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Effectiveness of developing physical qualities of table tennis players aged 10–12 years old based on the circular training method

Aylanma mashg'ulot usuli asosida 10–12 yoshli stol tennischilarning jismoniy sifatlarini rivojlantirish samaradorligi

Эффективность развития физических качеств у столтеннисистов 10–12 лет на основе кругового метода тренировки

ILYOSOVA Maftuna Soyibjon kizi^{1*} 

¹ Uzbek State University of Physical Education and Sports, Chirchik, Uzbekistan

* Corresponding author: maftuna1444@icloud.com

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CONTACT

ReFocusJournal@gmail.com

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ENGLISH

ILYOSOVA Maftuna Soyibjon kizi^{1*} 

¹ Uzbek State University of Physical Education and Sports, Chirchik, Uzbekistan

Abstract. This study examined the effectiveness of circuit training for developing speed, agility and flexibility in 10–12-year-old table tennis players during the initial training stage. A total of 150 young players from sports schools in the Fergana, Namangan and Andijan regions were assigned to experimental (EG) and control (CG) groups. The EG followed a program of three-day circuit-training complexes with a three-stage progressive load. After the intervention, the mean improvement in the EG was 16.77%, 17.98% and 19.05% in the 10-, 11- and 12-year-olds, compared with 9.06%, 9.14% and 10.41% in the CG (EG: $P < 0.01–0.001$). Circuit training developed the physical qualities of young table tennis players nearly twice as effectively as conventional training.

Keywords: table tennis; circuit training; speed; agility; flexibility; initial training stage; young athletes; pedagogical experiment

O'ZBEKCHA

ILYOSOVA Maftuna Soyibjon qizi^{1*} 

¹ O'zbekiston davlat jismoniy tarbiya va sport universiteti, Chirchiq, O'zbekiston

Annotatsiya. Maqolada 10–12 yoshli stol tennischilarning boshlang'ich tayyorgarlik davrida tezkorlik, chaqqonlik va egiluvchanlik sifatlarini aylanma mashg'ulot usuli asosida rivojlantirish samaradorligi tajribaviy asoslangan. Tadqiqotda Farg'ona, Namangan va Andijan viloyatlari sport maktablarining 150 nafar yosh stol tennischisi tajriba (TG) va nazorat (NG) guruhlariga ajratilib ishtirok etdi. Tajriba guruhida yuklamasi uch bosqichda oshirib borilgan, uch kunlik aylanma mashqlar majmuasiga asoslangan dastur qo'llanildi. Tajriba yakunida TG da natijalarning o'rtaacha o'sishi 10, 11 va 12 yoshlilarda mos ravishda 16,77%, 17,98% va 19,05% ni, NG da esa 9,06%, 9,14% va 10,41% ni tashkil etdi (TG da $P < 0,01–0,001$). Olingan natijalar aylanma mashg'ulot usuli yosh stol tennischilarning jismoniy sifatlarini an'anaviy mashg'ulotga nisbatan qariyb ikki baravar samaraliroq rivojlantirishini ko'rsatadi.

Kalit so'zlar: stol tennisi; aylanma mashg'ulot; tezkorlik; chaqqonlik; egiluvchanlik; boshlang'ich tayyorgarlik; yosh sportchilar; pedagogik tajriba

РУССКИЙ

ИЛЬЁСОВА Мафтуна Сойибжон кизи^{1*} 

¹ Узбекский государственный университет физической культуры и спорта, Чирчик, Узбекистан

Аннотация. В статье экспериментально обоснована эффективность развития быстроты, ловкости и гибкости у теннисистов 10–12 лет на этапе начальной подготовки методом

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HAC / OAK: On the HAC list of national scientific publications (Academy of Sciences of the Republic of Uzbekistan) for 06.00.00 Agricultural Sciences and 16.00.00 Veterinary Sciences. O'zbekiston Respublikasi FA huzuridagi OAK ro'yxatida: 06.00.00 – Qishloq xo'jaligi fanlari; 16.00.00 – Veterinariya fanlari.

