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Tėvų vaidmuo skatinant krepšininkų motyvaciją sportuoti

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Santrauka

Tėvai, dalyvaudami vaikų sportinėje veikloje, atlieka svarbų vaidmenį, kuris lemia vaikų norą, motyvaciją bei sėkmę sporte. Sportas svarbus ne tik patiems sportininkams, bet įtraukia ir kitus svarbius dalyvius: tėvus, trenerius, teisėjus, komandos narius. Dabartiniu laikotarpiu vis dažniau dėmesys atkreipiamas į vaikų sportinę veiklą ir tėvų įtaką jaunuolių ugdymui. Pastebima tendencija, kad tėvų dalyvavimas vaikų sporte gali būti įvairus. Mokslininkų nuomone, tėvams svarbu suprasti, kad jaunajam sportininkui reikėtų leisti išbandyti kuo daugiau sporto šakų ir atrasti save, mėgautis sportu bei įgyti teigiamos patirties. Tačiau pastarųjų metų moksliniai tyrimai rodo, kad tėvų noras matyti savo atžalos sėkmę dažnai užgožia tai, kas išties yra svarbiausia vaikų sporte.

Straipsnio tikslas – atskleisti tėvų vaidmens svarbą skatinant paauglių (krepšininkų) motyvaciją sportuoti. Tyrimo uždaviniai: 1) atskleisti tėvų (mamos ir tėčio atskirai) vaidmens svarbą skatinant vaikų motyvaciją sportuoti, atsižvelgiant į sportininkų amžių; 2) atskleisti tėvų (mamos ir tėčio atskirai) vaidmens svarbą skatinant vaikų motyvaciją sportuoti, atsižvelgiant į krepšininkų sportinį meistriškumą. Tyrimo metodai: kiekybinis tyrimas (anketinė apklausa). Tyrimo dalyviai: 75 krepšininkai – 15–16 ir 17–18 m. paaugliai.

Tyrimo rezultatai atskleidė, kad mamos ir tėčio įsitraukimas į krepšininkų sportinę veiklą yra svarbus pagal visas tėvų įsitraukimo vertinimo skales. Tačiau savarankiškumo palaikymo (paramos) skalėje mamos vaidmuo yra stipresnis ir svarbesnis jaunesniems, t. y. 15–16 m., nei 17–18 m. krepšininkams. Tyrimo rezultatai taip pat atskleidė, kad didesnę sportinę patirtį turintys krepšininkai jaučia didesnį tėčio įsitraukimą nei mamos. Ilgesnę treniruočių ir varžybinę patirtį turintys krepšininkai pažymi didesnį tėčio palaikymą ir daromą įtaką jų karjerai.

Raktažodžiai: *sportinė veikla, tėvai, mama, tėtis, krepšininkai, motyvacija.*

Įvadas

Sportas užima svarbią vietą daugelio vaikų gyvenime. Sportas svarbus ne tik patiems sportininkams, sportas įtraukia ir kitus svarbius dalyvius: tėvus, trenerius, teisėjus, komandos narius. Dabartiniu laikotarpiu vis dažniau dėmesys atkreipiamas į vaikų sportinę veiklą ir tėvų įtaką jaunuolių ugdymui (Lisinskienė, 2016; Holt, Knight, 2014). Kiekvieno tėčio ir mamos pagrindinis tikslas – išauginti dorą, sveiką, aktyvų vaiką, leisti ir padėti jam pažinti savo asmenybę. Sportas – vienas iš didžiausių faktorių, kuris skatina vaikus ir tėvus domėtis įvairia fizine veikla, padedančia vaikui ugdytis kaip asmenybei, stiprėti fiziškai, skatinti organizmą visavertiškai vystytis. Pastebima tendencija, kad tėvų dalyvavimas vaikų sporte gali būti įvairus (Dorsch, Smith, McDonough, 2009). Vis dažniau išsakoma nuomonė, kad tėvų vaidmuo vaikų sporte gali būti probleminis: nekultūringas tėvų elgesys varžybų metu ir po jų, per didelis tėvų įsitraukimas į vaikų sportą, psichologinis spaudimas vaikams, netaktiškas elgesys su treneriais, teisėjais ir kitais dalyviais. Visa tai turi neigiamos įtakos jaunojo sportininko motyvacijai sportuoti (Holt, Tamminen, Black et al., 2009). Kita vertus, reikėtų atkreipti dėmesį į tai, kad tėvai mano, jog elgiasi teisingai, norėdami padėti savo vaikui, ir toks jų įsitraukimas yra pozityvus ir palaikantis. Moksliniai tyrimai rodo (Lisinskienė, Šukys, 2016; Singh, 2006), kad tėvai, stokodami edukologinių, psichologinių ir kitų žinių, ne visuomet elgiasi tinkamai. Mokslininkų teigimu (Singh, 2006; Lisinskienė, Šukys, 2014), tėvams svarbu suprasti, kad jaunam sportininkui reikėtų leisti išbandyti kuo daugiau sporto šakų ir atrasti save, mėgautis sportu bei suteikti teigiamos patirties. Tačiau pastarųjų metų moksliniai tyrimai rodo, kad tėvų noras matyti savo atžalos sėkmę dažnai užgožia tai, kas išties yra svarbiausia vaikų sporte.

Tėvų misija yra sudominti vaiką veikla, kurioje nuolat dalyvaudami jie ugdosi pasitikėjimą savimi, gebėjimą spręsti kylančias problemas, siekti tikslo, skiepijamos vertybės (Lisinskienė, Šukys, 2014).

Dabartiniu laikotarpiu jau priešmokyklinio ugdymo amžiaus vaikai turi daug galimybių pasirinkti norimą sporto šaką: krepšinį, futbolą, gimnastiką, ledo ritulį ir kt. Dauguma tėvų siekia atrasti vaikų pašaukimą, leidžia aktyviam laisvalaikiui pasirinkti sporto ir kitas asmenybę ugdančias veiklas. Tyrimai rodo, kad sportinė veikla viena populiariausių popamokinių veiklų mokykloje (Lisinskienė, 2016). Pažymėtina ir tai, kad sportas padeda vaikui ne tik stiprėti fiziškai, bet ir suprasti, atpažinti ir ugdyti save kaip asmenybę, suartina šeimas, sustiprina tėvų ir vaikų tarpusavio santykius (Lisinskienė, 2016).

Tėvai, dalyvaudami vaikų sportinėje veikloje, atlieka svarbų vaidmenį, lemiantį vaikų norą sportuoti ir sėkmę. Tačiau tėvų požiūris turi būti atsargus ir atsakingas, nes jų įtaka vaiko sportinei veiklai gali turėti tiek neigiamą, tiek teigiamą poveikį. P. McCathy'io ir kt. (2008) atliktas vaikų dalyvavimo sportinėje veikloje tyrimas atskleidė pozityvų tėvų įsitraukimą. Mokslininkai padarė išvadą, kad tokie vaikai bus motyvuotesni, mėgausis savo sportine veikla ir, tikėtina, sieks pasirinktos sporto šakos sportinių rezultatų. Be to, kalbant apie vaiko vystymąsi, tėvų dalyvavimas gali prisidėti ugdant svarbius vaiko asmenybės bruožus: motyvaciją, savigarbą, socialinius, emocinius įgūdžius (McCathy, Jones, Clark-Carter, 2008). Ypač akcentuotinas vaiko skatinimas būti savarankiškam, kūrybingam, iniciatyviam, remtis įgūdžiais, kuriuos įgijo. Tai ypač sustiprina pasitikėjimą ir palengvina kitas gyvenimo situacijas.

Daugelis autorių pripažįsta, kad į motyvacijos sportuoti klausimus, neatsižvelgiant į tai, kad praktiškai juos bandoma pritaikyti jau seniai, nėra pakankamai atsakymų. Motyvaciją sportuoti tyrė daugelis mokslininkų (Deci, Ryan, 1985; Gibson, Fosters, 2002; Malinauskas, 2003; Razmaitė, Grajauskas, 2012). Jau ne vienus metus mokslininkus domina tai, kas skatina žmogų imtis vienokios ar kitokios veiklos, kas nukreipia jo aktyvumą. Šiuo tyrimu siekta išsiaiškinti, kaip tėvų vaidmuo galėtų prisidėti prie sportininkų motyvacijos didinimo. Taigi, keliamas probleminis klausimas – koks yra tėvų vaidmuo skatinant sportininkų, t. y. krepšininkų, motyvaciją sportuoti. Paminėtina ir tai, kad šiuo tyrimu siekta atskirai atskleisti tėčio ir mamos vaidmenį, nes iki šiol mokslinėje literatūroje, ypač šalies kontekste, tokių tyrimų pasigendama. Remiantis išsikeltais probleminiais klausimais, formuluojamas toks tikslas – atskleisti tėvų vaidmens svarbą paauglių krepšininkų (15–18 m.) motyvacijai sportuoti.

Tyrimo metodai

Kiekybinis tyrimas: anketinė apklausa. Tyrimui atlikti buvo naudotas Tėvų vaidmens nustatymo klausimynas (POPS) (Deci, Ryan, 1994). Šio tyrimo pagrindu siekiama validuoti E. L. Deci ir R. M. Ryan (1994) sukurtą klausimyną, adaptuotą Lietuvai. Klausimynu siekta įvertinti vaikų suvokimą apie jų tėvų palaikymą ir įtaką sportininkų įgyjamai sportinei patirčiai. Klausimynas skirtas paaugliams ir jį sudaro 42 teiginiai: 21 teiginys apie mamą ir 21 apie tėtį. Pagal šiuos klausimus suformuotos 6 subskalės: mamos palaikymas, mamos įtaka ir rūpestis bei nuoširdumas, taip pat ir tėvo palaikymas, tėvo įtaka ir jo rūpestis ir nuoširdumas. Atsakydami į kiekvieną teiginį, tiriamieji turėjo pasirinkti atsakymo variantus pagal septynių pakopų Likerto skalę su rangais 1, 2, 3, 4, 5, 6, 7 – nuo „visiškai neteisinga" (1) ir „vidutiniškai teisinga" (5) iki „labai teisinga" (7). Prieš apklausą respondentai supažindinti su tyrimo tikslu, uždaviniais ir garantuotas jų atsakymų anonimiškumas.

Sporto mokyklų mokinių motyvacijai tirti buvo naudota Lietuvoje aprobuota (Grajauskas, 2008) Sporto motyvacijos skalė (Pelletier et al., 1995). Sporto motyvacijos skalę sudaro 28 teiginiai, suskirstyti po keturis į 7 subskales: vidinės motyvacijos – sužinoti; vidinės motyvacijos – siekti tobulumo; vidinės motyvacijos – patirti; išorinės motyvacijos – identifikuotis, susitapatinti; išorinės motyvacijos – nesąmoningai priimtas išorinis reguliavimas; išorinės motyvacijos – tiesioginis išorinis reguliavimas; nemotyvuotumas (nei išorinių, nei vidinių motyvų nebuvimas). Atsakydami į kiekvieną teiginį, tiriamieji turėjo pasirinkti atsakymo variantus pagal penkių pakopų Likerto skalę su rangais 1, 2, 3, 4, 5 – nuo „visiškai su teiginiu nesutinku" (1) iki „visiškai su teiginiu sutinku" (5). Prieš apklausą respondentai supažindinti su tyrimo tikslu, uždaviniais ir garantuotas jų atsakymų anonimiškumas.

Sportininkų sportavimo stažas buvo nustatytas pateikiant atvirąjį klausimą: „Kiek metų lankote krepšinio sporto šakos treniruotes?".

