Pedagogic control of schoolchildren fitness in skiing training with the help of posturography methods

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Abstract
Purpose: Pedagogic control of schoolchildren’s fitness in skiing training with the help of posturography bio-mechanical methods is regarded. To show effectiveness of posturography methods for determination schoolchildren’ fitness in skiing training.

Material: in the research schoolchildren participated (n=90, age 16 years). For determination schoolchildren’s fitness we used the following tests: stance on left (right) foot, test for balance.

Results: by results of first bio-mechanical researches we determined: formed models of technique’s bio-mechanical structure in skiing; registered schoolchildren's fitness; worked out methodic of schoolchildren's motor skill formation in skiing. This methodic is based on application of bio-mechanical indicators, psychological components of motor actions' control. We also found quantitative indicators of speed acceleration, pushing efforts and sliding. It permits for schoolchildren to show better result at finish.

Conclusions: for current determination of schoolchildren’s fitness it is recommended to use bio-mechanical methods of posturography.

Keywords: bio-mechanical, posturography, ski training, schoolchildren, pedagogic, control.

Introduction
In Ukraine, physical education of children and youth is one of important links of preparation for integration in society [3, 4, 20, 29]). It is directed at improvement their physical and psychic health, perfection of readiness for active life, creative professional functioning [10, 12, 22, 23]. In school physical education formation of motor technique is of great importance [8, 9, 18, 30].

By importance for health, physical condition and physical fitness of schoolchildren one of leading places is engaged by ski training [7, 13]. In the process of ski training schoolchildren receive knowledge of skiing technique. They receive information about skiing hygiene, familiarize with accessories and its maintaining; they pass control tests [5]. Of not less importance is children’s training to vitally significant motor skills. In such training application of posturography methods has its advantages [1, 2, 32]. Basing on individual bio-mechanical models it is possible to correct schoolchildren’s and elite sportmen’s technique [6, 15].

Application of posturography methods permits to solve the following sport-pedagogic tasks:
– Test static-dynamic stability of sportsman’s body or system of bodies; assess quantitatively and qualitatively; supplement knowledge about exercises’ sport technique [11, 32];
– provide quality control of exercises’ training, connected with complex motor skill of body balance [21, 28, 31, 34];
– determine the level and dynamic of motor skills’ formation [17, 19, 24, 26].

Great importance is acquired by methods of schoolchildren’s pedagogic control [25, 27, 33, 35]. Posturography methods were used for determination of additional qualities and skills of students in light athletics [16], choreography [14], swimming [2], volleyball [17], outdoors games [1]. Posturography methods were also used in research of different age biathlon girls’ movements in out of school establishments [15]. But we have not found study of schoolchildren’s movements in skiing with the help of posturography methods.

The purpose of the research is to show effectiveness of posturography methods for determination schoolchildren’ fitness in skiing training.

The tasks of the research:
1. Analysis of literature sources devoted to this topic.
2. Working out of methodic of schoolchildren’s motor skills’ formation in skiing with the help of bio-mechanical control methods.
3. To show effectiveness of posturography methods for determination schoolchildren’ fitness in skiing training.

Material and methods
Participants: in the research schoolchildren of 16 years age participated (n=90). Schoolchildren with higher results formed model group (MG, n=30). Schoolchildren with worse results formed general group (GG, n=60). GG was divided into two groups (30 persons in each): control group, which was trained by traditional methodic; experimental group (EG), which was trained by the author’s methodic.

Organization of the research: the work was fulfilling during 2012-2014:
- In bio-mechanical laboratory of Chernigov National Pedagogical University, named after T.G. Shevchenko,
- In two out-of-school establishments (Chernigov specialized children-junior Olympic reserve skiing school and Chernigov regional children-junior sport school for children-orphans “Olymp”),
- In Chernigov municipal comprehensive school of 1“-3“ grade № 3,
- In Chernigov municipal information-technological...
lyceum № 16,
- Khalyavinska comprehensive school of 1*-3rd grade (Chernigov district).

For determination of schoolchildren’s skills condition in skiing training we conducted stating experiment with 3 methods of posturography: “Stance on left foot”, “Stance on right foot”, tests for stability. Parents gave consent for their children’s participation in the research.

Statistical analysis was fulfilled with the help of Excel program.

Results

By results of correlation analysis we constructed models of oscillations of general mass center (GMC) of schoolchildren’s bio-mechanical structure (see Fig.1).

Fig. 1. Graph-analytic model of bio-mechanical structure of test “For stability”: MG – model group; GG – general group; Q(x) – dispersion by frontal axis, mm; V – velocity of general mass center (GMC) traveling, mm/sec; IV – mean-amplitude value of velocity, mm/sec; AM – assessment of movement; LX – length of GMC trajectory by frontal axis, mm; LY – length of GMC trajectory by sagittal axis, mm; QBF – quality of balance function, %; Lup – forward deviation, mm.

In test “For stability” we see the difference by results of GG and MG indicators: GG – dispersion by frontal axis is 44.10±2.14 mm; MG – 29.06±1.46 mm. Increase of Q(x) indicators means reduction of schoolchildren’s stability in corresponding plane. Mean velocity of general mass center (GMC) traveling, is the following: GG – V=57.57±5.21 mm/sec; MG - V=34.30±2.89 mm/sec. This indicator determines mean-amplitude value of GMC traveling velocity during testing. High velocity illustrates active processes of keeping vertical posture, connected with disorder of one or several organism’s systems (for example vestibular function). The highest velocity means timely compensation of appearing body deviations-normal work of systems, sustaining vertical posture.