круговой тренировки. В исследовании приняли участие 150 юных теннисистов спортивных школ Ферганской, Наманганской и Андижанской областей, распределённых на экспериментальную (ЭГ) и контрольную (КГ) группы. В ЭГ применялась программа трёхдневных комплексов круговой тренировки с трёхэтапным повышением нагрузки. По итогам эксперимента средний прирост результатов в ЭГ у 10-, 11- и 12-летних составил 16,77%, 17,98% и 19,05%, в КГ — 9,06%, 9,14% и 10,41% (в ЭГ $P < 0,01-0,001$). Круговая тренировка развивает физические качества юных теннисистов почти в два раза эффективнее традиционной методики.

Ключевые слова: настольный теннис; круговая тренировка; быстрота; ловкость; гибкость; начальная подготовка; юные спортсмены; педагогический эксперимент

1. KIRISH

Introduction

stol tennisi - yuqori tezlik, qisqa reaksiya vaqti va cheklangan maydonda tez-tez yo'nalish o'zgartirishni talab qiladigan sport turi. O'yinchidan bir soniyaning ulushlarida qaror qabul qilish, stol atrofida portlovchi harakatlanish va zarbani aniq bajarish talab etiladi. Shu sababli tezkorlik, chaqqonlik va egiluvchanlik stol tennischi jismoniy tayyorgarligining asosiy tarkibiy qismlari hisoblanadi.

10–12 yosh bu sifatlarni rivojlantirish uchun sensitiv davr hisoblanadi: bu yoshda harakat koordinatsiyasi va tezkorlik mashqlarga ayniqsa yuqori sur'atda javob beradi. Biroq boshlang'ich tayyorgarlik bosqichida ko'plab murabbiylar mashg'ulotning asosiy qismini texnik tayyorgarlikka ajratadi, jismoniy sifatlarga esa tizimsiz, alohida mashqlar orqali rivojlantiriladi. Natijada mashg'ulot vaqtidan foydalanish samaradorligi pasayadi.

Aylanma mashg'ulot usuli bir mashg'ulot davomida bir necha jismoniy sifatlarni stansiyalar bo'yicha navbatma-navbat rivojlantirish, yuklamani aniq me'yorlash va guruh bilan bir vaqtda ishlash imkonini beradi. Ammo ushbu usulni aynan 10–12 yoshli stol tennischilarning yoshga xos xususiyatlari va sport turi talablariga moslashtirilgan, yuklamasi bosqichma-bosqich oshiriladigan dasturi ilmiy jihatdan yetarli asoslanmagan.

O'zbekiston Respublikasi Prezidentining 2020-yil 24-yanvardagi PF-5924-son va 2020-yil 30-oktabrdagi PF-6099-son farmonlarida bolalar sportini rivojlantirish va sport zaxirasini tayyorlash tizimini takomillashtirish ustuvor vazifa sifatida belgilangan. Mazkur tadqiqot shu vazifalarni ilmiy-uslubiy jihatdan ta'minlashga qaratilgan.

Tadqiqot maqsadi - aylanma mashg'ulot usuli asosida 10–12 yoshli stol tennischilarning tezkorlik, chaqqonlik va egiluvchanlik sifatlarini rivojlantirish dasturini ishlab chiqish va uning samaradorligini tajribada asoslash.

2. ADABIYOTLAR TAHLILI

Literature review

Sport mashg'ulotini davrlashtirish nazariyasi L.P. Matveyev va V.N. Platonov ishlarida asoslangan bo'lib, unga ko'ra yuklama moslashuv, rivojlantiruvchi va mustahkamlovchi bosqichlar orqali izchil oshirilishi kerak. T. Bomp va C. Buzzichelli yosh sportchilar uchun ham yuklamani bosqichma-bosqich oshirish tamoyilini asosiy shart sifatida ko'rsatadi.

