

Utilizing step aerobics as a methodology to enhance physical and coordination fitness in girls aged 12-14 years

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Abstract:

Improving physical education means and methods among children, adolescents and youth is an urgent and in-demand area of activity for specialists in this field. The low rate of improvement in the indicators of physical health of the population, its insufficient motivation for physical activity makes it necessary to search for effective methods of wellness orientation. **Research aim.** To develop and experimentally substantiate a program for motor qualities and coordination abilities development fitness in 12-14-years-old girls in the process of extracurricular step aerobics classes. **Materials and methods.** The experimental project was carried out on the basis of a comprehensive school in Chelyabinsk (Russia). There were 30 girls under observation, aged 12-14, who had no medical restrictions on physical activity. The girls were divided into two groups: control (CG, n=15) and experimental (EG, n=15). As part of additional physical education in school conditions, girls of both groups studied three times a week for 45 minutes according to the general education program «General physical training». The program used complexes of general developmental physical exercises to develop the students' basic motor qualities and coordination abilities. The educational process for the EG girls followed our developed program. EG girls engaged in a traditional general educational curriculum twice a week, while incorporating special aerobic exercise complexes using a step platform once a week. Rigorous testing was conducted to assess the level of general physical fitness and coordination abilities. **Results.** Upon project completion, it was evident that EG girls exhibited significantly higher values in almost all motor and coordination tests, along with notable growth rates than the CG girls. At the end of the project, 60.0% of girls were classified as «high» in terms of motor skills and 53.3% in coordination skills, which is significantly more than in CG. A positive vector for the motivation to engage in wellness fitness development has been established not only among EG girls, but also among their classmates. **Conclusions.** The proposed program for the general physical fitness and coordination skills development has shown its effectiveness. It can be used in regular and additional physical training of students, studying at educational institutions.

Key Words: step aerobics, extracurricular activities, physical culture, physical abilities and skills

Introduction

Despite the existing scientific and practical achievements in optimizing the educational process of physical education of young people, this area continues to be relevant for specialists in physical culture and sports (Almonacid-Fierro, 2021; Hrehorowicz, 2021). The importance of further studying the issues of introducing innovative technologies and methods of physical education among the younger generation is due to the still low indicators of their physical health (Chekhovska et al., 2020; Tortella et al., 2021; Drenowatz, 2021; Tomás Reyes-Amigo, 2021). Most researchers consider hypokinesia to be the cause of insufficient physical condition of modern youth, which leads to the severe abnormalities development on the part of organs and functional systems (Jieyu Chen et al., 2017; Kolokoltsev et al., 2021; Guryanov et al., 2022), disruption of metabolic processes in the human body (Ding et al., 2020).

The lack of motivation for physical activity among young people (Kuśnierz et al., 2020) and, often, the low effectiveness of traditional physical education programs (Biino et al., 2020) are key causes of the physical

inactivity development in children and adolescents. Some authors see a way out of the current situation with physical inactivity in the use of innovative physical education technologies. Case technologies can be used for this purpose (Mischenko et al., 2023). Their use has shown a good result in increasing the level of educational activities formation, which increases the effectiveness of mastering the material on physical culture and increases motivation for physical activity. They began to actively apply training methods from various sports in the teaching of "Physical culture" discipline (Viktorov et al., 2020; Kolokoltsev et al., 2023). This fact does not only allow increasing the level of physical health, but also developing an interest in physical activity among university students. The methods of using additional physical education for young people using modern sports activities that are popular among the population have proved to be very effective, which also significantly increases the effectiveness of forming good physical and psychosomatic health (Zorio-Ferreres et al., 2018; Jessica et al., 2020).

It is known that the reserve capabilities of the children's and adolescents' body largely depend on the level of its physical indicators development, which determine the morphofunctional development vector of a young organism for the next years of its life. The age of a person from 11-12 to 14-15 refers to the middle school period of life. It is the most difficult in view of the rapid morphofunctional and psychoemotional restructuring of the body due to puberty. This period is one of the most favorable for all motor qualities development, including coordination abilities (Nikitushkin et al., 2016). At the age of 11-14, the accuracy of muscle efforts and the ability to perform the proposed pace and rhythm of physical movements increases, the level of complex coordination skills formation increases.