Tyrimo dalyviai. Tiriamųjų imtį sudarė 75 sportininkai – Vilniaus krepšinio ir Sostinės krepšinio mokyklų 15–18 m. krepšininkai. Didžiausią dalį apklaustųjų sudarė 16 m. krepšininkai (28 %), 15 m. sportininkai – 21,33 %, vyriausi (18 m.) apklaustieji – 16 % ir 17 bei 14 m. krepšininkai – po lygiai, po 17,33 %. Net 84 % apklaustųjų turi 7 metų ir didesnę patirtį, o 16 % turi 6 metų ir mažesnę krepšinio sporto šakos treniruočių ir varžybų patirtį.

Matematinė statistika. Siekiant nustatyti motyvacijos ypatumus pagal subskales, buvo apskaičiuoti: subskalių teiginių sumos aritmetiniai vidurkiai, tiriamųjų požymių reikšmių sklaidos apibūdinimui iliustruoti – vidutiniai kvadratiniai nuokrypiai (SD), skirtumų patikimumui tarp lyčių, sportiniam meistriškumui, amžiui nustatyti buvo taikytas Stjudento (angl. *Student*) t kriterijus nepriklausomoms imtims. Statistinė tyrimo duomenų analizė atlikta naudojantis SPSS 21 versijos programa. Statistiniai metodai (standartinis vidurkis, standartinis nuokrypis) taikyti atliekant tyrimo duomenų statistinį įvertinimą, vadovaujantis reikšmingumo lygmenimis. Atlikta Spirmeno (angl. *Spearmen*) koreliacinė analizė. Siekiant palyginti respondentų atsakymus pagal amžių ir sportinį stažą, buvo naudotas dviejų nepriklausomų imčių T testas bei neparametrinis Mano ir Vitnio (angl. *Mann-Whitney*) U testas. Tiek T testas, tiek Mano ir Vitnio U testas naudojamas tam pačiam tikslui – palyginti dviejų nepriklausomų imčių skalės atsakymus ir nustatyti, ar dviejų grupių duomenys statistiškai reikšmingai skiriasi. Tačiau T testas naudojamas ir yra tikslus tada, kai skalės yra arti normaliojo skirstinio arba kai yra nemažas respondentų kiekis. Jei respondentų nedaug ir skalės yra nenormalios ir asimetriškos, tuomet reikia naudoti neparametrinį Mano ir Vitnio U testą, kuris palygina ne vidurkius, o vidutinius rangus.

Tyrimo rezultatai

Tyrimo rezultatai pateikti l, 2 ir 3 lentelėse. 1 lentelėje pateikti tyrimo rezultatai tėvų vaidmens (mamos ir tėčio atskirai) svarba sportininkų (krepšininkų) motyvacijai sportuoti pagal sportininkų amžių. 2 lentelėje pateikti tėvų vaidmens svarbos rezultatai, atsižvelgiant į krepšininkų sportinį stažą. 3 lentelėje pateikta koreliacinė analizė ir siekiama išsiaiškinti tėvų vaidmens svarbą krepšininkų motyvacijai sportuoti. Tiriamieji pagal amžių ir sportinį stažą suskirstyti į 2 grupes: atitinkamai pagal amžių 15–16 ir 17–18 m. sportininkai bei sportinį stažą iki 6 m. ir 7 m. ir daugiau.

1 lentelė

Tėvų vaidmens svarba krepšininkų motyvacijai sportuoti pagal sportininkų amžių

Subskalės	Respondentų amžius				T testo p reikšmė	Mano ir Vitnio U testo p reikšmė
	15–16 m. (N = 50)		17–18 m. (N = 25)			
	Vidurkis	SN	Vidurkis	SN		
VM_sužinoti	4,19	0,628	4,11	0,826	0,663	0,945
VM_patirti	4,22	0,584	4,24	0,436	0,880	0,820
VM_siekti	4,28	0,584	4,23	0,718	0,747	0,986
IM_susitapatinti	3,62	0,625	3,79	0,648	0,263	0,344
IM_nesąmoningas IR	4,02	0,571	4,01	0,663	0,946	0,794
IM_tiesioginis IR	3,34	0,829	3,27	0,699	0,738	0,718
Nemotyvuotumas	1,77	0,733	1,90	0,933	0,495	0,612
Vidinė_motyvacija	4,23	0,563	4,19	0,604	0,805	0,809
Išorinė_motyvacija	3,66	0,557	3,69	0,477	0,799	0,748
M_įsitraukimas (įtaka)	4,26	0,611	4,02	0,415	0,077	0,080
M_savarankiškumo palaikymas (parama)	5,30	0,566	4,98	0,541	0,025	0,029
M_ rūpestis ir nuoširdumas	4,68	0,444	4,55	0,587	0,288	0,582
T_įsitraukimas (įtaka)	4,21	0,771	4,13	0,436	0,636	0,244
T_savarankiškumo palaikymas (parama)	5,22	0,805	5,05	0,868	0,432	0,639
T_ rūpestis ir nuoširdumas	4,58	0,745	4,41	0,711	0,339	0,342

Pastaba: VM – vidinė motyvacija, IM – išorinė motyvacija, IR – išorinis ryšys, M – mama, T – tėtis.

Pagal gautas rezultatus 2 lentelėje matyti, kad tėčio ir mamos reikšmė abiejų grupių krepšininkams iki 16 m. ir 17–18 m. yra vienoda, tačiau mamos paramos skalėje matyti jaunesnių tyrimo dalyvių, kuriems yra iki 16 metų, aukštesni įverčiai (abiejų testų $p < 0,05$).

2 lentelė

Tėvų vaidmens svarba krepšininkų motyvacijai sportuoti pagal sportininkų sportinę patirtį

Subskalės	Sportinis stažas				T testo p reikšmė	Mano ir Vitnio U testo p reikšmė
	iki 6 m. (N = 24)		7 ir daugiau m. (N = 51)			
	Vidurkis	*SN*	*Vidurkis*	*SN*		
VM_sužinoti	4,22	0,485	4,13	0,778	0,559	0,845
VM_patirti	4,25	0,489	4,22	0,561	0,798	0,752
VM_siekti	4,29	0,535	4,25	0,671	0,79	0,940
IM_susitapatinti	3,55	0,599	3,73	0,648	0,259	0,150
IM_nesamoningas IR	4,00	0,516	4,02	0,639	0,87	0,701
IM_tiesioginis IR	3,15	0,847	3,39	0,749	0,207	0,233
Amotivacija	1,79	0,740	1,82	0,835	0,893	0,927
Vidinė_motyvacija	4,25	0,469	4,20	0,619	0,677	0,759
Išorinė_motyvacija	3,57	0,504	3,72	0,538	0,256	0,267
M_įsitraukimas (įtaka)	4,09	0,426	4,23	0,615	0,335	0,525
M_savarankiškumo palaikymas (parama)	5,32	0,538	5,13	0,586	0,186	0,182
M_rūpestis ir nuoširdumas	4,65	0,377	4,63	0,547	0,88	0,680
T_įsitraukimas (įtaka)	4,01	0,555	4,27	0,711	0,141	0,008
T_savarankiškumo palaikymas (parama)	5,36	0,520	5,07	0,924	0,163	0,208
T_ rūpestis ir nuoširdumas	4,64	0,459	4,46	0,829	0,235	0,498

Pastaba: VM – vidinė motyvacija, IM – išorinė motyvacija, IR – išorinis ryšys, M – mama, T – tėtis

Pagal Mano ir Vitnio U testo rezultatus didesnį sportinį stažą turintys krepšininkai įvertino tėčio įtaką kaip stipresnę nei krepšininkai, kurių sportavimo stažas iki 7 m. ($p = 0,008$). Nors T testas tokio reikšmingo rezultato neparodė, tikslesnis šiuo atveju laikomas Mano ir Vitnio U testo rezultatas, nes tėčio įtakos skalė buvo asimetriška ir neatitiko normalumo kriterijų. Kitų subskalių statistiškai reikšmingo skirtumo tarp didesnio ar mažesnio sportinio stažo krepšininkų nebuvo rasta.

4 lentelėje pateikti sportininkų motyvacijos ir tėvų vaidmens koreliacinės analizės rezultatai. Mamos ir tėčio įtakos ir sportininkų motyvacijos skalės statistiškai reikšmingai nekoreliuoja, išskyrus mamos įsitraukimo kaip išorinės krepšininkų (IM) motyvacijos įverčius, kur rasta silpna teigiama koreliacija 0,229. Tiek mamos, tiek tėčio savarankiškumo palaikymas turi teigiamos įtakos vidinei krepšininkų motyvacijai bei išorinės motyvacijos susitapatinimo subskalei. Be to, tik tėčio savarankiškumo palaikymas turi teigiamos įtakos išorinės motyvacijos nesąmoningumo subskalei ir bendrai išorinei motyvacijai. Tiek tėčio, tiek mamos subskalių įvertis „rūpestis ir nuoširdumas“ (angl. *warmth*) turi teigiamos įtakos vidinei ir išorinei motyvacijai bei jų subskalėms, išskyrus IM nesamoningas IR. Tarp nemotyvuotumo subskalės ir tėvų vaidmens nebuvo rasta statistiškai reikšmingo koreliacinio ryšio.

3 lentelė

Mamos ir tėčio įsitraukimo į sportininko veiklą ir sportininkų motyvacijos koreliacinė analizė

	Įsitraukimas (įtaka)		Savarankiškumo palaikymas (parama)		Rūpestis ir nuoširdumas	
	Mama	**Tėtis**	**Mama**	**Tėtis**	**Mama**	**Tėtis**
VM sužinoti	,005	,033	,241*	,267*	,300**	,266*
VM patirti	–,040	,017	,254*	,321*	,366**	,305**
VM siekti	–,043	–,070	,261*	,270*	,366**	,269*
IM susitapatinti	,086	,104	,243*	,299*	,296**	,364**
IM nesąmoningas IR	–,170	–,169	,220	,282*	,226	,209
IM tiesioginis IR	,229*	,181	,096	,160	,371**	,345**
Nemotyvuotumas	,089	,141	–,121	–,175	–,164	–,224
Vidinė motyvacija	–,022	,005	,272*	,303**	,360**	,301*
Išorinė motyvacija	,099	,095	,217	,287*	,372**	,388**

Pastaba: * – $p < 0,05$. ** – $p < 0,01$.

Tyrimo rezultatų aptarimas

Šio tyrimo metu nagrinėta, kokį vaidmenį atlieka tėvai paauglių krepšininkų motyvacijai sportuoti. Pirmiausia analizuoti demografiniai duomenys: krepšininkų pasiskirstymas pagal amžių. Didžiausią dalį apklaustųjų sudarė šešiolikmečiai. Išsiaiškinus respondentų procentinį pasiskirstymą pagal amžių, sudarytos dvi amžiaus grupės: krepšininkai iki 16 m. ir 17–18 m. sportininkai. Atliekant tyrimą pirmiausia siekta nustatyti tėvų vaidmenį motyvuojant sportuoti pagal tiriamųjų paskirstymą į dvi amžiaus grupes. Gauti rezultatai parodė, kad tiek pirmai grupei iki 16 m., tiek antrai – 17–18 m. krepšininkams – tėčio ir mamos reikšmė yra vienoda, išskyrus mamos savarankiškumo (paramos) skalės įverčius, kurie didesni yra jaunesnių sportininkų. Tai patvirtina ir kitų tyrėjų (Kaye et al., 2015) duomenys, kad jaunesnio amžiaus paauglių prieraišumas prie tėvų buvo daug didesnis nei vyresnių paauglių. Kitų tyrėjų (Šniras, Bakanauskas, 2016) duomenimis, 17–18 m. jauniai krepšininkai geriau vertina kai kuriuos varžybinius socialinius psichologinius įgūdžius nei jaunučiai. Apibendrinus atsakymus, kiek tyrimo dalyviams yra svarbus tėčio ir mamos palaikymas, palyginti pagal amžių, rezultatas yra logiškas. Jaunesni krepšininkai turi mažiau patirties ir gyvenimiškų įgūdžių, todėl, kaip parodo ir rezultatai, mama teikia didesnę paramą ir motyvuoja jaunesnius krepšininkus.