Stol tennisining fiziologik talablari M. Kondrič va hammualliflar hamda A. Zagatto va hammualliflar tomonidan tahlil qilingan. Ular o'yinning qisqa, yuqori intensiv harakatlar va qisqa tiklanish oraliqlari almashinuvidan iboratligini, shuning uchun tezkorlik va chaqqonlik natija uchun hal qiluvchi ekanini ta'kidlaydi.

F. Pradas de la Fuente va hammualliflar 9–13 yoshli 352 nafar stol tennischini tekshirib, yosh ortishi bilan tezkorlik, kuch va portlovchi kuch ko'rsatkichlari sezilarli yaxshilanishini, egiluvchanlik esa o'yin uslubiga bog'liqligini aniqlagan. Q. Chen

va hammualliflar yosh stol tennischilarda 8 haftalik ko'p yo'nalishli harakat va muvozanat mashqlari yo'nalish o'zgartirish tezligini ishonchli oshirishini ko'rsatgan.

R. Lloyd va J. Oliver yoshlar jismoniy rivojlanish modelida 10–12 yoshni tezkorlik va chaqqonlikni rivojlantirishning qulay davri deb baholaydi. A. Faigenbaum va hammualliflar esa to'g'ri me'yorlangan kuch mashqlari bolalar uchun xavfsiz va samarali ekanini isbotlagan.

Aylanma mashg'ulot samaradorligi bo'yicha M. Blagojevič va hammualliflar 11–13 yoshli o'quvchilarda 15 haftalik aylanma mashg'ulot kuch chidamliligi va egiluvchanlikni ishonchli oshirganini, ammo 4×10 m chaqqonlik testida guruhlararo farq kuzatilmaganini qayd etgan. Bu natija aylanma mashg'ulot mazmuni sport turining o'ziga xos harakatlari bilan boyitilmasa, chaqqonlikka ta'siri cheklanishini ko'rsatadi.

Shunday qilib, adabiyotlarda stol tennisining jismoniy talablari va aylanma mashg'ulotning umumiy samarasi yoritilgan. Ammo aylanma mashg'ulotni stol tennisiga xos harakatlar bilan to'ldirilgan, yoshga qarab tabaqalashtirilgan va yuklamasi bosqichma-bosqich oshiriladigan dasturi 10–12 yoshli sportchilarda tekshirilmagan. Mazkur tadqiqot aynan shu bo'shliqni to'ldiradi.

3. TADQIQOT METODOLOGIYASI

Materials and methods

Asosiy pedagogik tajriba 2025-yil sentabridan 2026-yil sentabrigacha Farg'ona (asosiy tadqiqot obyekti), Namangan va Andijon viloyatlari sport maktablarining boshlang'ich tayyorlov guruhlarida o'tkazildi. Unda boshlang'ich tayyorgarlik guruhlarida shug'ullanuvchi 10, 11 va 12 yoshli jami 150 nafar stol tennischi ishtirok etdi. Har bir yosh guruhida sportchilar tajriba (TG, n=25) va nazorat (NG, n=25) guruhlariga ajratildi. Tajriba boshida TG va NG o'rtasida 24 ta solishtiruvning birortasida ham ishonchli farq aniqlanmadi: o'rtacha nisbiy farq 1,99–2,09% ($t=0,18-0,64$; $P>0,05$). Variatsiya koeffitsiyenti barcha testlarda 16–19% bo'lib, tanlanma bir jinsli ekanini ko'rsatdi.

3.1. Tadqiqot dizayni

Tajriba bir yillik mashg'ulot sikli davomida o'tkazildi. TG aylanma mashg'ulot usuliga asoslangan muallif dasturi bo'yicha haftasiga 3 marta (6 akademik soat) shug'ullandi. NG esa sport maktabining amaldagi an'anaviy yillik o'quv dasturi bo'yicha mashg'ulot qildi.