The use of traditional means and methods of physical culture to improve human physical health often does not achieve the goal set by teachers (Biino et al., 2020). This fact is due to the insufficient number of study hours for this subject and the high academic level of training sessions. All this reduces the motivation for physical activity in students and adolescents (Kuśnierz et al., 2020). Increasing interest in physical education and sports can be solved through the introduction of modern health and educational technologies in the course of classes in the system of additional physical education outside of school hours (Zorio-Ferreres et al., 2018; Jessica et al., 2020). In our opinion, a promising direction for solving this problem may be the use of tools and methods from wellness fitness, in particular, step aerobics, which is a simple and effective style from all modern aerobics directions.

Using a step platform for training allows increasing the strength qualities of the limbs and trunk muscles. There is an increase in overall endurance, speed and strength qualities, flexibility and movements coordination (Moeskops et al., 2018; Charmi Salot et al., 2020). Along with this, there is an improvement in the functional parameters of the central and autonomic nervous, cardiorespiratory, musculoskeletal systems, the activity of the vestibular apparatus and proprioception (Kokarev et al., 2023). Step aerobics classes form a harmoniously developed physique, correct posture and the foot arch. Step aerobics is especially popular among female representatives (Populo, Safonenko, 2020).

Despite the numerous research works available on the problem of the impact of educational and training sessions with recreational types of aerobics on the body of those involved, some issues continue to be insufficiently studied. The scientific literature does not fully cover the issues of the influence of step aerobics training sessions in the system of additional physical education on the development of basic indicators of physical fitness and coordination abilities of girls aged 12-14. There is a shortage of step aerobics training programs for puberty girls.

Therefore, they practice in groups of children's step aerobics, or in fitness groups for adult women. Such classes do not correspond to the morphofunctional and age characteristics in 12-14-years-old girls, so they stop classes. We believe that the study of these issues will improve the physical fitness in 12-14-years-old girls and the level of their motor coordination development as components of physical training by means of modern physical culture and wellness technologies.

Research aim. To develop and experimentally substantiate a program in 12-14-years-old girls motor qualities and coordination abilities development in the process of extracurricular step aerobics classes.

Material & methods

The pilot project was carried out from October 2022 to May 2023 on the basis of secondary school No. 104 in Chelyabinsk (Russia). There were 30 girls aged 12-14 (12.9 ± 1.2 years) who had no medical restrictions on physical activity. Using a randomized method, the girls were divided into two groups of 15 people: control (CG) and experimental (EG). The parents have received written consent for the children's participation in the project. We have observed the ethical rules and norms of the organization of experimental biomedical research, which do not contradict the documents of the Helsinki Declaration of 2003.

As part of additional physical education in school conditions, girls of both groups studied three times a week for 45 minutes according to the general education program "General Physical Training" (Lyakh, 2021). The program used complexes of general developmental physical exercises to develop the students' basic motor qualities and coordination abilities.

The EG girls' educational process was carried out according to the program developed by us. Twice a week, the EG girls were additionally engaged in a general developmental curriculum and once a week they used special aerobic exercise complexes using a step platform, the FITMAN SPF-1030-Bb model with a step height of 15 cm.

The developed experimental program «Step Aerobics» includes theoretical and practical parts, designed for 34 classes. The practical part of the developed experimental program is based on a differentiated approach of additional impact on insufficiently developed types of motor qualities and coordination abilities of girls involved, which were determined as a result of our preliminary testing. Classes on the step platform were held for 40 minutes.

We used elements from basic aerobics, running and jumping exercises, dance steps and turns on the platform. Running and jumping exercises were performed on 8 counts in 4 sets. After that, the basic steps of aerobics were performed for 8 counts in 4 sets, and running and jumping were performed again. Exercises for the upper and lower limbs and torso were selected taking into account the increasing complexity. The structure of the step aerobics training session was performed in the following sequence: walking → general developmental physical exercises → various jumps → elements of dance exercises → flexibility exercises → dance ligaments that performed by the flow method → strength-oriented exercises → stretching → breathing exercises.

In the introductory part of the lesson, the heart rate was 100-130 beats /min, in the main part of the workout it ranged from 130 to 150 beats/min. During the completion of the training session, the pulse returned to its original level. Step aerobics classes were performed to musical compositions, taking into account the age and physical fitness of the girls and corresponded to modern topics.