Nustatant tėvų vaidmenį motyvuojant krepšininkus sportuoti, tiriamieji pagal demografinius duomenis ir turimą patirtį suskirstyti į dvi grupes. Didesnę respondentų dalį sudarė 7 m. ir daugiau sportinę patirtį turintieji. Kitos grupės tiriamųjų sportinis stažas 6 m. ir mažiau. Tiriant, koks tėvų vaidmuo motyvuojant krepšininkus sportuoti, rezultatai parodė, jog tiek pirmajai grupei (7 m. ir daugiau), tiek antrajai grupei (6 m. ir mažiau) tėčio ir mamos vaidmuo motyvuojant sportuoti yra vienodas. Tačiau tenka pastebėti, tai kad tėčio įsitraukimas svarbesnis daugiau sportinės patirties turintiems krepšininkams negu mažesnę patirtį turintiems krepšininkams. Remiantis kito tyrimo (Malinauskas, 2008) duomenimis, 18–24 m. žaidžiančius krepšinį studentus siekti sportininko karjeros ir būti pripažintiems visuomenėje skatina išoriniai motyvai. Todėl galima teigti, kad ilgiau sportuojančių krepšininkų ir jų tėvų įtaka turi sąsają su didesnio rezultato ir sportininko karjeros siekimu ateityje, negu vėliau pradėjusių sportuoti krepšininkų.

Taip pat buvo analizuojamas mamos ir tėčio įsitraukimas į sportininko veiklą ir kokią tai turi įtaką motyvacijai sportuoti. Tiek mamos, tiek tėčio vaiko savarankiškumo palaikymas turi teigiamos įtakos vidinei motyvacijai ir jos subskalėms bei išorinės motyvacijos susitapatinimo subskalei. Tiek tėčio, tiek mamos rūpestis ir nuoširdumas turi teigiamos įtakos vidinei ir išorinei motyvacijai bei jų subskalėms, išskyrus išorinės motyvacijos nesąmoningam išoriniam reguliavimui. Šiltų santykių ir motyvacijos ryšys buvo stipriausi. Iš respondentų atsakymų matyti, kad tiek mama, tiek tėtis neturi amotyva-

cinių siekių savo vaikams ir tuo klausimu nebuvo rasta nė vieno reikšmingo ryšio. Mamos parama yra didesnė jaunesnio amžiaus krepšininkams, tačiau tobulėjant ir kylant į aukštesnį lygį, tėčio įtaka tampa svarbi priimant svarbius sprendimus tiek krepšininko karjeros klausimais, tiek gyvenime. Mokslininkų atlikti tyrimai patvirtina, kad yra reikalingas nuolatinis ir nenutrūkstamas tėvų domėjimasis ir įsitraukimas į vaiko sportinį gyvenimą (Dorsch et al., 2009). Galima teigti, kad tiek mamos, tiek tėčio įsitraukimas į krepšininkų sportinį gyvenimą yra svarbus.

Tyrimo rezultatai rodo, kad aukšto meistriškumo krepšininkai pagal savo amžių jaučia tiek mamos, tiek tėčio palaikymą sportinėje veikloje ir tai leidžia paaugliams dominuoti savo amžiaus grupėse. Remiantis tyrimais atskleista, kad tėvai turi įtakos motyvuojant savo vaikus sportinei veiklai (McCarthy, Jones, 2007; Bowker et al., 2009; Sanchez-Miguel et al., 2013).

Išvados

Tyrimas atskleidė, kad abiejų amžiaus grupių (15–16 ir 17–18 m.) krepšininkų tiek mamos ir tiek tėčio svarba ryški visose skalėse. Tačiau pagal savarankiškumo palaikymo (paramos) skalę mamos vaidmuo yra stipresnis ir svarbesnis jaunesniems, o ne 17–18 m. sportininkams. Didesnę sportinę patirtį turintiems krepšininkams (7 m. ir daugiau) tėčio įtaką (įsitraukimas) yra didesnė negu krepšininkų, kurie sportuoja 6 m. ir mažiau. Ilgesnę treniruočių ir varžybų patirtį turintiems krepšininkams tėčio palaikymas ir daroma įtaka jų karjerai yra didesnė.

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THE ROLE OF PARENTS IN MOTIVATING ADOLESCENTS BASKETBALL PLAYERS IN SPORT

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SUMMARY

Sport plays an important role in the lives of many children. Sport is important not only for the athletes themselves, but also includes other important participants: parents, coaches, referees, teammates. However, in the current period more attention is being paid to children's sports activities and the influence of parents on the education of young athletes. There is a tendency to note that parental involvement in children's sports can be diverse.

As the researchers highlight, it is important for parents to understand that they should show the young athlete as many as possible ways, to introduce to different sports so that the young athlete later could find himself/herself, to enjoy sport and to have positive experiences. However, resent research shows that parents' desire to see their offspring succeeding, and parents often forget what really matters in children's sport. Therefore, the role of parents in motivating adolescent basketball players in sports is the object of this research. The tasks of the study is to reveal the importance of parents' (mothers and fathers separately) role in motivating basketball players (15–18 years of age), regarding of the athletes age; and to reveal the importance of parents' (mothers and fathers separately) role of motivating basketball players regarding athletes experience in their career.

The following research methods are used: Analysis of the scientific literature; Quantitative study: Questionnaire; Mathematical statistics methods. Basketball players of two basketball schools (n = 75) participated in the questionnaire survey.

The results of this study have demonstrated that mother's and father's role is important in both age groups (15–16 years old and 17–18 years old). In autonomy support range (scale) mother's role is stronger and more important for younger players than in group of 17–18 years old athletes. Basketball players with more experience (7 years or more) have bigger father's involvement than players with less experience (6 years and less). With bigger and longer experience in training and competitions basketball players have stronger father's involvement and support in their careers.

Keywords: parents, mother, father, adolescents, basketball players, motivation.

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Individual characteristics of players' ability to anticipate

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Summary

Today Kazakhstan is known as an independent and rapidly developing country. A certain contribution to this has been made by sports and, in particular, by football. The current state of football in the republic is due to its socio-economic development. Modern football involves the manifestation of high-level footballers of special working capacity that consists of several components, in the first place, technical and tactical skills.

The goal of the work is to determine the individual characteristics of the players' anticipation in terms of their abilities to predict the opportunities successfully to perform motor actions with the ball and without the ball.

The players of the team, participating in the Championship of the country, were examined for the study. The accuracy of the subjective prediction of tested players (field players, n = 11) was considered under three levels of anticipation: sensorimotor, perceptive, and representative.

Evaluation of individual types of subjective prediction of players, participating in the research, under the three levels of anticipation showed the following: at the sensorimotor level of anticipation, players with a fairly high degree of accuracy predict their capabilities, and the differences in individual indicators are very small; at the perceptive level of anticipation, there are, on the one hand, a reassessment of their capabilities, and, on the other hand, the largest inter-individual differences in forecasting indicators that indicate significant differences between players; at the representative level of anticipation, the accuracy of forecasting is low, despite the good knowledge of their rivals (the average group value of the individual indices for predicting the results of football games one by one is only 50%). Inter-individual differences in indicators of predicting the results of games in football, one on one, on the contrary, are significant; this indicates that players are dramatically different from each other in their ability to predict.

Keywords: *individualization, anticipation, selection, forecasting, football players.*

Introduction

Today Kazakhstan is known to the world community as an independent and rapidly developing country. A certain contribution to this has been made by sports and, in particular, by football. The current state of football in the republic is due to its socio-economic development. However, without the advancing development of football, it is impossible to achieve success and progress. And this requires a systematic, purposeful organization of research and methodological work (Karazhanov, 2000; Akpaev, 2003; Adambekov, 2006). As you know, modern football involves the manifestation of high-level footballers of special working capacity that consists of several components, in the first place, technical and tactical skills.

Technical and tactical training in sports is a multifaceted concept. In some cases, it is treated as the art of wrestling, in others – as a combination of methods and techniques with the use of athletes' power in accordance with the specific conditions of competition and the actions of partners and rivals (Carling et al., 2005; Reilly, Korkusuz, 2009). The basis of technical and tactical competence in any sport is technical and tactical knowledge as well as skills and determination of the quality of tactical thinking of athletes (Franks et al., 1999; Hughes, Franks, 2004).

The effectiveness of technical and tactical attacking and defensive actions of players is largely related to their personal psycho-functional features and the current psycho-functional state. This is due to the fact that players need quickly to make appropriate decisions on how to act in various fast-changing game situations during the course of games (Levin et al., 2003; Zwierko, 2006; Voronova, Shutova, 2007; Duncan et al., 2013).

In the process of solving technical and tactical tasks during the competition, athlete's thinking is evaluative as well as it is aimed at guessing opponent's plans and, therefore, is predictory (anticipatory). In the practical thinking, the most important role belongs to player's ability to anticipate. In the broadest sense, anticipation implies the ability of a person to act with some space-time advance of events (Morris, 2000; Gonçalves et al., 2015). Forms of anticipation in thinking are diverse. One of them is subjective probabilistic forecasting – a person's ability to compare incoming information about the

current situation with the stored information about the past experience and build, on the basis of all available data, a hypothesis about upcoming events with a definition of the degree of probability of their origin (Roca et al., 2012; Martins et al., 2014).

In terms of technical and tactical activity of football players, it is very important to predict accurately players' ability successfully to perform various motor activities with the ball and without the ball as well as similar opportunities for partners and rivals (Williams, 2003; Adambekov, 2003; Boranbaev, 2005).

Such self-evaluation plays an important role both in terms of the effectiveness of individual game actions and in the position of implementing communication ties that largely determine the tactical interactions of players in the game and their relationship in the team.

Re-evaluation by players of their technical and physical capabilities leads to errors in the actions with the ball and in the performance of defensive actions, and their underestimation does not allow them to fully realize their potential in particular game situation.

Thus, the conscious regulation by football players of their special sporting activities is important for achieving high sport results. This served as the basis for the study of the specialists' manifestations of various psychological factors in football (Adambekov, 2007).

However, it should be noted that despite the large number of conducted studies, the issues of determining the individual abilities of players in terms of abilities for anticipation have not been studied in depth. This leads to the fact that in practice the evaluation of the players' ability of anticipation is carried out by trainers on an intuitive level, takes a lot of time and is not always objective (Ward et al., 2004; Акпаев, 2004).

The goal of the work is to determine the individual characteristics of the players' anticipation in terms of abilities to predict the opportunities successfully to perform motor actions with the ball and without the ball.

Material ant methods

As it is known, individual abilities of anticipation determine the volume and effectiveness of players' performance as individual and group technical and tactical actions in games under conditions of varying degrees of "game tension". Methods for assessing the ability of players to probabilistic prediction of their ability successfully to perform various motor actions with the ball and without the ball were developed for the study.

The examined players of the team were of high sportsmanship and had been participating in the Championships. The accuracy of the subjective prediction of the tested players (field players, n = 11) was considered at three levels of anticipation:

- the sensorimotor level, where the class of solved problems was the prediction of speed-strength qualities in the form of a long jump from the place by a jerk with both legs;
- the perceptual level, where the class of tasks to be solved was the prediction of technical capabilities when kicking in a vertical target from 11 meters;
- the representative level, where the class of tasks to be solved was to predict the possibilities of successful operation in situations that involved attacking and defensive actions in the complex while playing football one-on-one on a 10-15 m field.

