Influence of fitball aerobics on the development of individual coordinating abilities of girls 14–15 years old

Irina Kyzmenko[1]
Andrzej Ostrowski[2]
Viacheslav Zhuk[1]

[1]*Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine*
[2]*Academy of Physical Education, Krakyw, Poland*

Abstract

Purpose: to determine the change in the level of development of the dynamics of the coordination abilities of girls 14–15 years old under the influence of fitball aerobics exercises.

Material & Methods: the study was carried out on the basis of general secondary education in Kharkov. It was attended by 46 girls aged 14–15. The following methods were used in the course of the study: theoretical analysis and generalization of scientific and methodological literature, pedagogical testing, pedagogical experiment, methods of mathematical statistics.

Results: the level of development of coordination abilities of girls aged 14–15 was assessed by such manifestations of coordination abilities as the ability for spatial orientation, the ability to assess and regulate the spatial and dynamic characteristics of movements, the ability to maintain static balance and the ability to adapt and restructure motor actions. A comparison of the indicators of the development of coordination abilities in the age aspect with the corresponding norms before and after the use of fitball aerobics exercises is presented. The results of the study indicate a trend towards an increase in the level of manifestation of coordination abilities after the experiment. The most significant increase was observed in the indicators of a jump with a turn: from 23,1% to 62,4% and the results of the Bondarevsky test: from 18.6% to 30.6%. Comparison of the indicators of coordination abilities in the age aspect showed that girls of 14 years old in most cases demonstrate higher results than girls of 15 years old. Comparison of the studied indicators with the relevant standards showed that the results correspond to the "average" level.

Conclusions: the dynamics of the results indicates the stability of the level of development of coordination abilities and the trend towards their improvement. This confirms the expediency of organizing fitball aerobics classes in the sports section of the school.

Анотація

Ірина Кузьменко, Анджей Островський, В'ячеслав Жук. Вплив занять фітбол-аеробікою на розвиток окремих координаційних здібностей дівчат 14–15 років. Мета: визначити зміну рівня розвитку динаміку координаційних здібностей дівчат 14–15 років під впливом вправ фітбол-аеробіки. **Матеріал і методи:** дослідження здійснювалося на базі закладу загальноосвітньої середньої освіти м. Харкова. В ньому брали участь 46 дівчат 14–15 років. Під час проведення дослідження застосовувалися наступні методи: теоретичний аналіз і узагальнення наукової та методичної літератури, педагогічне тестування, педагогічний експеримент, методи математичної статистики. **Результати:** рівень розвитку координаційних здібностей дівчат 14–15 років оцінювався за такими проявами координаційних здібностей як здатність до просторової орієнтації, здатність до оцінки й регуляції просторово-динамічних характеристик рухів, здатність до збереження статичної рівноваги та здатність до пристосування і перебудови рухових дій. Представлене порівняння показників розвитку координаційних здібностей у віковому аспекті, з відповідними нормами до та після застосування вправ фітбол-аеробіки. Результати дослідження свідчать про тенденцію до підвищення рівня прояву координаційних здібностей після експерименту. Найбільш суттєвий приріст спостерігався у показниках стрибка з поворотом: від 23,1% до 62,4% та результатах проби Бондаревського: від 18,6% до 30,6%. Порівняння показників координаційних здібностей у віковому аспекті виявило, що дівчата 14 років у більшості випадків демонструють результати вищі, ніж учениці 15 років. Співставлення досліджуваних показників з відповідними нормами показало, що результати відповідають «середньому» рівню. **Висновки:**

Original Paper

DOI: 10.15391/snsv.2022-2.001
Received: 06.05.2022;
Published: 25.06.2022

Citation:
Kyzmenko, I., Ostrowski, A. & Zhuk, V. (2022). Influence of fitball aerobics on the development of individual coordinating abilities of girls 14–15 years old. *Slobozhanskyi Herald of Science and Sport*, 26(2), 35-40. doi: 10.15391/snsv.2022-2.001

Corresponding author:
Irina Kyzmenko
Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine
orcid.org/0000-0002-5373-314X
e-mail: kyzmenko_irina@ukr.net

Andrzej Ostrowski
orcid.org/0000-0003-3075-093X
Viacheslav Zhuk
orcid.org/0000-0003-2373-582X

Key words:
coordination
school
sports section
spatial orientation
spatial and dynamic parameters of movements
static balance
adaptation and restructuring of motor actions

Ключові слова:
координація
школа
спортивна секція
просторова орієнтація
просторово-динамічні параметри рухів
статична рівновага
пристосування та перебудова рухових дій

динаміка результатів свідчить про стабільність рівня розвитку координаційних здібностей, та тенденцію до їх покращення. Це підтверджує доцільність організації занять фітбол-аеробікою у спортивній секції школи.