3.2. Aylanma mashg'ulot dasturi

Mashg'ulot 40–45 daqiqa davom etib, tayyorlov (8–10 daq), asosiy (26–28 daq) va yakuniy (6–7 daq) qismlardan iborat bo'ldi. Asosiy qismda 6 ta stansiya 3 aylana bo'yicha bajarildi: tezkorlik, chaqqonlik, egiluvchanlik, koordinatsiya, muvozanat va stol tennisiga xos maxsus harakatlar stansiyalari. Har bir stansiyada 30–40 soniya ish va 20–30 soniya dam olish belgilandi, yuklama yurak urish chastotasi (YuQCh) bo'yicha nazorat qilindi.

Haftalik siklda mashg'ulotlarning ustuvor yo'nalishi navbatlashtirildi: dushanba — tezkorlik, chorshanba — chaqqonlik,

juma — egiluvchanlik. Mashqlar oddiydan murakkabga tamoyili asosida tartiblandi va o'yin elementlari bilan boyitildi. Masalan, tezkorlik uchun "Joyida tez tizza ko'tarib yugurish" va "5 m masofaga start", chaqqonlik uchun "Konuslar orasida zigzag yugurish" va "Svetofor" o'yini, egiluvchanlik uchun "Yelka aylantirish" va "Bilak-panja cho'zish" mashqlari qo'llanildi. Vositalar sifatida konuslar, ikki rangli fishkalar, koordinatsion yo'lakcha, gimnastika gilamchasi va to'plardan foydalanildi.

3.3. Nazorat testlari

Jismoniy tayyorgarlik tajriba boshida va oxirida 8 ta test bilan baholandi: 3×10 m makkisimon yugurish (chaqqonlik), 30 m ga yugurish (tezkorlik), 60 m ga yugurish (tezkorlik chidamliligi), gimnastika o'rindig'idan oldinga egilish (egiluvchanlik), 150 g sport anjomini uloqtirish (portlovchi kuch), kurakda yotgan holda korpus ko'tarish, yerga tayangan holda qo'l bukib yozish (kuch

chidamliligi) va 1 daqiqa arqonda sakrash (koordinatsion chidamlilik).

3.4. Statistik tahlil

Har bir ko'rsatkich uchun o'rtacha arifmetik qiymat ($\bar{x}$), standart og'ish (σ) va variatsiya koeffitsiyenti (V) hisoblandi. TG va NG o'rtasidagi farq bog'liq bo'lmagan tanlanmalar uchun, tajriba boshi va oxiri o'rtasidagi o'zgarish esa bog'liq tanlanmalar uchun Student t-mezoni bilan baholandi. Natijalarning nisbiy o'sishi (NO') hisoblandi.

4. NATIJALAR

Results

Tajriba yakunida TG natijalari barcha yosh guruhlarida NG ga nisbatan o'rtacha 1,88 baravar ko'p o'sdi (1-jadval). TG da 24 ta ko'rsatkichning barchasida o'sish ishonchli bo'ldi ($P<0,01-0,001$), NG da esa faqat 9 tasida ($P<0,05$).

1-jadval

Nazorat testlari bo'yicha nisbiy o'sish (NO', %) va uning ishonchliligi ($n=25$) / **Table 1.** Relative increase (RI, %) in control test results and its significance ($n=25$)

