yandex.ru; National University of Physical Education and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

Otsupok A.P.: http://orcid.org/0000-0003-3332-5496; vanyatereschencko@yandex.ru; National University of Physical Education and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

Krupenya S.V.: http://orcid.org/0000-0001-7888-1133; svetboock@ukr.net; National University of Physical Education

and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

Liauchuk T.M.: http://orcid.org/0000-0003-2890-387X; vanyatereschencko@yandex.ru; National University of Physical Education and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

Boloban V.N.: http://orcid.org/0000-0001-9119-0695; wboloban@ukr.net; National University of Physical Education and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

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