Introduction

Motor activity is one of the most important components of a healthy lifestyle and is essential for full physical and mental health, especially in childhood, adolescence and youth (Kolokoltsev et al., 2020; Podrihalo et al., 2022).

Modern conditions of human life contribute to a decrease in physical activity, which causes significant harm to health. The younger generation is especially vulnerable. To meet the biological need of a growing organism to move, the system of the educational process should provide for various forms of physical education, since even three physical education lessons a week do not provide the optimal level of physical activity for children (Denysenko et al., 2007; Platonova et al., 2013; Kuzmenko, 2020). Therefore, one of the ways to solve this problem is to organize various forms of physical exercises, including sports sections, in an educational institution.

To increase motivation for physical exercises, a number of authors note the importance of introducing modern innovative types of physical activity into the process of physical education of schoolchildren: cheerleading (Bala et al., 2018); modern dance (Kuzmenko & Tymchenko, 2019); health fitness (Matukhno, 2016; Chekhovskaya, 2020); workout (Nahorniuk & Masliak, 2018), etc.

Specialists in the field of physical culture and sports offer different ways to develop the coordination abilities of the younger generation: floorball means (Bilan, 2017); increasing the functional state of sensory systems (Kuzmenko, 2010); introduction of a multi-level system of differentiated learning (Mameshyna, 2018), etc.

One of the most common areas of physical activity among girls is fitball-aerobics. Fitball aerobics is one of the varieties of aerobics, where large, light, elastic balls – fitballs are used as the main projectile for performing exercises. Fitball-aerobics, as a modern type of physical activity, has an advantage over traditional ones, since it allows solving a variety of tasks (Chekhaniuk, 2013; Ilin & Kuchma, 2020).

Suvorova et al. (2018) note that exercises on fitballs have a positive effect on the functioning of the cardiovascular and respiratory systems, train the vestibular apparatus, improve mobility in the joints, increase efficiency, muscle strength and overall endurance, develop coordination abilities.

The diversity of fitball-aerobics exercises, its health-improving, educational, educational aspects and the possibility of attracting a contingent of people with different levels of physical fitness and health status are noted Bazylevych & Horbenko (2016), Bermudes (2016).

In our opinion, fitball-aerobics exercises can be considered as an effective tool for increasing the motivation of girls for physical exercises, achieving a harmonious physical and mental state, improving health, developing physical qualities, in particular, various types of coordination abilities.

It should be noted that a high level of development of coordination abilities is quite important in various fields of activity: educational, sports, labor, professional, etc. (Kolumbet, 2014; Chernykh et al., 2021; Serhiienko, 2021).

However, scientific works aimed at studying the effectiveness of the use of fitball aerobics for the development of coordination abilities of girls of secondary school age in the sports section of an institution of general secondary education were not found in the literature available to us, which determined the relevance of our study.

Purpose of the study: to determine the dynamics of the development of coordination abilities of girls aged 14-15 under the influence of fitball-aerobics exercises.

Material and Methods of the research

Participants

The study involved 46 people aged 14-15 years (22 girls 14 years old and 24 girls 15 years old). The girls who participated in the study were practically healthy and had a doctor's permission to engage in the sports section. Girls and parents gave informed consent to participate in the study.

Methods

The following methods were used in the course of the study: theoretical analysis and generalization of scientific and methodological literature; pedagogical testing; pedagogical experiment and methods of mathematical statistics.

Theoretical analysis and generalization of scientific and methodological literature was carried out to study the relevance of the problem under study.

Pedagogical testing was carried out to determine the state and dynamics of the level of development of individual manifestations of the coordination qualities of girls 14–15 years old. The tests proposed by Serhiienko (2001) and Skalii (2006) were used.