The data of the research were processed by the methods of mathematical statistics.

Results

At the first level of anticipation, the accuracy of predicting the length of a long jump from the place with both legs was as follows: the accuracy of predicting the same players was on average 94.73 ± 2.76%. Errors in the case of undervaluation were 4.72 ± 3.44%, and overvaluation was 0,55 ± 1.21% (Table 1).

Table 1

Accuracy (%) of predicting the distance of the long-jump from the place with a jog-kick

Players	A task for estimating the accuracy of predicting the range of a long jump from a place by a push with both legs		
	Accuracy of forecasting	Errors in forecasting	
		underestimation	overestimation
1	91	9	0
2	95	5	0
3	97	0	3
4	92	8	0
5	96	4	0
6	90	10	0
7	93	7	0
8	97	0	3
9	96	4	0
10	98	2	0
11	97	3	0
X ± Sx ± S	94.73 ± 0.83 ± 2.76	4.72 ± 1.04 ± 3.44	0.55 ± 0.37 ± 1.21

Estimating the accuracy of predicting the success of football players with a kick to the vertical target from 11 meters, it should be noted that the accuracy in forecasting among the nine studied players averaged 60.78 ± 13.85%. Errors in forecasting were as follows: underestimation was 12.55 ± 22.49%, and overvaluation was 26.67 ± 20.96% (Table 2).

Table 2

Accuracy (%) of predicting the success of the kicking in a vertical target from 11 m

Players	Task for assessing the accuracy of predicting the success of kicking in a vertical target from 11 m		
	Accuracy of forecasting	Errors in forecasting	
		underestimation	overestimation
1	55	0	45
2	53	0	47
3	75	25	0
4	63	0	37
5	72	0	28
6	65	0	35
7	34	66	0
8	52	0	48
9	78	22	0
X ± Sx ± S	60.78 ± 4.62 ± 13.85	12.55 ± 7.50 ± 22.49	26.67 ± 6.99 ± 20.96

The results of determining the accuracy of predicting the results of football games on a 10×15 m field are presented in Table 3. They show that the forecasting accuracy at the representative level is on average 50.00 ± 12.65%, and the forecasting errors - 50.00%, among which underestimation was 11.82 ± 10.79%, and overvaluation – 38.18 ± 11.68%.

Table 3

Indicators of accuracy (%) of forecasting the results of one-on-one football game on a 10×15 m field

	A task to assess the accuracy of forecasting results of one-on-one football games on a 10×15 m field		
Players	Accuracy of forecasting	Errors in forecasting	
		underestimation	overestimation
1	40	20	40
2	60	0	40
3	40	0	60
4	70	10	20
5	50	20	30
6	30	30	40
7	40	10	50
8	50	20	30
9	70	0	30
10	50	0	50
11	50	20	30
X ± Sx ± S	50.00 ± 3.81 ± 12.65	11.82 ± 3.25 ± 10.79	38.18 ± 3.52 ± 11.68

The analysis of the individual results of the performance of three tasks by the players gave an opportunity to characterize their ability to predict their abilities successfully to perform various actions with the ball and without the ball as follows.

Player 1. The accuracy of predicting opportunities to successfully operate in situations where attack and defensive actions are carried out in a complex is low, their underestimation is also observed as well as their overvaluation. The footballer in the middle degree overestimates his speed-power capabilities and largely technical capabilities.

Player 2. This player has a very high level of claims and, at the same time, his accuracy of predicting ability successfully to operate in game situations with the performance of attacking and defensive actions is high. The player very correctly assesses his speed and strength capabilities, but overestimates his technical capabilities to a very large extent.

Player 3. A very accurate self-assessment of speed-strength and technical capabilities supports a high level of claims. However, the accuracy of predicting the player's ability successfully to operate in situations where the complex of attacking and defensive actions are taken is low.

Player 4. This player has a high accuracy of assessing the possibilities successfully to operate in situations where the attack and defensive actions are performed in the complex. He appreciates his speed and strength capabilities with some of underestimation, but, at the same time, slightly overestimates his ability accurately to execute the blows on the ball.

Player 5. The football player very accurately assesses the speed and power as well as technical capabilities, but takes one of the last places in the team for accurately predicting their capabilities to successfully act in situations where the complex is performed by attacking and defensive actions.

Player 6. This player is characterized by a low indicator of the accuracy of predicting the possibilities successfully to operate in game situations (there is an underestimation and a reassessment to a high degree of these opportunities). He is among those players in the team, who have the lowest accuracy of the rating of speed-strength qualities and who greatly underestimate these opportunities. The player overestimates his ability to accurately perform transfers.

Player 7. This player has low accuracy of predicting opportunities successfully to operate in situations where attack and defensive actions are performed in the complex with their high overassessment. He accurately estimates his speed and strength, but clearly underestimates his ability accurately to perform the transfer that can manifest itself in games as a lack of desire to carry out risky transfer of the ball.

Player 8. A football player accurately assesses his speed-strength qualities. The accuracy of predicting technical capabilities is not very high in reassessment, but the ability successfully to operate in game situations is on medium degree as well as underestimation and overassessment.

Player 9. This football player is characterized by a high level of claims that, at the same time, are backed up. He also forms accurate assessments of his ability successfully to operate in situations where the complex includes attacking and defensive actions as well as very high accuracy in assessing his speed and strength and sufficiently adequate assessment of their technical capabilities.

Player 10. Despite the fact that this player also has a high level of claims, he is not supported by sufficient accuracy to predict his ability successfully to operate in situations where the complex must perform attacking and defensive actions. At the same time, the player correctly assesses his speed-strength qualities and the ability accurately to perform transfers.

Player 11. A football player evaluates his speed-strength and technical capabilities quite well. Accuracy of predicting ability effectively to act in situations where the complex must perform attacking and defensive actions is on medium degree as well as underestimation and overassessment.

Discussion

Individualization of technical and tactical training of players is the most effective form of sports perfection. Thus, this form of organization of the training process is an organic component of the training of young players and is formed through the creation of the unity of general pedagogical and specialized sports training in a holistic pedagogical process (Praça et al., 2015). Authors of this article argue that the indicators of the football game are multifactorial and characterized by the interaction of technical, tactical, physical, physiological, and psychological components. However, only a few studies have examined the direct relationship between these components in football players. The results of the study of the above mentioned authors point to a gap between knowledge about "how to do this", i.e., technical skills, and knowledge about "what to do", i.e., tactical knowledge. This gap underscores the need to improve the assessment of technical skills that also must emerge in the game context, for example, in games on a small site (Rampinini et al., 2007). I. Franks, T. McGarry (1996), T. Reilly et al. (2000), G. Praça et al. (2015) conclude that the offensive and defensive tactical characteristics of young players do not correlate well with the technical skills of performing, dribbling, and striking.

L. Rechenchosky et al. (2017) conducted a study where the purpose was to analyse the relationship between declarative tactical knowledge, physical training, and technical assignments for young players. They found that physical and technical characteristics were associated with declarative tactical knowledge since tactical knowledge increased with age.

H.Forsman et al. (2016) carried out the research during the course of one-year cycle of training and competition. 288 young players from 16 football clubs were surveyed. Participants were analysed under the aspects of self-esteem of perceived competence, tactical skills, and motivation, and conducted tests that determined technical skills, speed, and manoeuvrability. The results of this study showed that players' perception levels, tactical and technical skills, motivation, speed characteristics, and manoeuvrability were relatively high and stable throughout the entire year cycle.

O. Saygin et al. (2016) were examining the coincidence of high-speed qualities and game actions that improved speed qualities and strived for those to be included in the training program of players.

The ability to anticipate and make decisions is critical to skilled work in many sports (Roca et al., 2013). These authors examined the role and interaction between various perceptual and cognitive skills underlying expectations and decision-making and found that, in skilled and less skilled players, the perceptual and cognitive skills underlying superior predictive and decision-making differ in importance

of offensive or defensive position in player's half of the field.

J. North et al. (2016) examined the question, whether prediction relied on the perception of structured patterns or postural signals and whether the relative importance of these processes depended on the constraints of the tasks. This research concluded that various perceptual-cognitive skills contributed to the expectation with relative importance of the perception of structured patterns and the improvement of postural signals determined limitations of tasks and the availability of perceptual information.

The analysis of literary sources and our practical experience have shown that, given the fact that the ability to predict subjective to a large extent determines the effectiveness (accuracy) performance in competitive games of different technical and tactical actions, it is advisable to identify individual abilities of players to the anticipation and, on this basis, to put in front of them in the competition really feasible game problems, to make certain adjustments in building a team game as well as to individualize the training process in the section of technical and tactical training.

Conclusions

Evaluation of individual types of subjective prediction of players participating in the research, along three levels of anticipation showed the following:

- at the sensorimotor level of anticipation, players with a fairly high degree of accuracy predict their capabilities, and the differences in individual indicators are very small;
- at the perceptive level of anticipation there are, on the one hand, a reassessment of their capabilities by football players, and, on the other hand, the largest inter-individual differences in forecasting indicators that indicate significant differences between players;
- at the representative level of anticipation, the accuracy of forecasting by players is low, despite the good knowledge of their rivals (the average group value of the individual indices for predicting the results of football games one by one is only 50%). Inter-individual differences in indicators of predicting the results of games in football one-on-one, on the contrary, are significant, which indicates that players are dramatically different from each other in their ability to predict.

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INDIVIDUALIŲ FUTBOLININKŲ ANTICIPACIJOS GEBĖJIMŲ CHARAKTERISTIKA

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SANTRAUKA

Šiuo metu Kazachstanas pasaulio bendruomenei žinomas kaip savarankiška, veržliai besivystanti šalis. Tam tikrą indėlį į tai įneša sportas, o ypač – futbolas. Dabartinė futbolo būklė respublikoje priklauso nuo šalies socialinės, ekonominės raidos. Bet, kita vertus, be futbolo plėtros proveržio neįmanoma pasiekti progreso ir aukštų rezultatų šioje sporto šakoje. Reikalingas organizuotas, planingas, moksliniu-tiriamuoju ir metodiniu darbu pagrįstas futbolininkų rengimas.

Darbo tikslas – nustatyti individualius futbolininkų anticipacijos gebėjimus, prognozuoti galimybes sėkmingai atlikti veiksmus su kamuoliu ir be jo.

Ištirti didelio sportinio meistriškumo futbolininkai (n = 11), dalyvaujantys šalies čempionate.

Tyrime dalyvaujančių žaidėjų subjektyvios prognozės tikslumas, vertintas pagal tris anticipacijos lygmenis (sensorinį, perceptualųjį ir reprezentatyvųjį), parodė, kad sensoriniu anticipacijos lygmeniu futbolininkai gana tiksliai prognozuoja savo galimybes atliekant greitumo-jėgos reikalaujančius pratimus. Tyrimo duomenys atskleidė, kad vertinant perceptualiuoju anticipacijos lygmeniu futbolininkai, viena vertus, savo veiksmus pervertina, kita vertus, – įvertina nepakankamai. Reprezentatyviajame anticipacijos lygmenyje prognozuojamų futbolininkų veiksmų tikslumas žaidimo vienas prieš vieną metu siekė tik 50 %.

Raktažodžiai: individualizacija, anticipacija, atranka, prognozavimas, futbolininkai.