Mean-amplitude value of velocity, (IV) was: GG – 34.80±2.97; MG – 21.26±1.69.

Assessment of movement (AM) was: GG – 21.46±1.10; MG – 14.16±0.96.

Next indicator is relation of static-kinesiograms to average dispersion, related to the time of research. Its increase says about stability worsening and decrease – about improvement. The length of GMC trajectory by frontal axis (LX) was: GG – 1284.25±93.28 mm; MG – 848.74±65.23 mm.

The length of GMC trajectory by sagittal axis (LY) was: GG – 1322.36±95.61 mm; MG – 869.46±66.22 mm.

The quality of balance function (QBF) was: GG – 10.92±0.85%; MG – 27.42±2.11%.

Forward deviation was: GG – 105.30±6.63 mm; MG – 127.00±4.45 mm.

QBF indicator assesses minimal velocity of movement center (MC). The higher QBF is the better schoolchild’s body stability in both planes; the better schoolchild keeps balance.

The author’s methodic is built on objective bio-
mechanical analysis and modeling. The methodic has exact tasks with preparatory and special power exercises, required trainings methods, load dozing, biomechanical control indicators in the basis (see table 1).

In one year after the author’s methodic application we determined effectiveness of the offered methodic, resulted from formation experiment by the same 3 methods of posturography (see Fig.2).

It was proved that in EG, comparing with CG schoolchildren there were confident changes and results improved in tests “Stance on left foot” – by 20.54 %; “Stance on right foot – by 18.18 %. It proves effectiveness of posturography methods in determination of schoolchildren’s skills in ski training.

Discussion
Analysis of scientific-methodic literature and own practical experience shows that the problem of development and implementation bio-mechanical control methods in pedagogic process (meaning control over schoolchildren’s skills formation at ski training) has been still insufficiently studied. Students’ motor fitness was determined with the help of biomechanical control methods in light athletics, choreography, swimming, volleyball, outdoors games [1, 2, 14, 17]. In biathlon motor fitness of schoolgirls was determined [15]. In all cases the methods of bio-mechanical control were applied. All results proved effectiveness of bio-mechanical methods.

On the base of the received by us data we constructed bio-dynamic parameters’ models of schoolchildren’s supporting reactions in skiing. Besides, we found difference between control, experimental and model groups.

Table 1. Methodic of 16 years age schoolchildren’s motor skills formation in skiing training (fragment)

| Task                                                                 | Training method | Content of training                                                                 | Dozing            | Control indicators          |
|----------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------|-------------------|-----------------------------|
| 1. To form the feeling of skis cohesion with snow                    | Training 1      | Control of static-dynamic stability indicators in schoolchildren                     | Q(x) mm           | 3.37±0.18                   |
| 2. To master coordination of arms, torso, legs movements; balance    | In gym: (preparatory part) | 1. Theory. 2. Warming up. General (GE). 3. Special power exercises (SPE) on simulator “Belts with rings”. 4. Exercises for mastering forms of arms, torso and legs movements (imitation of skiing). | V mm              | 30.02±1.49                  |
| 3. To master movements of legs, arms and torso in ski stepping and sliding | On snow (main part) | Jumping on skis on the spot: 1. Alternating legs with the help and without ski sticks with GMC transfer. 2. On both ski with and without help of of sticks, with turning ski to the right and to the left. | R mm              | 4.19±0.21                   |
| 4. Mastering of motor skills: endurance, flexibility, dexterity, quickness and strength. | Leading up exercises: | 3. On one right or left ski with and without sticks with turning ski to the left or to the right. | 5 minutes         |                             |
| 5. Home task: imitate skiing, motion on skis by classic alternate steps with and without sticks; power exercises. | Uniform | Demonstration of ski stepping with and without sticks 1. Slow ski stepping and sliding with and without sticks 2. Slow sliding on one ski with and without sticks. 3. Skiing with alternative classic style with sticks and without them. | 3 minutes         |                             |
|                                                                      | Circular Encourage-ment | 1. Chin ups, rising of legs, pressing ups on simulator “Parallel bars-horizontal bar”. 2. Squatting on one leg | Training circle – 200 meters |                             |
|                                                                      |                  | 3. Special power exercises (SPE) on simulator “Belts with rings”. | 60 m run, sec.    | 10.20±0.67                  |
|                                                                      |                  | 4 minutes | Shuttle run 4x9 m, sec. | 8.2±0.74 |
|                                                                      |                  | 5 km | 9.20±1.05 |

In one year after the author’s methodic application we determined effectiveness of the offered methodic, resulted from formation experiment by the same 3 methods of posturography (see table 1).
The author’s methodic of schoolchildren’s skills’ formation in ski training process is an integrated system of motor skills formation. It is based on application of bio-mechanical indicators and psychological components of motor control. Earlier we conducted theoretical studies with the help of posturography tests [5, 6, 15], in the base of which calculated data were. In the present work we received actual characteristics of posturography parameters, which were used in ski training. Such approach to formation of motor skills significantly increases skiing technique. The methodic considers psycho-emotional state of schoolchild. Pedagogue helps schoolchild to choose optimal skiing speed, considering quantitative indicators of acceleration, pushes and sliding. It permits for the schoolchild to achieve higher results at finish.

Conclusions
For the first time methodic of schoolchildren’s skiing motor skills has been worked out and implemented in practice. Effectiveness of posturography methods in determination of schoolchildren’s fitness in ski training has been proved.

For determination of fitness level it is necessary to select bio-mechanical control methods, according to age.

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Conflict of interests
The author declares that there is no conflict of interests.

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