During the study, the following manifestations of coordination abilities were assessed: the ability for spatial orientation in complicated conditions – a jump with a turn, running towards numbered balls; the ability to assess and regulate the spatial and dynamic characteristics of movements – throwing rings on the rack, throwing the ball at the target; the ability to maintain static balance – Bondarevsky's test, Yarotsky's test; the ability to adapt and restructure motor actions – performing three somersaults forward, Kopylov's test "ten eights".

The control exercise "Jump with a turn" involved a jump with a 360° turn over the gymnastic bench from five steps of the run and then continued running. Each jump was rated with points from 0 to 2,0 – the turn failed. 1 – the turn was made only partially, there was no transition to running without stopping, landing on both legs was observed, and not in the step position. 2 – good coordination of jumping and turning with a slow transition to running.

The exercise "Running to numbered balls" was performed as follows: the student stood in front of the counter, behind her lay 5 balls numbered from 1 to 5 in circles. The number was called, the student returned 180°, ran to the return ball, touched it with her hand and returned back to the counter. Then another number was called, etc., the exercise ended after the student completed it 3 times and touched the rack. The time of the exercise was determined. The exercise had to be completed in 8,0 s for the "excellent" rating, 9,1 s for the "good" rating, 10,3 s for the "satisfactory" rating, and 11,2 s for the "enough" rating.

The exercise "Throwing a ring on a rack" involved throwing a rubber ring (diameter 20 cm) with one hand onto a rack 10 cm high out of 10 attempts from a distance of 1.5 m. The total number of hits was recorded. In girls aged 14, the "low" level corresponded to a result of <4 points, "below average" – 5–6 points, "average" – 7–9 points, "above average" – 10–11 points, "high" – 12> points. Schoolgirls aged 15 had <4 points, 5-6 points, 7-8 points, 9-10 points and 11> points, respectively.

The control exercise "Throwing a tennis ball at a target" was performed by a participant with the leading hand at a target with a total diameter of 60 cm, an average diameter of 40 cm, an inner diameter of 20 cm. A tennis ball was thrown at a target from five distances) from 4 m – 5 attempts; 2) from 16 m – 5 attempts; 3) from 7 m – 5 attempts; 4) from 13 m – 5 attempts; 5) from 10 m – 5 attempts. The result was determined by the total number of hits from 25 attempts. When the ball hit the inner circle, there were 3 points, in the second circle – 2 points, in the third circle – 1 point, outside the target – 0 points. In girls aged 14, the "low level" corresponded to the result <10 points, "below average" – 11–13 points, "average"

– 14–16 points, "above average" – 17–19 points, "high" – 20> points. For girls aged 15 – <10, 11-13, 14-16, 17-19, 20>, respectively.

The Yarotsky test was performed from the initial position of the main stance, eyes closed, the test participant made head turns in one direction at a pace of two movements per second. The time from the beginning of head movement to the moment of loss of balance was determined. Maintaining balance for 35 s was assessed as "excellent", 20 s – "good", 16 s – "satisfactory".

The Bondarevsky test involved keeping the balance with closed eyes, standing on one leg, hands on the belt. Registration of time began after finding a stable position, and ended at the moment of loss of balance. The time of holding a static posture was determined. The average indicators of static balance for students in grades 8-9 were 18,5 s.

The exercise "Three somersaults forward" was performed as follows: the participant stood on the edge of the mats, taking the main stance. On command, she took a crouching position and sequentially, without stopping, performed 3 somersaults forward, trying to do this in the minimum amount of time. The time to complete the task was fixed. In girls aged 14, the "low" level corresponded to the result of 5,2 s, "below average" – 5,1–4,9 s, "average" – 4,8–4,3 s, "above average" – 4,2 -4,0 s, "high" – 3,9 s; in girls aged 15: 5,4 s, 5.3–5,1 s, 5,0–4,5 s, 4,4–4,2 s, 4,1 s, respectively.