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Capabilities of using bar elastic properties in the training of weightlifters

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Summary

Article aims to evaluate athletes' ability to catch the swinging bar, resulting from the performance of clean and jerk weightlifting. A device with an intelligent sensor, based on the method of wireless tensometry, was used to register the swingings. To identify key moments of the phases of movements, correlation of parameters of bar swingings with moves exercise, was carried out. As a result of the research, indices, characterizing the dynamics of apparatus swingings, were obtained and the evaluation of athlete's use of bar elastic properties was given. On the basis of the experiment, it had been shown that the model stereotype of movements was better to form under the condition of optimum use of bar elastic properties, when in trainings and competitions the equipment of identical manufacturing firms is used. Comparing the Eleikobar and ZKC bar, it was found that the Eleikobar in the load testing had a higher amplitude of swingings; that is a strong argument in favour of its use in the training process. Eleikobar has less swinging load on ligaments and joints, preventing possible injuries of athletes. The presence of intelligent sensor in the device provides biological feedback, while the athlete, in the controlled phase of movements, has the ability to track the bar swinging and combine maximum effort with optimal resonance of the bar.

Keywords: *weightlifting, clean and jerk, bar elastic properties, intelligent sensor, evaluation algorithm.*

Introduction

Rapid growth of records, significant intensification of training and competitive loads, as well as tough competition of powerfully equal opponents are typical for modern sport. To achieve high sport results, you need decades of intense training. In weightlifting, the result depends not only on the scores of athletes, but also on the technique of performing the exercise, which involves Provence's high-level control and structure-engine action (Storey, Smith, 2012; Akkus, 2012; Musser et al., 2014; Kipp, Harris, 2015).

The growth of athletic performance in weightlifting is achieved by increasing training loads. Nevertheless, further increasing of their volumes cannot be perpetual since the increasing relevance has the problem of finding new ways to improve the efficiency of the process of training (Gourgoulis et al., 2009; Ho et al., 2014; Petrizzo et al., 2016).

As considered, the most difficult elements of athletes' movements in weightlifting, in terms of cooperation, are the clean and jerk lifts. The reason for this is its performance that takes place before the background of the processes of fatigue after the snatch and is characterized by a large lifting weight as well as maximum tension during the lift (Gourgoulis et al., 2009; Ikeda et al., 2012; Harbili, 2012; Harbili, Alptekin, 2014; Жуков, 2009). As a result, there are frequent lift-offs at competitions during the performance of clean and jerk power (Жуков, 2009; Gourgoulis et al., 2009; Ikeda et al., 2012; Harbili, 2012; Harbili, Alptekin, 2014;). Aiming to improve the efficiency of the technique of performing a competitive clean and jerk move, great importance lies in the ability of an athlete to catch the weight bar swinging (Chiu et al., 2008; Chiu, 2010; Мамий, Поляков, 2014). The forces, arising on the bar at the time of the apparatus swingings, are determined by bar elastic properties. In particular, performing power jerk due to bar elastic properties and the barbell weight under the influence of external force are at its own swinging. An experienced athlete, who applies appropriate efforts, causes these fluctuations and, in the process of performing the ascent, uses them to achieve the best result (Lanka et al., 2017). In this regard, it has become necessary to develop a system that would allow determining the time of occurrence of swingings, their amplitude, and direction.

The received results can be used to improve the technical training of weightlifters in execution

of clean and jerk moves on the basis of the use of the barbell inertial forces, coinciding in time and direction with the force, applied by the athlete, to the apparatus in the phases of jerk and clean power.

Goal of the research is to improve the technical readiness of weightlifters in the clean and jerk move based on the use of bar elastic properties.

Object of the research: the training process of weightlifters.

Subject of the research: technical preparedness of weightlifters during clean and jerk lifting.

Material and methods

The following methods were employed for the study: analysis of scientific and methodological literature, the method of strain measurement, high-speed video, calculation and graphical methods of data analysis.

The study involved an athlete of age 22 with experience in performances at the World and European Championships.

The ability of the athlete to catch the bar swingings, resulting from the performance of the clean and jerk weightlifting, was evaluated. A special device with a built-in intelligent sensor, based on the method of wireless strain measurement, was developed for swingings registration. The connection diagram and the main elements for data logging are shown in Figure 1. Synchronous time video recording was carried out by digital video camera Panasonic HC-V770 with a frame rate of 60 Hz. This synchronization is necessary for the selection of the corresponding phases in the barbell swinging registration files.

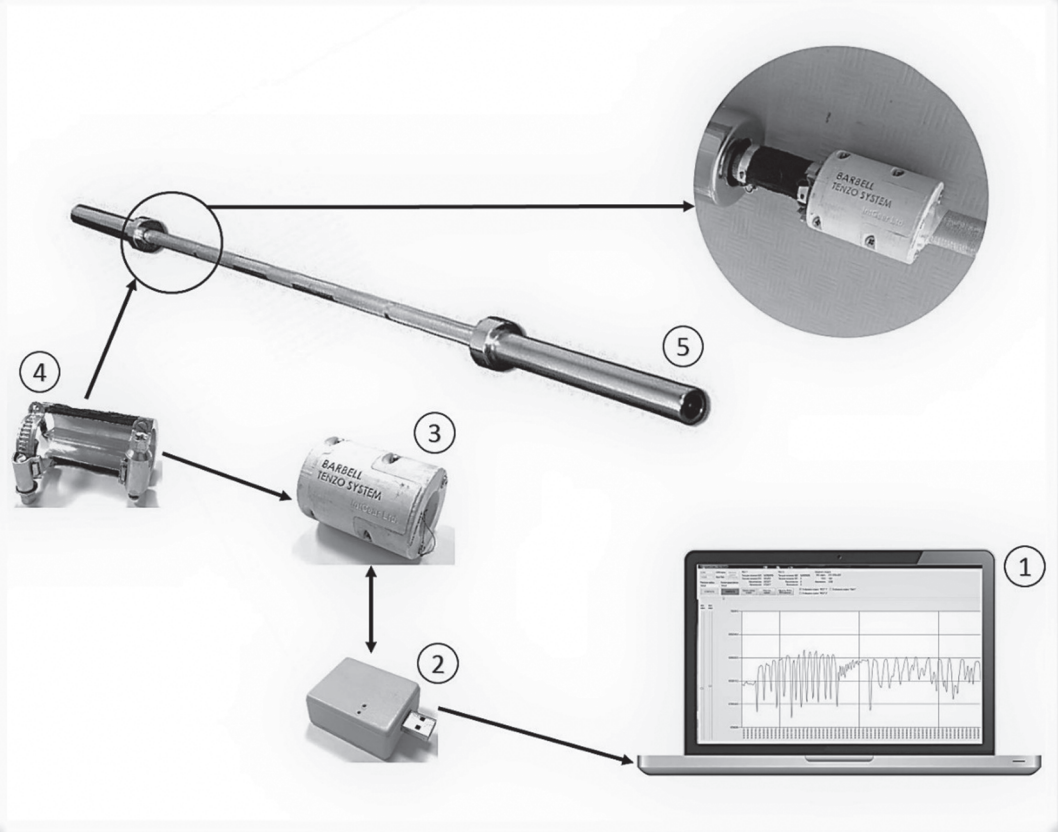

Fig. 1. The connection of diagram and key elements of the device for bar elastic properties evaluation
1 – personal computer; 2 – Bluetooth signal transmission; 3 – Bluetooth module transmission;
4 – intelligent transmitter; 5 – bar

Determination of bar elastic properties was carried out using specially designed device that was fixed at one end of the bar. The weight of the device was 120.0 gr.

Algorithm of bar elastic properties evaluation consisted of three main blocks (Fig. 2).

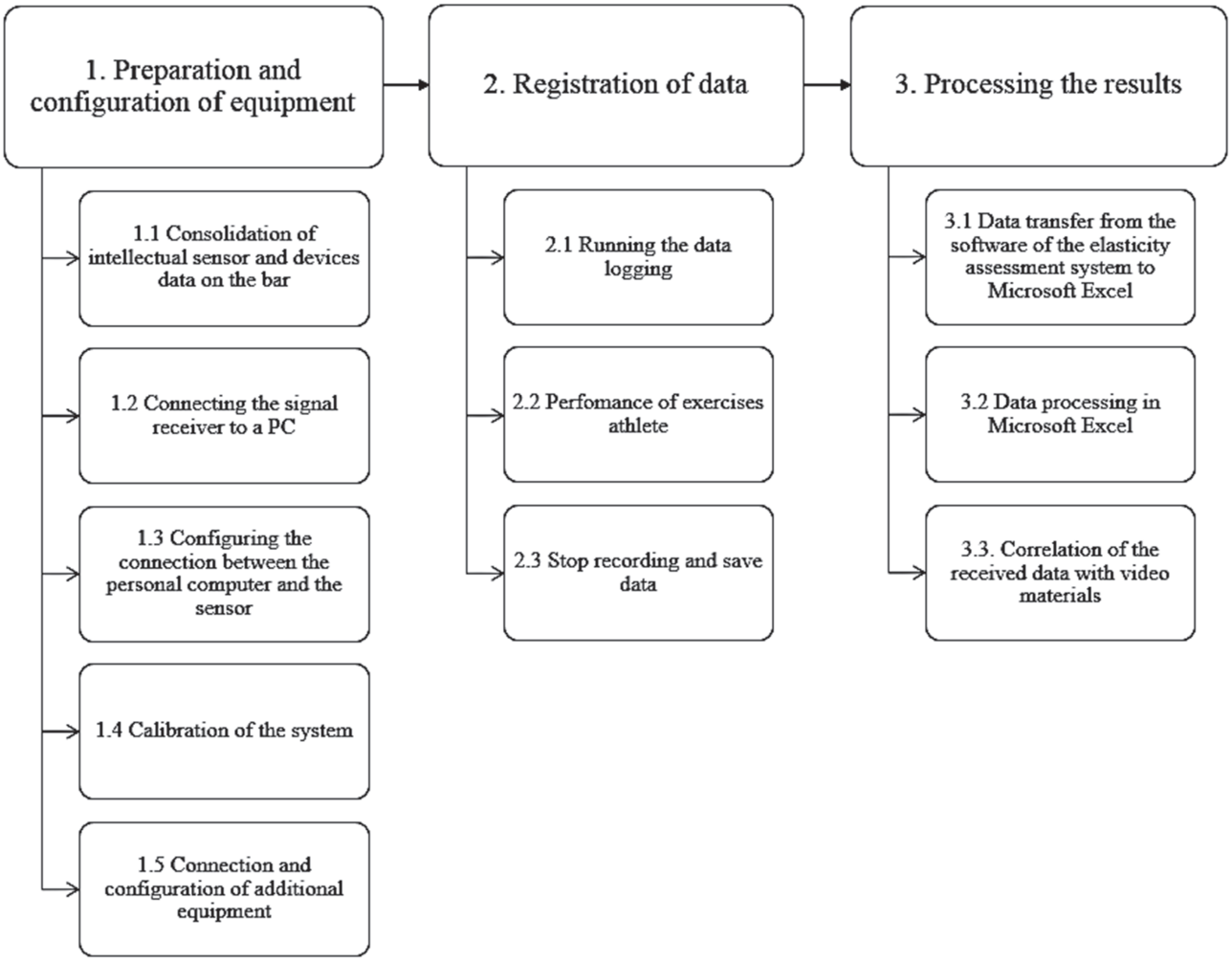

Fig. 2. Functional diagram of bar elastic properties evaluation

In block 1, the following actions were consistently carried out:

- fixing the module of signal transmission and power supply of the intelligent sensor on the bar;
- connection via USB between a signal receiver and a personal computer;
- configure the connection between the PC and the sensor;
- running the software and creating a stable data connection;
- entering personal data of an athlete and the working weight of the barbell;
- calibration of the system (during changing the bar);
- connection and setting of the multimedia projector to display information about the bar swinging.