During the theoretical training, EG girls were introduced to the basics of proper nutrition, exercises to perform at home, and knowledge of a wellness orientation was formed (characteristics of aerobic physical activity, the state of their motor activity, the effect of physical exercises on the human cardiorespiratory system, modern technologies for combating and preventing excessive body fat content).

High-stakes testing of the general physical fitness level was carried out. To do this, we used a battery of tests: "Shuttle run 3x10 m, s; "unning 30 m from a low start", s; "Bend forward from a sitting position", cm; "Sit-up in 1 min", the number of times; "Running 300 m", s. For a high-stakes determination of the coordination movements state the following tests were used: "Three somersaults forward", s; "Standing on one leg with eyes closed", s; "Turns on a gymnastic bench», s; «Stepping over a gymnastic stick» (5 times with the right; 5 times with the left foot), s; "Sprint in a given rhythm", s.

The research used generally accepted statistical methods. The Statistica 6.0 software package was used. The significance of the differences in the values of the indicators was carried out according to the Student's t-criterion ($p < 0.05$ was considered a significant difference).

Results

At the beginning of the project, a comparative analysis of the indicators values characterizing the level of general physical fitness development of girls in the observed groups did not reveal significant differences between them, $p > 0.05$, Table 1.

Table 1. Values of high-stakes testing indicators of motor qualities (M±m)

Tests	CG (n=15)		EG (n=15)	
	At the beginning of the project	At the end of the project	At the beginning of the project	At the end of the project
1. Shuttle run 3x10 m, s	8.81±0.67	8.23 ± 0.42	8.72±0.45	7.14 ± 0.28*
2. Running 30 m from a low start, s	6.23±0.55	5.93 ± 0.30	6.42±0.86	4.91 ± 0.13*
3. Bend forward from a sitting position, cm	4.1±1.23	8.1 ± 2.35*	4.8±1.12	10.5 ± 3.58*
4. Sit-up in 1 min, the number of times	33.8±3.56	37.0 ± 4.71	32.6±3.45	49.0 ± 5.84*
5. Running 300 m, m/s	1:24.0±0:16	1:19.0 ± 0:21	1:25.0±0:18	1:08.0 ± 0:14

Note. * significant difference in the test indicators values at the end of the research ($p < 0.05$)

Compared with the beginning at the end of the experimental project, a significant difference in the values of general physical fitness indicators was recorded in four out of five tests for EG girls and only in 1 test for SG girls, $p < 0.05$. It was found that the increase in the values of indicators in all tests was greater for EG girls compared with the increase in CG ones, Figure 1.

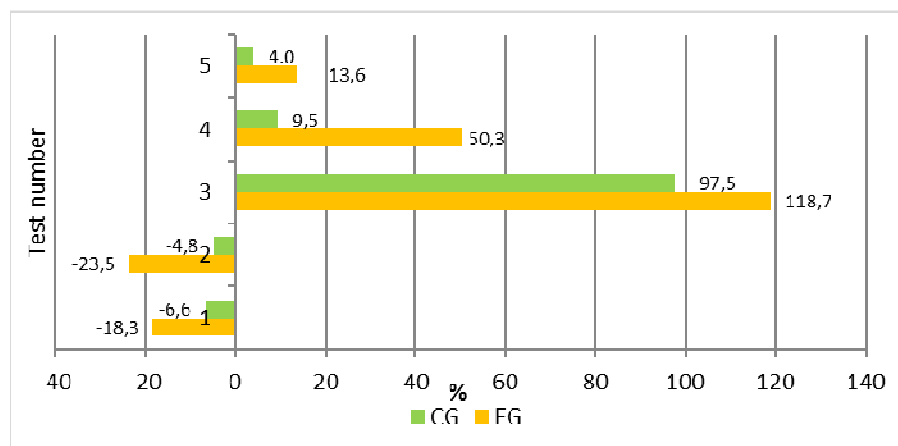


Fig. 1. The increase in the indicators values in the general physical fitness tests

The greatest increase in the indicators values was established in test No. 3 («Bend forward from a sitting position»), which characterizes the motor quality of «flexibility» (in CG by 97.5% and in EG by 118.7%). In tests No. 4 and No. 2, the increase in the indicators values of the for girls of the EG was 5.3 and 4.9 times greater than for girls of the CG. Additional physical exercises for girls of both groups had a positive effect on their level of coordination abilities at the end of the pilot project, Table 2.