Kopylov's test "Ten Eights" provided for the fastest performance by a participant of an imaginary eight, which was carried out by passing the ball from hand to hand between the legs at the level of the knees. The exercise time was recorded. For female students of the 8th grade, the score "excellent" corresponded to the result of 8,4–10,5 s, "good" – 10,6–12,5 s, "satisfactory" – 12,6–14,5 s; for girls of grade 9: 8,0–10,0 s, 10,1–12,0 s, 12,1–14,0 s, respectively.

Girls of 2 ages participated in the pedagogical experiment: the first group – girls of 14 years old, the second group – girls of 15 years old. At the beginning of the academic year, preliminary testing was carried out to determine the initial level of development of coordination abilities. After that, during the school year, the girls were engaged in fitball-aerobics in the sports section of the school. Classes were held 3 times a week, their duration was 60 minutes. At the end of the academic year, a final test was conducted to determine the impact of classes on the level of development of coordination abilities.

The structure of the fitball aerobics lesson consisted of an introduction, main and final parts. The introduction included exercises of a general developmental nature, varieties of walking, running, basic aerobic movements, their combinations in combination, dance exercises. The main part of the lesson consisted of various sets of exercises with fitballs, performed from different starting positions. In the final part, breathing exercises, muscle relaxation exercises, attention, and ideomotor exercises were carried out. Musical accompaniment was used in the classes.

Procedure

The study was carried out in stages. At the first stage, the analysis and generalization of scientific and methodological literature was carried out, which made it possible to study the state of the problem under study, develop a research program, determine the contingent of those studied and select informative methods. At the second stage, preliminary testing of the level of development of coordination abilities of the studied contingent and a pedagogical experiment were carried out. At the third stage, final testing was carried out to determine the degree of change in the studied indicators under the influence of fitball-aerobics exercises. The results were processed and compared, and the conclusions of the study were drawn.

Statistical analysis

The obtained data were processed using the statistical package of Excel XP. Mathematical and statistical methods included: calculation of arithmetic average characteristics – $\bar{X}$; standard error of the mean – m; t-criterion, which determined the degree of reliability of the difference in indicators according to the Student's table.

Results of the research

Considering the indicators of coordination abilities by age before the experiment, it should be noted that 14-year-old girls demonstrate higher results in such exercises as throwing a tennis ball at a target, the Yarotsky, Bondarevsky test, three forward somersaults and in the Kopylov "Ten Eights" test. And girls 15 years old – in exercises jumping with a turn, running to numbered balls and throwing a ring on the rack.

Comparison of the results of the level of development of the coordination abilities of girls aged 14-15 at the beginning of the academic year with the relevant standards revealed the "average" level of their development.

At the end of the academic year, after the use of fitball-aerobics exercises, there was a positive trend towards improving the level of development of coordination abilities in the studied contingent. Thus, the analysis of indicators of jumps with a turn and running to numbered balls of girls aged 14–15 revealed (Table 1) that there was an increase in the studied indicators. At the same time, the results of 14-year-old female students in the exercise jumping with a turn have significant differences ($p<0,01$).

Table 1

Results of the ability to spatial orientation of girls of middle school age before and after the experiment

Age	n	Before the experiment $\bar{X}_1 \pm m_1$	After the experiment $\bar{X}_2 \pm m_2$	$t_{1,2}$	p
Jumping with a turn (points)					
14	22	1,03±0,24	1,65±0,17	4,28	<0,01
15	24	1,11±0,22	1,31±0,18	1,12	>0,05
Run to numbered balls (s)					
14	22	9,97±0,44	9,73±0,47	0,32	>0,05
15	24	9,98±0,46	9,80±0,49	0,28	>0,05

Analysis of the results of jumps with a turn in percentage terms indicates an improvement in this type of coordination qualities: for 8th grade girls by 62,4%, for 9th grade girls by 23,1%; data on running to numbered balls also slightly increased: for 8th grade schoolgirls by 2,1%, for 9th grade – by 1,8%.

Comparison of the performance of jumps with a turn with the standards proposed by Serhiienko (2001) showed that the results correspond to the «average» level, and the performance of running to numbered balls – to the assessment of «satisfactory».

Consequently, the introduction of fitball aerobics exercises had a positive trend towards increasing the indicators of the ability for spatial orientation of 14–15-year-old schoolgirls.