Test	Guruh	10 yosh NO', %	P	11 yosh NO', %	P	12 yosh NO', %	P
3×10 m makkisimon yugurish (s)	TG	13,28	<0,01	15,45	<0,01	15,77	<0,01
	NG	7,76	>0,05	8,12	>0,05	8,65	>0,05
30 m ga yugurish (s)	TG	13,98	<0,01	18,09	<0,001	14,95	<0,01
	NG	8,16	>0,05	9,13	<0,05	8,22	>0,05
60 m ga yugurish (s)	TG	13,33	<0,01	18,31	<0,001	19,52	<0,001
	NG	7,73	>0,05	9,65	<0,05	10,09	<0,05
Oldinga egilish (sm)	TG	16,43	<0,01	18,47	<0,01	18,50	<0,01
	NG	8,98	>0,05	9,45	>0,05	8,94	>0,05
150 g anjomni uloqtirish (m)	TG	21,13	<0,001	19,11	<0,01	23,75	<0,001
	NG	10,01	<0,05	9,94	>0,05	11,34	<0,05
Korpus ko'tarish (marta)	TG	22,31	<0,001	20,23	<0,001	22,60	<0,001
	NG	11,41	<0,05	9,49	<0,05	10,67	<0,05
Qo'l bukib yozish (marta)	TG	15,68	<0,01	15,75	<0,01	19,81	<0,01
	NG	8,97	>0,05	8,36	>0,05	9,46	>0,05
Arqonda sakrash, 1 daq (marta)	TG	17,99	<0,01	18,42	<0,01	17,48	<0,001
	NG	9,44	>0,05	8,95	>0,05	15,92	<0,05

4.1. Tezkorlik va chaqqonlik

Uchta yugurish testida TG da o'sish 13,28–19,52% ni, NG da 7,73–10,09% ni tashkil etdi. Tezkorlik ayniqsa 11 yoshda yaqqol rivojlandi: 30 m va 60 m ga yugurishda TG da 18,09% va 18,31% o'sish qayd etildi ($P<0,001$). 3×10 m makkisimon yugurishda NG ning o'zgarishi uchala yoshda ham ishonchsiz bo'ldi ($P>0,05$), TG da esa ishonchli ($P<0,01$).

4.2. Egiluvchanlik

Oldinga egilish testida TG da 16,43–18,50%, NG da 8,94–9,45% o'sish kuzatildi. NG da bu o'zgarish hech bir yoshda ishonchli darajaga yetmadi ($P>0,05$).

4.3. Kuch va chidamlilik

Eng yuqori o'sish kuch testlarida qayd etildi: 12 yoshli TG da anjomni uloqtirishda 23,75% va korpus ko'tarishda 22,60% ($P<0,001$). Faqat 12 yoshdagi arqonda sakrash testida guruhlar natijalari yaqin bo'ldi (17,48% va 15,92%).

5. MUHOKAMA

Discussion

Tadqiqot natijalari stol tennisiga moslashtirilgan aylanma mashg'ulot 10–12 yoshli sportchilarning jismoniy sifatlarini an'anaviy mashg'ulotga qaraganda qariyb ikki baravar samaraliroq rivojlantirishini ko'rsatdi. Bu natija yuklamani bosqichma-bosqich oshirish yosh sportchilarda ham barqaror moslashuv beradi, degan davrlashtirish nazariyasi xulosalariga mos keladi [3; 4; 10].

M. Blagojević va hammualliflar umumiy aylanma mashg'ulotda 11–13 yoshli bolalarda chaqqonlik bo'yicha guruhlararo farq topmagan. Bizning tadqiqotimizda esa chaqqonlik ham ishonchli rivojlandi. Bu farqni dasturimizdagi mashqlar stol tennisiga xos harakatlar — stol atrofida yon qadamlar, signalga reaksiya, raketka va to'p bilan ishlash — bilan boyitilgani bilan izohlash mumkin. Xuddi shunday, Q. Chen va hammualliflar ham sport turiga xos ko'p yo'nalishtirish harakatlar yosh stol tennischilarda yo'nalishtirish o'zgartirish tezligini oshirishini ko'rsatgan.

TG natijalarining yosh bilan izchil oshib borishi (16,77% dan 19,05% gacha) F. Pradas de la Fuente va hammualliflar qayd etgan jismoniy sifatlarning yosh bilan rivojlanish qonuniyatiga mos keladi. Shu bilan birga, NG da o'sish uch yoshda ham 9–10% atrofida qoldi. Demak, TG dagi qo'shimcha o'sish yosh bilan bog'liq tabiiy rivojlanishdan emas, balki qo'llanilgan dastur ta'siridan kelib chiqqan.