Table 2. Values of high-stakes testing indicators of coordination abilities (M±m)

Tests	CG (n=15)		EG (n=15)	
	At the beginning of the project	At the end of the project	At the beginning of the project	At the end of the project
1. Three somersaults forward, s	5.4±0.67	4.9 ± 0.32	5.5±0.69	3.7 ± 0.26*
2. Standing on one leg with eyes closed, s	5.4±1.15	6.9 ± 1.24	5.5±1.16	9.7 ± 1.22*
3. Turns on a gymnastic bench, s	11.2±2.68	10.9 ± 2.29	11.5±2.44	9.0±2.07
4. Stepping over a gymnastic stick (5 times with the right; 5 times with the left foot), s	23.3±3.56	20.0±3.13	24.4±3.87	16.0±2.18*
5. Sprint in a given rhythm, m/s	1:27.0±0:08	1:17.0 ± 0:07	1:29.0±0:08	1:09.0 ± 0:06*

Note. * significant difference in the test indicators values at the end of the research ($p < 0.05$)

In all tests evaluating the coordination abilities of girls, a positive dynamics of the indicators values was established. Among EG girls, four out of five coordination tests showed a significant increase in the indicators values, $p < 0.05$. There was no significant increase in the indicators values among the CG girls in any test, $p \geq 0.05$. It was found that the increase in the values of indicators in all coordination tests was higher for girls in the EG, compared with CG, Figure 2.

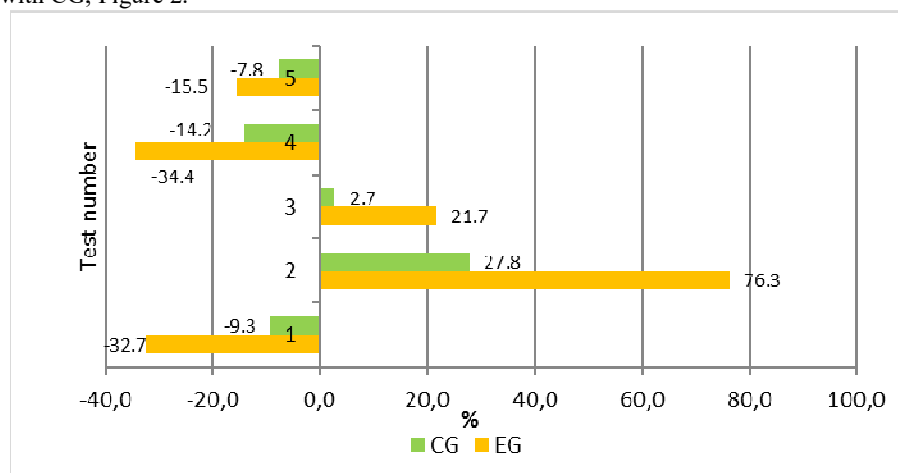


Fig. 2. The increase in the indicators values in the tests for coordination abilities in girls

The largest increase in the values of the indicators (76.3%) was noted in EG girls in test No. 2 («Standing on one leg with eyes closed»). The value of the indicator increase in this test turned out to be 2.7 times higher in girls who used the experimental program compared to CG girls. The increase in the indicators values of coordination abilities in EG girls, which exceeds 30%, was registered in test No. 4 («Stepping over a gymnastic stick», (5 times with the right; 5 times with the left foot), and in test No. 1 («Three somersaults forward»). The increase in the indicators values of coordination abilities in these tests in EG girls turned out to be 2.4 and 3.5 times higher, respectively, then in CG ones.

The conducted high-stakes testing of the girls' in both observation groups general physical fitness and coordination abilities made it possible to carry out an integral distribution of the number of girls by their physical fitness levels by the end of the project. Due to the fact that at the beginning of the experimental project, the indicators of girls' motor qualities practically did not differ, we present an analysis of the distribution of the number of girls by levels of general physical fitness and coordination abilities at the end of the observation, Figures 3 and 4.