Analyzing the results of the ability to assess and regulate the spatial and dynamic parameters of movements after the use of fitball aerobics exercises (Table 2), it should be noted that the data of throwing rings on the rack and throwing a tennis ball at the target improved somewhat. However, no

significant differences were observed in the scores (p>0,05).

Table 2

Results of the ability to assess and regulate the spatial and dynamic parameters of movements in girls of middle school age before and after the experiment

Age	n	Before the experiment $\bar{X}_1 \pm m_1$	After the experiment $\bar{X}_2 \pm m_2$	$t_{1,2}$	p
Throwing rings on the rack (times)					
14	22	5,03±0,74	5,80±0,56	1,18	>0,05
15	24	7,15±0,90	8,76±0,95	1,54	>0,05
Throwing a tennis ball at a target (points)					
14	22	15,95±1,20	16,01±0,98	1,16	>0,05
15	24	14,76±1,52	15,84±1,35	0,54	>0,05

Considering the dynamics of indicators in the ratio, it should be noted that in the exercise of sketching rings for stable results improved as follows: for schoolgirls aged 14 – 16,1%, for girls aged 15 – by 8,7%; in the exercise of throwing a tennis ball – by 0,6% and 7,3%.

Comparison of the obtained results with the standards proposed by Skalii (2006) revealed that the indicators of the exercise of throwing rings on the rack among schoolgirls of 14 years correspond to "below average", in girls of 15 years old – "above average", and the data of throwing a tennis ball at a target – "average" level for girls 14-15 years old.

The use of fitball aerobics exercises ensured the constancy of the indicators of the ability to assess and regulate the spatial and dynamic parameters of movements.

Analyzing the data on the level of development of the ability to maintain static balance in girls aged 14–15 years after the use of experimental exercises (Table 3), it should be noted that there was an improvement in the results. It should be noted that the indicators of the Bondarevsky test in 15 years old increased significantly (p<0,05).

Table 3

Results of the ability to maintain static balance in girls of middle school age before and after the experiment

Age	n	Before the experiment $\bar{X}_1 \pm m_1$	After the experiment $\bar{X}_2 \pm m_2$	$t_{1,2}$	p
Yarotsky test (s)					
14	22	23,02±1,97	26,76±2,09	1,34	>0,05
15	24	22,87±1,84	25,85±1,77	1,03	>0,05
Bondarevsky test (s)					
14	22	21,02±1,88	24,93±1,85	0,61	>0,05
15	24	18,63±1,37	23,59±0,91	3,04	<0,05

Comparing the dynamics of the obtained results in the ratio, it should be noted that in the Yarotsky test, the indicators increased by 16,2% for 14-year-old schoolgirls, by 13,1% for 15-year-old schoolgirls; in the Bondarevsky test, the data increased by 18,6% and 30,6%, respectively.

Comparison of the data on the maintenance of the static balance of girls aged 14–15 years with the norms proposed by Serhiienko (2001) showed that in the Yarotsky test the indicators correspond to the "good" assessment, and in the Bondarevsky test the results are "above average".

Therefore, the proposed means had a positive trend to improve the ability to maintain static balance in the study population.

An analysis of the indicators of three forward somersaults and the Kopylov test "Ten eights" in girls aged 14–15 after doing fitball aerobics (Table 4) showed that the results improved somewhat, but there were no significant differences (p>0,05).

Table 4

The results of the ability to adapt and restructure motor actions in girls of middle school age years before and after the experiment

Age	n	Before the experiment $\bar{X}_1 \pm m_1$	After the experiment $\bar{X}_2 \pm m_2$	$t_{1,2}$	p
Three somersaults forward (s)					
14	22	4,52±0,17	4,43±0,18	0,41	>0,05
15	24	4,64±0,11	4,55±0,15	0,44	>0,05
Kopylov's test "Ten eights" (s)					
14	22	10,95±0,44	10,82±0,43	0,17	>0,05
15	24	11,72±0,68	11,52±0,69	0,18	>0,05

Considering the indicators of the ability to adapt and reorganize motor actions in the ratio, it should be noted that in the exercise three somersaults forward, the results of fourteen-year-old girls improved by 2 %, girls of 15 years old – by 1,8%; in Kopylov's Ten Eights test, 14-year-old schoolgirls improved their performance by 1,1%, and fifteen-year-olds – by 1,5%.