In block 2, the actions, related to the order of the exercise performance and data registration, were performed:

- the athlete held the starting position, the assistant-coach synchronously turned the device and the video camera on;
- when performing the exercise, the athlete was tracked through a multimedia projector on the wall with the image of the forces acting on the bar. The success of the attempts with the stated weight was due to the contact forces, applied by the athlete, to the bar resonance;
- completing a weightlifting exercise or an attempt, the assistant coach stopped recording on the device and the video camera with the preservation of information.

The same sequence of actions can be used without biofeedback, when the task is to assess the level of technical readiness of the athlete.

In block 3, the actions, related to the processing of test results and analysis of the data, were carried out:

- transferring the digital array of the space-time parameters, reflected by interaction of an athlete with a bar from the software of the device to the Excel table;

- processing the data, eliminating additive error values, and calculating the required values;

- construction of graphs, reflecting the bar swingings, during performance of exercises, with a given weight;

- data correlation of the bar swingings with video fragments of phases of the athlete's movements (displayed by putting markers on the graph).

In the experiment, the athlete alternately performed four attempts of lifting a barbell with a weight of 170 kg from racks. In the dynamics of exercises on the wall, a graph of the bar swingings was displayed using a multimedia projector. The athlete had to start the jerk phase when the curve on the graph reached its lowest point (it was an indicator of the maximum bending of the bar in the direction of the squat). A fragment of the exercise with the use of a device for assessing the bar elastic properties using biological feedback is shown in Figure 3.

Fig. 3. Fragment of the exercise using neuro-feedback Processing of the data was carried out using Microsoft office Excel

Results and discussion

Obtained data gave a characteristic to the apparatus swinging when performing clean and jerk lifts. Dynamics graph of the bar swinging, during the performance of the first attempt, is represented in Figure 4.

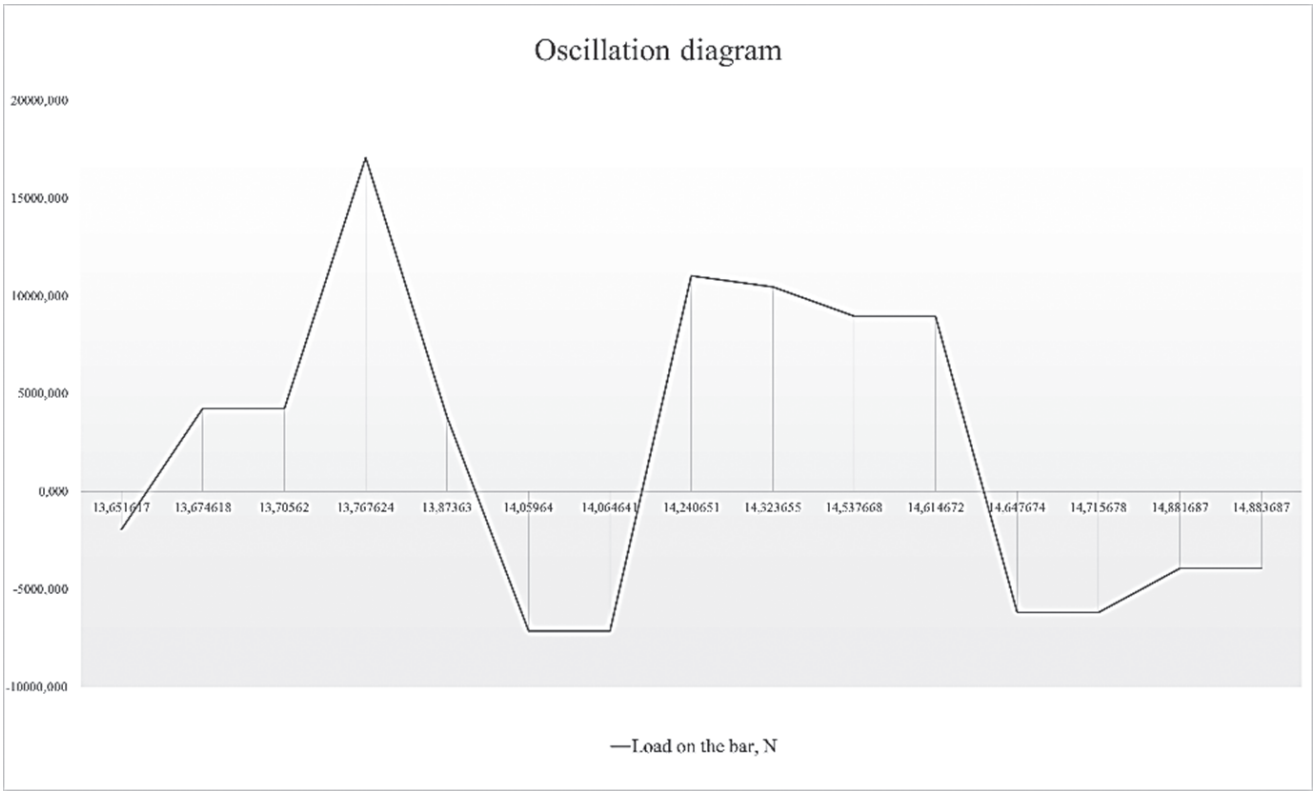

Fig. 4. Dynamics graph of the bar swinging during the performance of the exercise with 170 kg weight (1st attempt)

In the analysis of the graph of the first attempt, it can be concluded that the athlete started the phase of jerk, when inertial forces of bar swingings already coincided with the direction of the force, applied by the athlete, as evidenced by the marker on the graph, located on the upward line. This performance can be considered satisfactory, but the athlete started the phase of jerk with delay.

Dynamics graph of the bar swinging, during the performance on the second attempt, is represented in Figure 5.

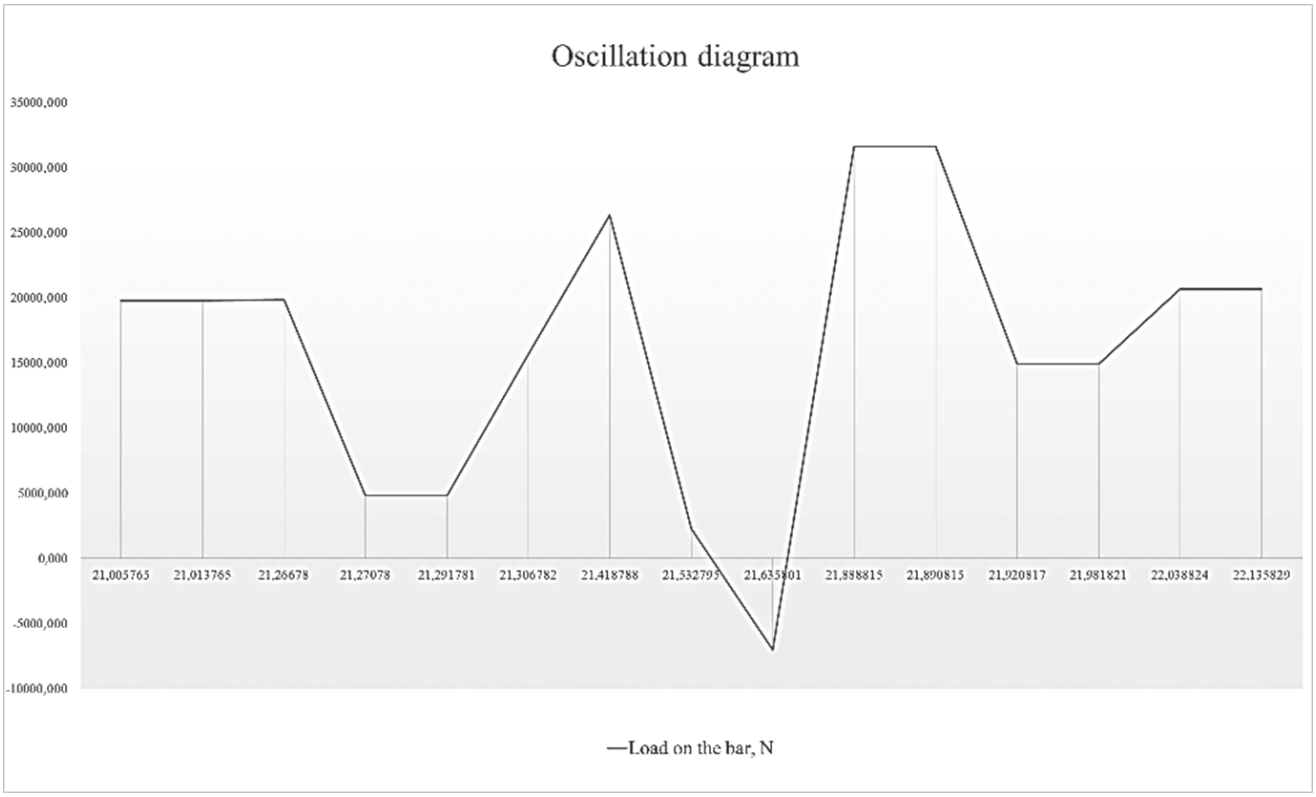

Fig. 5. Dynamics graph of bar swinging during the performance of exercise with 170 kg weight (2nd attempt)

Performing the second attempt, the athlete started the jerk phase prematurely, as evidenced by the marker on the downward line of the graph. However, this performance can be considered satisfactory, as it did not lead to the attenuation of the bar swingings(it would be expressed in the graph as a plateau).

Dynamics graph of the bar swinging, during the performance on the third attempt, is represented in Figure 6.

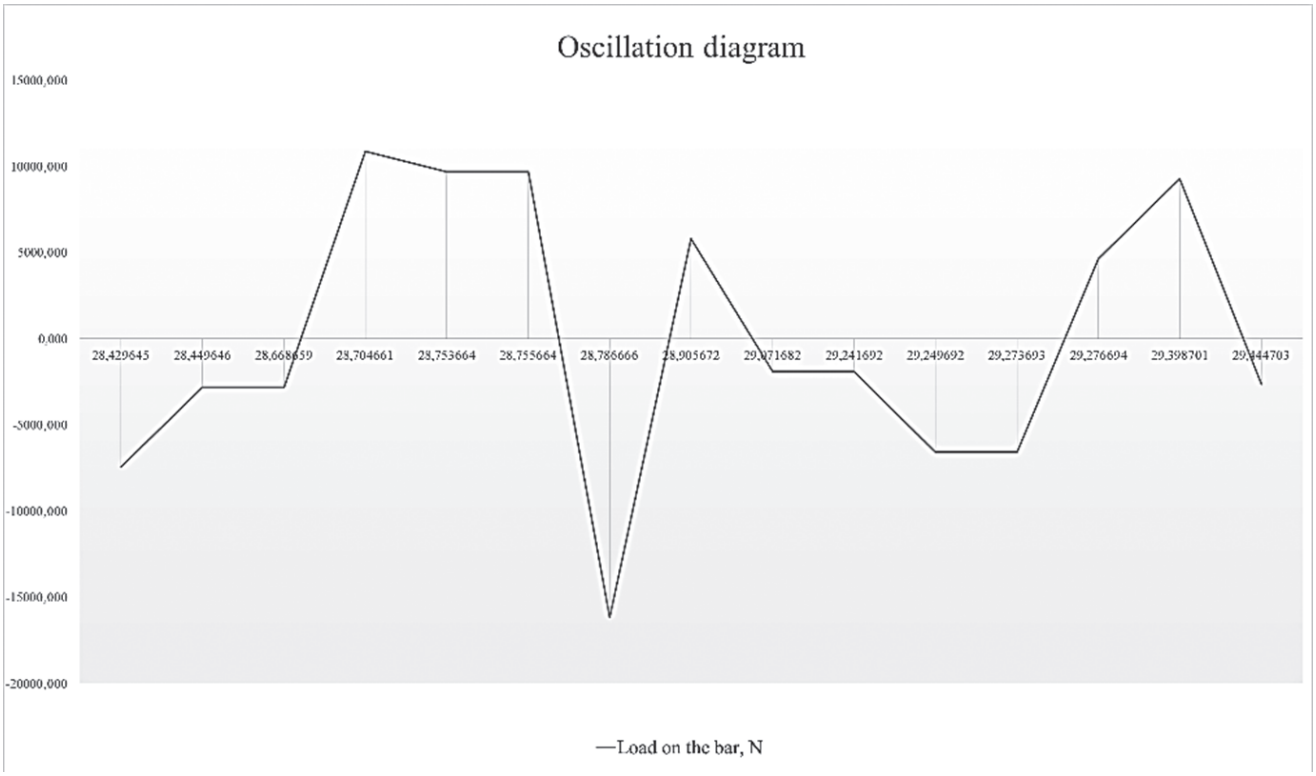

Fig. 6. Dynamics graph of bar swinging during the performance of the exercise with 170 kg weight (3rd attempt)

Performing the third attempt, the athlete was in resonance with the bar swinging as evidenced by the marker at the beginning of jerk, falling on the peak. The force, applied by the athlete, exactly coincided with the inertial forces of bar swingings. Such performance can be considered as the model.