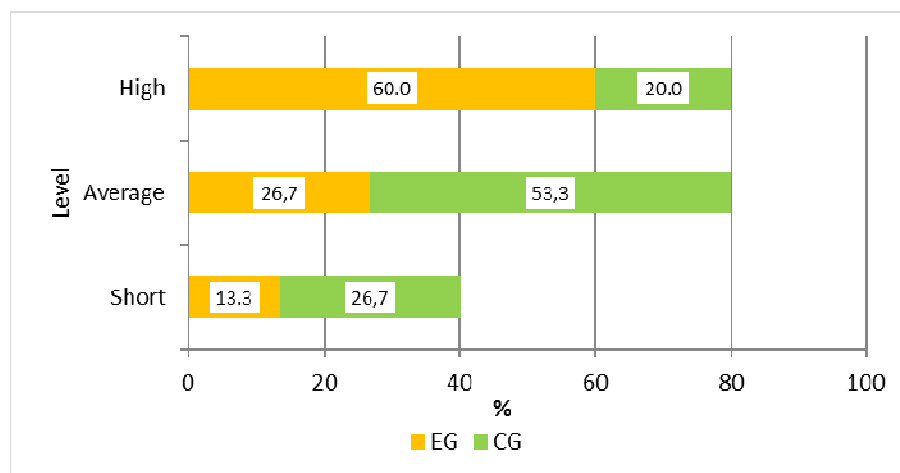


Fig. 3. Distribution of the number of girls CG and EG by general physical fitness levels

It was found that at the end of the project, more than 60.0% of EG girls were classified as «high» in general physical fitness, in CG there were 3 times fewer representatives of this level (20.0%). By the end of the project, the experimental group had 2 times fewer girls with «medium» and «low» levels of motor skills development compared to the control one. The distribution of CG and EG girls by levels of coordination abilities development is shown in Figure 4.

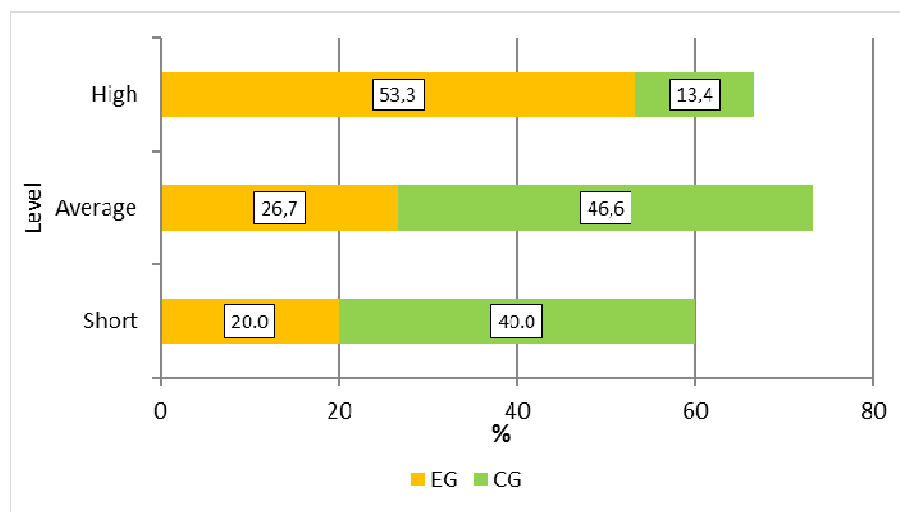


Fig. 4. The number of CG and EG girls according to the levels of the coordination abilities state

At the end of the project, it was found that in EG, the number of girls with a «high» level of coordination abilities development was 3.9 times more than representatives with the same level in CG. At the

same time, the number of girls with «medium» and «low» levels were higher among CG girls (46.6 and 40.0%, respectively) compared to the experimental group.

The EG girls' step aerobics classes have formed a strong motivation for everyone to continue their extracurricular activities. All the girls of this group decided to continue further health improving fitness classes. The results of our experimental project indicate that the training sessions conducted using step aerobics in the system of additional physical education turned out to be more effective for improving in 12-14-years-old girls basic motor qualities and coordination abilities development level than the method of conducting extracurricular classes according to a standard program for improving general physical training.