Comparison of the data obtained with the standards proposed by Serhiienko (2001) showed that in the exercise three somersaults forward, the indicators of girls aged 14–15 correspond to the "average" level, the results of Kopylov's test "Ten Eights" are assessed as "good".

It should be noted that the means of fitball aerobics had a positive trend, but the ability to adapt and restructure motor actions was not significantly affected.

The trend of the level of development of coordination abilities in the age aspect did not change after the experiment: girls of 14 years old have indicators slightly higher than girls of 15 years old. With the exception of the results of the exercise throwing rings on the rack, where the indicators of 15-year-old girls are significantly higher than those of 14-year-old students (p<0,05). The positive trend of changes in the indicators of the level of development of coordination abilities in girls was not reflected on the rating scale either: the results correspond to the "average" level.

Discussion

Coordination abilities are an important physical quality of a person, since a high level of their development contributes to faster mastery of various motor skills and abilities, better performance of technical elements in various sports, better orientation in space and time, and more effective development of other physical abilities (Serhiienko, 2001; Skalii, 2006; Chernykh et al., 2021).

Specialists in the field of physical culture and sports offer a variety of ways to develop coordination among schoolchildren (Kuzmenko, 2010; Kolumbet, 2014; Bilan, 2017; Mameshyna,

2018). The results of our study supplemented the knowledge about the current level of development of certain types of coordination abilities in girls aged 14–15 and expanded the arsenal of increasing their level of development by means of fitball aerobics.

Studies by Bazylevych & Tonkonoh (2019), Ilina & Kuchmy (2020) indicate that fitball aerobics classes contribute to a significant increase in female students' indicators of physical fitness, functional state, as well as health promotion, involving them in a healthy lifestyle. increase interest in exercise. The results of our study complement the data of the authors on the positive effect of fitball aerobics on the level of development of physical qualities, in particular, the coordination abilities of girls of middle school age.

Chekhaniuk (2013), Suvorova and others (2018) consider fitball aerobics one of the effective means of strengthening and maintaining health, increasing the level of physical condition and interest in physical education and sports for high school students. In their opinion, fitball-aerobics exercises have a healing effect, train the vestibular apparatus, develop coordination of movements, stimulate metabolism, and activate motor reflexes. In the process of doing fitball aerobics, the authors note an improvement in the level of development of physical qualities in high school girls, in particular, such a manifestation of coordination abilities as a sense of balance. The experimental data of our study supplement the knowledge of the authors about the change in the level of development of various types of coordination abilities of school-age girls under the influence of fitball aerobics in the sports section of the school.

Bazylevych & Horbenko (2016) offers fitball aerobics as a new, innovative means of physical education for children assigned to special medical groups. Fitball aerobics exercises are offered by the authors as a means of complex impact on the physical condition of schoolchildren of all ages. In our opinion, the health-improving orientation, moderation of physical activity, the possibility of strict adherence to the principle of an individual approach in fitball aerobics classes is a good option for increasing the motor activity of girls in the puberty period.

Our study is consistent with the data of specialists in the field of physical culture, sports, medicine on the positive effect of exercises with fitballs on increasing motivation, changing the level of development of physical qualities, in particular, coordination abilities, and confirms the expediency of introducing fitball aerobics classes into the sports section of the school.

Conclusions

Fitball aerobics classes in the sports section of the school had a positive effect on the indicators of the coordination abilities of girls aged 14–15, which is confirmed by the stability of the results and the tendency to increase them. However, the ambiguity of the obtained results in dynamics requires further research in this direction. A significant improvement in the results was noted in the manifestation of the ability to orientate in space according to the data of a jump with a turn in schoolgirls of 14 years old and the ability to maintain static balance according to the Bondarevsky test in girls of 15 years old.

The most significant increase occurred in the indicators of a jump with a turn: from 23.1% to 62.4% and the data of the Bondarevsky test: from 18,6% to 30,6%.

Comparison of indicators of coordination abilities in the age aspect revealed that the results of 14-year-old girls in most cases are higher than those of 15-year-old schoolgirls.