Dynamics graph of the bar swingings, during the performance the fourth attempt, is represented in the Figure 7.

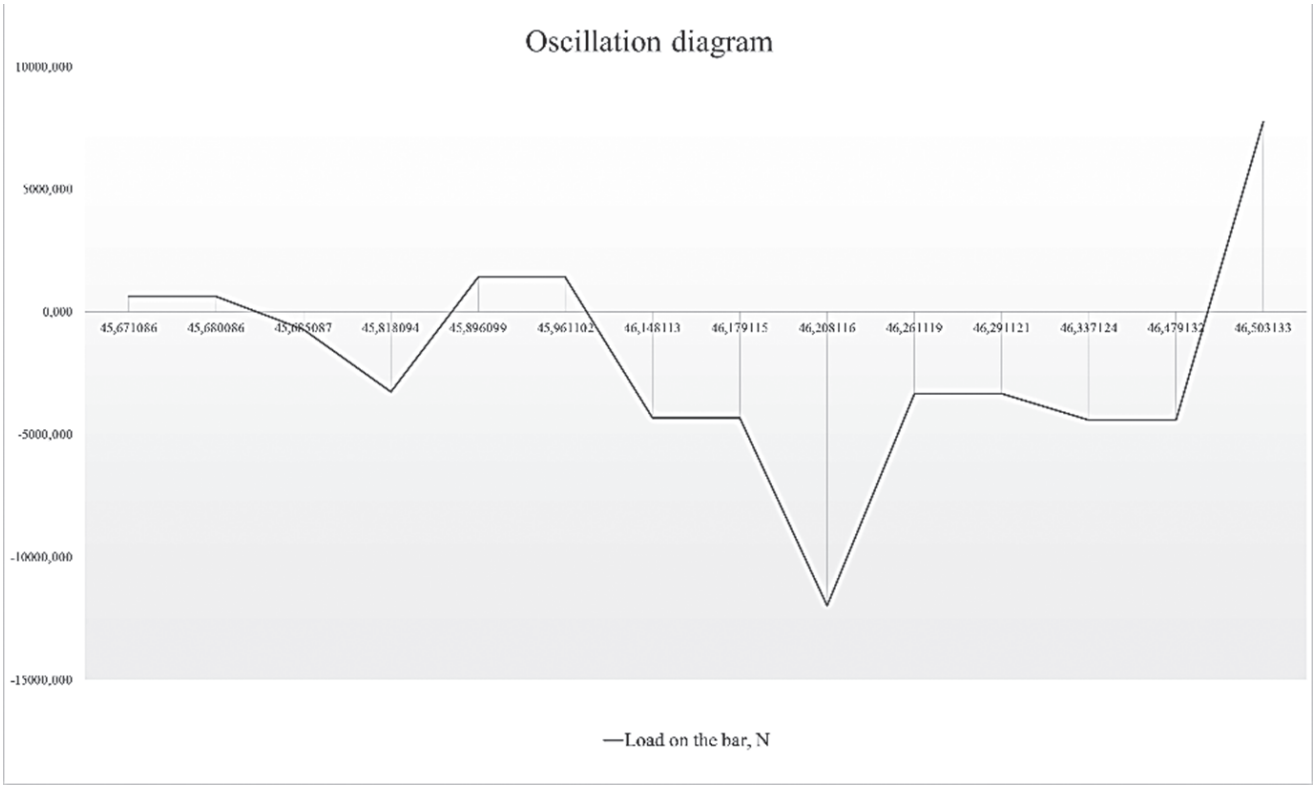

Fig. 7. Dynamics graph of bar swinging during the performance of the exercise with 170 kg weight (4th attempt)

Performing the fourth attempt, there is a premature start of the jerk phase as evidenced by the plateau in the graph after the vertical line that is a marker of the beginning of the jerk. Besides that, the beginning of the jerk came at the time of bar swinging motion, opposite in its direction to the force, applied by the athlete to the apparatus, which made it difficult to perform the exercise. This performance cannot be considered as satisfactory.

This study allows to conclude that the athlete has a significant potential in improving the utilization of bar elastic properties to facilitate the exercise through the use of barbell inertial forces coinciding in time and direction with the force, applied to the apparatus, in the phase of jerk. However, to learn how to optimally use bar elastic properties, as well as to take into account the elastic and power capabilities of the muscles and the entire musculoskeletal system of a weightlifter a long training is needed. Although, an important condition should be realized: the elasticity of the training bar should be the same as that of the competition (Chiu et al., 2008; Chiu, 2010; Мамий, Поляков, 2014). Currently, the weightlifting competition of the continental and planetary scale is carried out using sports equipment company Eleiko.

In this regard, we have compared the vultures of Eleiko and ZKC that were used in the training process of weightlifters. Vultures have a good elasticity effect and are made of special spring steel. The Eleikobar withstands the maximum load up to 1500 kg, the ZKC bar carries a load up to 1000 kg.

Using the developed devices parameters of incurvation and swinging amplitude of the bar with 25 kg weight plates were measured. Following tests were carried out:

1. Static test with the bar on the racks (weight of 70 kg bar). During carrying out the test, the weight plates of equal weight were installed on the bar. The test was carried out on racks. With the help of the device, the bar incurvation, caused by this load, was fixed.

2. Bar dynamic test performing barbell clean and jerk lift from the starting position *"*power clean*"* (from the racks). The athlete took the bar (weight 70 kg) from racks and did the jerk lift from the chest to outstretched arms. During the movement, data of the bar swinging amplitude were recorded.

3. Bar dynamic test performing barbell clean and jerk lift from the starting position *"*power clean*"* (from the racks) with a shifted position of the weight plates (weight of the barbell: 70 kg and 120 kg). The athlete took the bar from the racks and performed jerk lift from the chest to the outstretched arms. To increase the moment of force, weight plates were shifted closer to the ends of the bar at a fixed distance by means of locks. During the process of the jerk lift, the sensor recorded the data of the bar swinging amplitude.

Data, obtained in the process of carrying out the tests, are represented in Table 1.

Table 1

Data of comparing bars according to their elastic properties

Test title and content	**Apparatus weight, kg**	**Measured parameter**	**Comparable bars**	
			Eleiko	**ZKC**
			relative units	**relative units**
Test № 1. Static test with the bar on the racks	70	incurvature magnitude	5041	17641
Test № 2. Bar dynamic test performing barbell clean and jerk lift from the starting position *"*power clean*"* (from the racks)	70	swinging amplitude	67024	177358
Test № 3. Bar dynamic test performing barbell clean and jerk lift from the starting position *"*power clean*"* (from the racks) with a shifted position of the weight plates	70	swinging amplitude	79266	193665
	120	swinging amplitude	103618	292251

According to the obtained data, the difference in the amplitude of the bar swingings is more than doubled and the readings increase in proportion to the increase in the total weight of the apparatus. It is natural for the results of dynamic test with shifted position of the weight plates. According to the measured parameters, the Eleiko bar differs significantly from the ZKC analogue, which is a strong argument in favour of its use in training. With a lower swinging amplitude, the Eleiko

bar has less stress on the ligament apparatus and joints, which prevents injury to the joints and their premature wear. Taking into account that the athlete performs about 70–100 lifts per training, of which 10–20% with weights, 80% or more of the limit, the use of the ZKC bars in the preparation can lead to changes in the technique of movements and the formation of an incorrect motor skill. This change may have a negative impact on the preparation of the athlete and, as a result, cause failure of attempts at a competition.

Conclusion

The constant search for ways to optimize the training process, in order to achieve the highest sports results, requires the use of modern mobile tools in the evaluation and improvement of technical training of athletes in weightlifting. The device approved by us allows to determine the dynamics of the bar swinging and to evaluate the effectiveness of bar elastic properties by the athlete on the key phases of the clean and jerk lift. The use of biofeedback in training allows the athlete, using bar elastic properties in real time with high accuracy, determining the most favourable moments for the development of maximum effort in the controlled phases of movement in combination with the bars optimal resonance. In addition, the developed device can be used in the comparison of bar elastic properties of different manufacturers in order to select the most similar properties to those used in competitions.

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ŠTANGOS PLIENINIO VIRBALO TAMPRUMO SAVYBIŲ PANAUDOJIMAS RENGIANT SUNKIAATLEČIUS

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SANTRAUKA

Darbo tikslas – įvertinti sportininkų gebėjimą panaudoti štangos plieninio virbalo vibravimą sunkiaatlečiams atliekant klasikinį štangos stūmimo veiksmą. Vibravimų registracijai buvo panaudota įranga su išmaniuoju davikliu, kuris veikia belaidės tenzometrijos būdu. Pagrindinių judesio fazių nustatymas vyko lyginant štangos plieninio virbalo vibravimą su pratimo atlikimo vaizdo įrašo fragmentais. Tyrimo metu buvo gauti duomenys, apibūdinantys įrankio vibravimo dinamiką ir įvertintos kitos štangos plieninio virbalo tamprumo pritaikymo galimybės atliekant štangos stūmimo veiksmą.

Eksperimento būdu nustatyta, kad modelinį judesių stereotipą geriausia yra formuoti optimaliai išnaudojant štangos plieninio virbalo vibravimo savybes, kai treniruotėse ir varžybose naudojamas vienos firmos gamintojų inventorius. Lyginant firmų „Eleiko“ ir ZKC virbalus, nustatyta, kad „Eleiko“ virbalas, testuojant jį su svoriu, turi didesnę svyravimo amplitudę ir tai yra svarbus argumentas jį naudoti treniruočių procese. „Eleiko“ virbalas sukelia mažesnį svorio poveikį sąnariams ir raiščiams, labiau sumažina sportininkų traumų pavojų. Išmanusis daviklis įrankyje suteikia biologinį grįžtamąjį ryšį, dėl kurio sportininkas vaizdo monitoriuje matydamas atskiras judesio fazes turi galimybę sekti įrankio judėjimą ir suderinti maksimalias savo pastangas su optimaliu štangos virbalo rezonansu.

Raktažodžiai: sunkioji atletika, štangos stūmimas, štangos virbalo tamprumas, išmanusis daviklis, vertinimo algoritmas.