Dicussion

Improving the effectiveness of physical education tools and methods used in the educational process to improve children's, adolescents' and youth's physical health continues to be an urgent problem (Almonacid-Fierro, 2021; Hrehorowicz, 2021). It is due to low indicators of youth health (Chekhovskao et al., 2020; Tortella et al., 2021; Drenowatz, 2021; Tomas Reyes-Amigo, 2021). Their low motivation for physical activity is noted (Kuśnierz et al., 2020), due, among other things, to the still widespread use of traditional physical education technologies (Biino et al., 2020). The chosen topic of scientific research is aimed at finding ways to improve the educational and training process in the system of additional physical education and is aimed at developing the basic motor qualities and coordination abilities of girls aged 12-14. For this purpose, we have proposed and tested the «Step Aerobics» program during extracurricular physical training. A feature of the proposed program is a differentiated approach to the step aerobics use, depending on the level of general physical indicators and coordination abilities development of girls aged 12-14.

Our experimental project allowed us to establish the positive impact of step aerobics, which was included in the traditional general physical training program (Lyakh, 2021), on the development of basic motor qualities and coordination abilities in 12-14-years-old girls.

The study of the high-stakes state of motor qualities development demonstrated that by the end of the experimental project it showed a significant increase in the indicators values in almost all physical fitness tests for EG girls, in contrast to the CG ones, where a significant increase was noted in only one of the five tests. Compared with CG, a significant increase in the indicators values in EG girls was established in coordination skills. In some tests, the increase in the values of the indicators in EG girls turned out to be 2.4 - 3.5 times greater than in CG ones. In the test («Standing on one leg with eyes closed»), the value of the indicator increase was 2.7 times higher in girls who used an experimental program compared to CG ones. This test characterizes the state of body position (proprioception) and vestibular stability of the body and is key to the formation and improvement of other motor qualities of a person. This fact is indicated by studies conducted by a number of authors (Ştefan Alecu, Dragoş Ionescu – Bondoc, 2018; Montesano Pietro, Mazzeo Filomena, 2019), who proved a honestly significant influence of coordination on athletes' technical and tactical characteristics development.

The use of step aerobics in the educational and training process for the motor qualities education allowed by the end of the experiment to attribute 60.0% of EG girls to a «high» level of their development, while in CG only 20.0% were attributed to this level. The number of girls with a level of «high» coordination abilities development in EG was the largest and amounted to 53.3%.

In our opinion, the more significant results of improving motor qualities and coordination abilities can be explained by the use of a step platform in the educational and training process. This fact is indicated by the positive results of other researchers who conducted similar observations with various fitness equipment (Boloban et al., 2016; Kryzhevsky et al., 2020).

Our use of the step aerobics program among girls caused them to form a stable positive motivation to continue practicing this sport. In addition, an analysis of the results of 40 children's questionnaire survey showed that in three forms in which EG girls studied, 75.0% of respondents revealed a desire to start doing step aerobics outside of school hours, 25% expressed a desire to engage in other types of recreational aerobics – classical, fitball aerobics, aqua aerobics. It may indicate the positive development of motivation for physical culture and sports among the surrounding classmates and the high interest of girls in wellness fitness.

Conclusions

To increase the effectiveness in 12-14-years-old girls basic physical qualities and coordination abilities development in the system of additional physical education, a step aerobics program has been proposed, which is included in the traditional curriculum of general physical training. The program provides for the additional use of classes twice a week on a general educational curriculum and 1 time a week the use of special complexes of aerobic exercises performed on a step platform.

At the end of the project, a significant increase in the indicators values was found in almost all tests of physical fitness and coordination abilities in EG girls. In the CG, an honestly significant increase in the value of the indicator was noted only in one test. There was a significantly greater increase in the indicators values in motor and coordination tests compared with the control group. By the end of the experiment, it was found that

60.0% of EG girls were assigned to a «high» level of general physical fitness, in CG there were 3 times fewer representatives of this level (20.0%).

By the end of the project, the experimental group had 2 times fewer girls with «medium» and «low» levels of motor skills development compared to the control one. In EG, the number of girls with the level of coordination abilities development «high» was 3.9 times more than representatives with this level in CG.

Step aerobics is quite a popular type of wellness fitness in the educational space of middle school age students. In this regard, the introduction of this wellness area into regular and extracurricular forms of physical education in 12-14-years-old schoolchildren is quite relevant and timely.

Conflicts of interest. The authors declare no conflict of interest.

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