Comparison of indicators of coordination abilities of girls aged 14-15 with the relevant standards showed that the results correspond to the «average» level.

Author Contributions
Irina Kyzmenko: data collection, input, data analysis, statistics, data interpretation, manuscript preparation, Andrzej Ostrowski: design, research planning, Viacheslav Zhuk: analysis, literature search.

Funding
This article didn't receive financial support from the state, public or commercial organizations.

Conflicts of Interest
The authors declare no conflict of interest.

References

Bala, T., Krivoruchko, N., Masliak, I., Stasyuk, R., Arieshyna, Y., & Kuzmenko, I. (2018). Influence of cheerleading classes on functional state of respiratory system of 10-16 year old teenagers. Journal of Physical Education and Sport (JPES), 18 (Supplement issue 4), Art 271, 1850-1855. doi: 10.7752/ jpes..s 4271.

Bazylevych, N. O., & Horbenko, M. I. (2016). Orhanizatsiino-metodychni osoblyvosti vykorystannia elementiv fitbol-aerobiky na zaniattiakh v spetsialnykh medychnykh hrupakh zi shkoliaramy. Naukovyi chasopys Natsionalnoho pedahohichnoho universytetu imeni M. P. Drahomanova. Seriia 15: Naukovo-pedahohichni problemy fizychnoi kultury (fizychna kultura i sport): zb. nauk. prats. Kyiv: NPU im. M. P. Drahomanova, 10, 288-292.

Bazylevych, N. O., & Tonkonoho, O. S. (2019). Vplyv, zaniat fitbol-aerobikoiu na riven fizychnoi pidhotovlenosti ta funktsionalnoho stanu studentok. Visnyk Prykarpatskoho universytetu. Seriia: Fizychna kultura, 31, 3-8.

Bermudes, D. V. (2016) Teoriia i metodyka vykladannia aerobiky: navchalno-metodychnyi kompleks: navchalno-metodychnyi posibnyk. Sumy: FOP Tsoma S. P.

Bilan, Ya. O. (2017). Sutnist i zmist metodyky rozvytku koordynatsiinykh yakostei uchniv osnovnoi shkoly zasobamy florbolu u pozaurochnii roboti. Naukovyi chasopys Nats. ped. un-tu imeni M. P. Drahomanova. Zb. nauk. pr. Kyiv, 3K(84), 57-59.

Chekhaniuk, L. (2013). Vplyv zaniat fitbol-aerobikoiu na riven fizychnoi pidhotovlenosti starshoklasnyts. Fizychne vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi: zbirnyk naukovykh prats, 2 (22), 93-96.

Chekhovska, M., Shevtsiv, L., Zhdanova, O., & Chekhovska, L. (2020). Fitness in school physical education lessons. Journal of Physical Education and Sport, Vol 20 (Supplement issue 1), Art. 60, 420 – 424. doi:10.7752/jpes.2020.s1060

Chernykh, T., Mulyk, V., Mulyk, K., Skaliy, A., Ostrowski, A., & Skaliy, T. (2021). The relationship between the effectiveness of

performing technical elements and indicators of static and dynamic balance in young acrobats 6-7 years old. Health, Sport, Rehabilitation, 7(4), 58-68. https://doi.org/10.34142/HSR.2021.07.04.05

Denysenko, N., Pedik, L., & Fuks, L. (2007). Osoblyvosti rivnia zdorovia, fizychnoi pidhotovlenosti, samopochuttia ta vedennia zdorovoho sposobu zhyttia v uchniv zahalnoosvitnikh shkil i himnazii. Teoriia i metodyka fizychnoho vykhovannia i sportu, 3, 44-46.

Ilin, A., & Kuchma, A. (2020). Vplyv zaniat step-aerobikoiu i fitbol-aerobikoiu na fizychnu pidhotovlenist studentok. Problemy aktyvizatsii rekreatsiino-ozdorovchoi diialnosti naselennia: materialy KhII Mizhnar. nauk.-prakt. konf. (23–24 kvitnia 2020 r., m. Lviv). Lviv, 109-111

Kolokoltsev, M. M., Iermakov, S. S., Tretyakova, N. V., Kraynik, V. L., & Romanova, E. V. (2020). Physical Activity as a Factor to Improve the Quality of Student Life. The Education and science journal, 22(5), 150-168. doi: https://doi.org/10.17853/1994-5639-2020-5-150-168

Kolumbet, O. M. (2014). Rozvytok koordynatsiinykh zdibnostei molodi: monohrafiia. K.: Osvita Ukrainy.