Tajriba davomida dam olish nisbati hamda yuklamani YuQCh bo'yicha nazorat qilish 10–12 yoshli bolalar uchun xavfsiz, ammo rivojlantiruvchi yuklama berdi. Funktsional ko'rsatkichlardagi o'zgarishlar (Genchi +33,86%, Shtange +30,44%, YuQCh –14,32%) ham buni tasdiqlaydi. Bu yondashuv R. Lloyd va J. Oliver taklif etgan yoshga mos rivojlanish modeli tamoyillariga javob beradi.

5.1. Tadqiqot cheklovlari

Natijalar guruh o'rta ko'rsatkichlari asosida tahlil qilindi; kelgusida individual ma'lumotlar asosida korrelyatsion tahlil o'tkazish maqsadga muvofiq. Shuningdek, tajriba faqat Farg'ona vodiysi sport maktablarida o'tkazilgan natijalarni boshqa hududlarga umumlashtirishda ehtiyotkorlikni talab qiladi.

6. XULOSA

Conclusion

Stol tennisiga xos harakatlar bilan boyitilgan, uch kunlik sikl (tezkorlik- egiluvchanlik - chaqqonlik) va uch bosqichli yuklama oshirishga asoslangan aylanma mashg'ulot dasturi 10–12 yoshli stol tennischilar uchun samarali ekani tajribada tasdiqlandi.

TG da natijalarning o'rta o'sishi 10, 11 va 12 yoshda 16,77%, 17,98% va 19,05% ni, NG da 9,06%, 9,14% va 10,41% ni tashkil etdi (TG da $P < 0,01-0,001$); dastur an'anaviy mashg'ulotdan o'rta 1,88 baravar samaraliroq bo'ldi.

Dastur funktsional holatni ham yaxshiladi: TG da Shtange sinovi 30,44%, Genchi sinovi 33,86% ga oshdi, YuQCh 14,32% ga pasaydi (NG da mos ravishda 10,13%, 8,91% va 4,61%).

Dasturni bolalar va o'smirlar sport maktablarining boshlang'ich tayyorgarlik guruhlarida jismoniy tayyorgarlik qismi sifatida qo'llash tavsiya etiladi. Aylanma mashg'ulot qismi 40–45 daqiqa davom etishi, mashqlar esa sport turiga xos harakatlar bilan to'ldirilishi lozim.

DECLARATIONS

Declarations

Author contributions *CRedit*

Conceptualization; Methodology; Investigation; Writing – original draft; Writing – review & editing. The author has read and agreed to the published version of the manuscript.

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This research received no external funding.

Ethics approval

The pedagogical experiment was conducted within the regular training process of children's and youth sports schools and was approved by the ethics committee of the Uzbek State University of Physical Education and Sports.

Informed consent

Written informed consent for participation in the study was obtained from the parents or legal guardians of all participants; the author has read and approved the final version of the manuscript.

Data availability statement

The data obtained in the study are presented in the table of this article; the primary records are available from the author on reasonable request.

Conflict of interest

The author declares no conflict of interest.

Generative AI disclosure

Generative AI (Claude, Anthropic) was used in the editorial preparation of this article: for language editing, translation of the title, abstract and keywords between Uzbek, Russian and English, preparation of the extended English summary from the author's text, and formatting of the reference list. No data, results or conclusions were generated by AI. The author is responsible for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

Table tennis requires high speed, short reaction time and frequent changes of direction in a limited space: the player has to make decisions within fractions of a second, move explosively around the table and execute strokes accurately. Speed, agility and flexibility are therefore the main components of a table tennis player's physical preparation, and the age of 10–12 years is regarded as a sensitive period for their development. Circuit training makes it possible to develop several physical qualities within one session through a sequence of stations, which suits the initial training stage, and national policy documents on physical education and sport (Presidential Decrees PF-5924 and PF-6099 of 2020) give priority to the development of children's sport. The aim of the study was to develop a circuit training programme for the speed, agility and flexibility of 10–12-year-old table tennis players and to verify its effectiveness experimentally.