Kuzmenko, I. (2020). Suchasni pidkhody do pidvyshchennia rukhovoi aktyvnosti shkoliariv osnovnoi shkoly. Fizychna aktyvnist i yakist zhyttia liudyny: zb. tez dop. IV Mizhnar. nauk.-prakt. Internet-konf. Lutsk: Skhidnoievrop. nats. un-t im. Lesi Ukrainky.

Kuzmenko, I. O. (2010). Zmina rivnia rozvytku okremykh koordynatsiinykh zdibnostei shkoliariv serednikh klasiv pid vplyvom spetsialno spriamovanykh vprav. Moloda sportyvna nauka Ukrainy: zb. nauk. prats z haluzi fizychnoi kultury ta sportu. Vyp. 14: u 4-kh t. L. LDUFK,2, 124-130.

Kuzmenko, I. O., & Tymchenko, V. V. (2019). Vplyv elementiv suchasnykh tantsiv na pokaznyky hnuchkosti uchniv 10–11-ty rokiv. Fizychna kultura, sport i zdorovia: stan, problemy ta perspektyvy: zbirnyk naukovykh dopovidei KhIKh Mizhnarodnoi naukovo-praktychnoi konferentsii, Kharkiv: KhDAFK.

Mameshyna, M. A. (2018). Dynamika pokaznykiv rozvytku koordynatsiinykh zdibnostei shkoliariv 7–9-kh klasiv pid vplyvom bahatorivnevoi systemy dyferentsiiovanoho navchannia. Naukovyi chasopys Nats ped. un-tu imeni M. P. Drahomanova. Zb. nauk. pr. Kyiv, 10(104), 49-55.

Matukhno, O. V. (2016). Formuvannia motyvatsii do zaniat fizychnoiu starshoklasnykiv zasobamy ozdorovchoho fitnesu. Naukovyi chasopys Natsionalnoho ped. un-tu imeni M. P. Drahomanova. Zb. nauk. pr. Kyiv, 11(81), 77-79.

Nahorniuk, V. Yu., & Masliak, I. P. (2018). Vplyv vorkautu na proiav sylovykh zdibnostei shkoliariv serednikh klasiv. Aktualni problemy fizychnoho vykhovannia riznykh verstv naselennia. Zbirnyk naukovykh prats, Kharkiv, 180-190. http://hdafk.kharkov.ua/ua/naukova-robota/naukovo-teoretichni-vidannya/aktualni-problemi-fizichnogo-vikhovannya-riznikh-verstv-naselennya

Platonova, A., Podrigalo, L., & Sokol, K. (2013). Rational for the use of children's motor activity as a criterion for the effectiveness of rehabilitation and recreation. Pedagogics, psychology, medical-biological problems of physical training and sports, 17(11), 72-76. https://doi.org/10.6084/m9.figshare.817929

Podrihalo, O., Jagiełło, W., Podrigalo, L., Iermakov, S., & Yermakova, T. (2022). The influence of health-improving fitness classes on the degree of fat deposition in women of the second mature age. Pedagogy of Physical Culture and Sports, 26(1), 19-25. https://doi.org/10.15561/26649837.2022.0103

Serhiienko, L. P. (2001). Testuvannia rukhovykh zdibnostei shkoliariv: [Uchebnyk]. Kyiv: Olimpiiska literatura.

Skalii, T. V. (2006). Pedahohichnyi kontrol rozvytku koordynatsiinykh zdibnostei ditei i pidlitkiv (dysertatsiia kandydata nauk z fizychnoho vykhovannia ta sportu). Khersonskyi derzhavnyi universytet. Kherson.

Suvorova, T. I., Radchenko, O. V., & Konstankevych, V. P. (2018). Pidvyshchennia rivnia fizychnoi pidhotovlenosti divchat-starshoklasnyts zasobamy fitbol-aerobiky. Molodyi vchenyi, № 12.1 (64.1), 68-71.