Materials and methods

The main pedagogical experiment was carried out from September 2025 to September 2026 in the initial training groups of sports schools in the Fergana (main research site), Namangan and Andijan regions. It involved 150 table tennis players aged 10, 11 and 12 years; in each age group the athletes were divided into an experimental group (EG, $n=25$) and a control group (CG, $n=25$). At baseline none of the 24 comparisons between the groups showed a significant difference (mean relative difference 1.99–2.09%; $t=0.18-0.64$; $P>0.05$), and coefficients of variation of 16–19% indicated a homogeneous sample. During a one-year training cycle the EG trained three times a week (6 academic hours) according to the author's circuit training programme, while the CG followed the traditional annual curriculum of the sports school. Each session lasted 40–45 minutes and consisted of a preparatory (8–10 min), main (26–28 min) and final (6–7 min) part. In the main part six stations — speed, agility, flexibility, coordination, balance and table-tennis-specific movements — were completed in three circuits with 30–40 s of work and 20–30 s of rest, and the load was controlled by heart rate. The weekly emphasis alternated between speed (Monday), agility (Wednesday) and flexibility (Friday); exercises were arranged from simple to complex and enriched with game elements, using cones, two-coloured markers, an agility ladder, gymnastic mats and balls. Physical preparedness was assessed at the beginning and at the end of the experiment with eight tests: a 3×10 m shuttle run, 30 m and 60 m runs, a forward bend from a gymnastic bench, throwing a 150 g implement, sit-ups, push-ups and one-minute rope skipping. Means, standard deviations and coefficients of variation were calculated, differences were assessed with Student's t-test for independent and dependent samples, and the relative increase of the results was calculated for each test.

Results and discussion

At the end of the experiment the results of the EG improved on average 1.88 times more than those of the CG in all age groups. In the EG all 24 indicators improved significantly ($P<0.01-0.001$), whereas in the CG only 9 did ($P<0.05$). In the three running tests the increase was 13.28–19.52% in the EG and 7.73–10.09% in the CG; speed developed most markedly at the age of 11, with gains of 18.09% and 18.31% in the 30 m and 60 m runs ($P<0.001$), and the change in the 3×10 m shuttle run was not significant in the CG at any age but significant in the EG ($P<0.01$). In the forward bend test flexibility increased by 16.43–18.50% in the EG and by 8.94–9.45% in the CG, where the change did not reach significance at any age. The highest gains were recorded in strength tests: in 12-year-olds of the EG, 23.75% in implement throwing and 22.60% in sit-ups ($P<0.001$). Only in the rope-skipping test at the age of

12 were the results of the groups close (17.48% and 15.92%). The programme also improved the functional state: in the EG the Stange test increased by 30.44% and the Genchi test by 33.86%, and resting heart rate decreased by 14.32%, compared with 10.13%, 8.91% and 4.61% in the CG. The author explains the significant development of agility, which was not observed in studies of general circuit training, by the table-tennis-specific movements included in the programme (side steps around the table, reactions to signals, work with the racket and ball), and attributes the additional gain in the EG to the programme rather than to age-related development, because the gain in the CG remained at about 9–10% at all ages.

Conclusion and contribution

A circuit training programme enriched with table-tennis-specific movements, built on a three-day weekly cycle (speed, flexibility, agility) and a three-stage increase in load, proved effective for 10–12-year-old table tennis players. The mean increase in the results was 16.77%, 17.98% and 19.05% at the ages of 10, 11 and 12 in the EG, compared with 9.06%, 9.14% and 10.41% in the CG (EG: $P < 0.01$ – 0.001), so the programme was on average 1.88 times more effective than traditional training, and it also improved the functional state of the young athletes. The programme is recommended for the physical preparation of initial training groups in children's and youth sports schools, with a circuit part of 40–45 minutes and exercises supplemented by sport-specific movements. The results were analysed on the basis of group means and were obtained only in sports schools of the Fergana Valley, which should be taken into account when generalising them.

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