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Experimental justification of methodical approach "Trainer's keys" in sports

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Summary

Management of technical and tactical training in educational and competitive activity of athletes in sport games provides effective formation of separate abilities. Competitive practice of players of various qualifications demonstrates decrease in technical and tactical potential of modern teams. Search for modern methodical approaches for the increase in level of individual technical and tactical skills is key activity of the trainer with young and qualified athletes. Among a variety of different methodical inclusion theories and techniques of athletes' training in sport games, recently, the conducting place is taken by "Trainer's keys" that are modern methodical approach, allowing to effectively influence by the means of specialized commands improvement of game actions of athletes on the purpose to achieve high sport results.

Improvement of individual technical and tactical skills of individual players allows diversifying physical actions of team and, on this basis, to achieve superiority over the rival. The emphasis on executed certain physical action at the expense of the operational sub-narration by the trainer allows to effectively operate the structure of the movement of athlete in training as well as in competitive activity, thereby, providing growth of sport skills.

The presented innovative approach can be applied by experts, working with athletes of various sport qualifications, as it has shown the high efficiency in experimental conditions.

Keywords: *volleyball, basketball, teams, individual skills.*

Introduction

The priority direction for considering non-contact (volleyball) and contact (basketball) types of sports is preparation of sports reserve and high-class athletes to important competitions and participation in local as well as in international arenas (Rodin, 2016).

The emphasis on sports importance predetermines interest in scientific research (Makarov, 2013; Pogorely, 2015) on complex of the problems of preparation in different sports (volleyball, basketball, etc.). In particular, the interest in questions (Belyaev, 2009; Losin, Makarov, 2011), connected with the organization of athletes' training process of sport games, that demands from the trainer constant search for modern and effective ways of increase in sport skills for achievement of high competitive results has been recently noticed.

A role of the trainer in ensuring effective technical and tactical preparation under requirements of modern sports is necessary in the conditions of training and competitive process as systematic tool and is aimed to impart own knowledge in order that the player could apply them in a game (Ayrapetyants, 1992; Belyaev, 2009; Bondar, 2015).

The analysis of special scientific and methodical literature (Guba, Rodin, 2009; Kozin, 2009; Karpov, Rodin, Pogorely, 2013; Guba, Marinich, 2016) has shown that, in the course of improvement of technical and tactical skills of athletes, the trainer has skilfully to apply various instructions in the performance of particular physical action with the subsequent formation of players' self-orders, providing concentration on the correct performance of the movement.

Considering the practice of trainers' work in volleyball and basketball, it should be noted that most of them, in the course of improvement of players' technical and tactical skills, use such methodical method as "Trainer's keys" that has not found its reflection in sports scientific and methodical literature (Portnov, 1989; Legonkov, 2003; Chesnokov, 2008; Losin, Makarov, 2011; Ramzaytseva, 2012; Makarov, 2013; Pogorely, 2015).

In this regard, theoretical development and deployment in training process of athletes of methodical approach "Trainer's keys" for its justification under experimental conditions and the subsequent introduction in practice of training of qualified teams is highly relevant (Uskov, 2004;

Rodin, Guba, 2009; Sonina, 2009; Khrustalyov, Guba, 2015; Rodin, 2016).

Research objective – experimentally to prove the methodical approach "Trainer's keys" in the course of technical and tactical training of athletes in sport games.

Material and methods

The research had been conducted from 2014 to 2017 at the Department of Theory and Technique of Sports of FGBOOU WAUGH "Smolensk State Academy of Physical Culture, Sport and Tourism" and at the Department of Physical Training of FGBOOU WAUGH "Tula State University". Qualified volleyball players (n = 32) and basketball players (n = 44), representing college teams of higher education institutions, which participated in the Games of Students' Volleyball Association of Russia and Association of Students' Basketball Association of Russia, participated in the research.

The main method of the research was creating pedagogical experiment that would be directed to development and experimental reasons for efficiency of application methodical approach "Trainer's keys" in the course of technical and tactical training of athletes in sport games. For this purpose, two groups from volleyball players and basketball players were created: control (CG; n = 38) and experimental (EG; n = 38).

The main feature of training occupations of the experimental group was that, in the course of technical and tactical preparation, such innovative methodical method as "Trainer's keys" was used.

The entity of the experimental methodical approach was that to each "key" there was correspondence of trainer's command – the short imperative specifying order, reflecting the main action (movement) of a player. For example: "it is strict on the centre!" – trainer's command on shock on ball centre in the case of execution of planning submission.

In return, the player has to find and put into practice his/her own self-orders / self-commands that would help concentrating on the correct performance of the movement. For example: "to look at legs!" – this self-order on visual control of the movement of legs of the attacking basketball player in the course of maintaining.

It is necessary to emphasize that trainer's teams are a direct link, since self-orders of the player are considered a feedback of technical and tactical training of athletes. These commands happen to be expressed in slang and perceived only by two – the trainer and the player. Such communication is necessary in the course of formation of individual technical and tactical skills of athletes.

It is very characteristic fact that, in the course of technical and tactical training of athletes of control group, this method was not used and correction of mistakes in exercise was carried out by the means of explanation after stopping a training task.

Competitive activity of qualified volleyball players imposes increased requirements to them, when performing the attacking blows and reception of the ball, that, in many respects, defines achievement of high sports results separately taken by the player and the team in general.

Results and discussion

Researchers have allowed to establish that, prior to the beginning of the formation of pedagogical experiment with qualified volleyball players of CG and EG, indicators of efficiency of performance of the attacking blow (38.9 and 39.7%) and reception of the ball (47.5 and 44.8%) were reliable and did not differ from each other ($p > 0.05$; Figure 1).

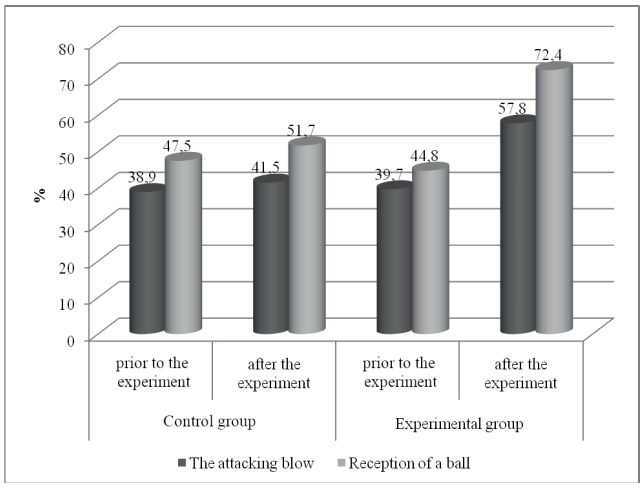

Fig. 1. The efficiency of technical and tactical actions of volleyball players of CG and EG in the course of the formation of pedagogical experiment

As a result of introduction in educational and training process of the experimental group, volleyball players of "Trainer's keys" indicators of the efficiency of the performance of attacking blow and reception of the ball have significantly increased by the end of the pedagogical experiment – respectively ($p < 0.05$) to 57.8 and 72.4%.

It is necessary to pay attention that, after the end of the forming pedagogical experiment with volleyball players of the control group, indicators of the efficiency of attacking blow performance and reception of a ball have slightly improved – respectively ($p > 0.05$) to 41.5 and 51.7%.

Received results allow noting that application of "Trainer's keys" enables to achieve more essential gain of results in efficiency of the attacking blow performance and reception of the ball in the course of competitive activity.

The analysis of research results has allowed to establish that, before the pedagogical experiment with qualified basketball players of CG and EG, indicators of efficiency of the performance of throwing the ball from average distance (30,2 and 32.9%) and passes (57.2 and 54.5%) in the course of competitive activity authentically did not differ from each other ($p > 0.05$; Figure 2).

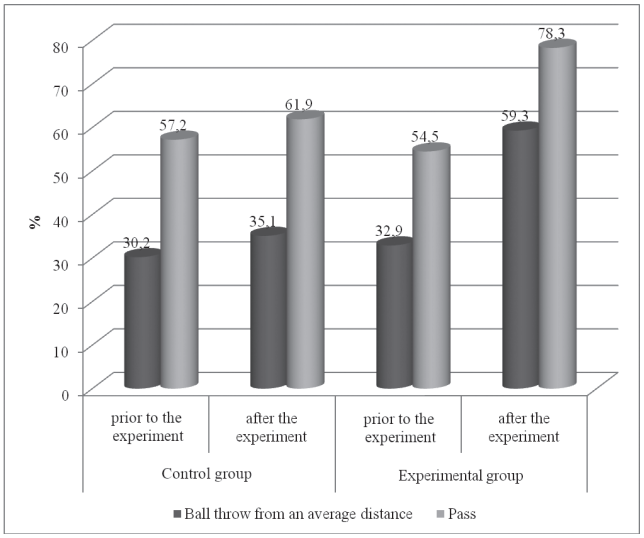

Fig. 2. The efficiency of technical and tactical actions of basketball players of CG and EG in the course of the pedagogical experiment

Introduction in educational and training process of the qualified basketball players of experimental group of "Trainer's keys", by the end of pedagogical experiment, has allowed significantly to raise indicators of efficiency of performance of throwing the ball from average distance and pass – respectively ($p < 0.05$) to 59.3 and 78.3%. It is very characteristic that, in the control group, by the end of the pedagogical experiment, ball throw indicators from average distance and pass have improved, though, insignificantly – 35.1 and 61.9% ($p < 0.05$).

Results of the research allow to note that expeditious entering of amendments into a game process by the means of methodical approach "trainer's keys" provides the increase in individual tactical skills of athletes. In our opinion, it is caused by the fact that, in the course of visualization of game actions of athletes, it is easy for trainer to identify mistakes in the structure of physical actions and, on this basis, to make recommendations to the player, according to key existential characteristics of the movement. Having changed structure of physical action, the player in his/her competitive activity begins to apply the most optimum ways of realization of game perception in the course of confrontation with the rival.

When generalizing data of pilot studies, it is necessary to allocate the age periods of effective individual tactical training of athletes in sport games that would be confirmed by results of researches of leading experts on the theory and a technique of sports (Ramzaytseva, 2012; Khrustalyov, Guba, 2015).

The versatility of performance of technique in various tactical situations is provided at expense of an intellectual component of individual tactical training of athletes in sport games (Kozin, 2009; Bondar, 2015). Our own researches and data of leading experts (Legonkov, 2003; Chesnokov, 2008) have shown that the age 13–15 (a stage of sports specialization) is optimum to formation of mental abilities of athletes on the basis of application of the method of "game tasks" and "Trainer's keys". These methodical approaches allow stimulating game conditions with high efficiency and making the most rational decision that would be supported by continuous verbal influence of the trainer in the course of performance of physical action as well as in training and competitive process.

Conclusion

It is established that application of methodical approach "Trainer's keys" in training process of qualified volleyball players and basketball players positively affects the increase in individual technical and tactical skills, since there is a straight line and feedback between trainer and athletes. The efficiency of this approach is caused by active application from trainer – instruction orders, and from athlete – self-orders that allow to concentrate on the correct performance of the movement.

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EKSPERIMENTINIS „TRENERIO RAKTAŽODŽIŲ“ METODO PAGRINDIMAS

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SANTRAUKA

Žaidimų sporto šakose treniruočių ir varžybų metu vykstančio techninio ir taktinio rengimo valdymas padeda efektyviau formuoti atskirus sportininkų įgūdžius. Varžybinė įvairios kvalifikacijos žaidėjų patirtis rodo dabartinių komandų mažėjantį žaidėjų techninį taktinį potencialą. Šiuolaikinių metodinių priemonių paieška, siekiant padidinti individualų žaidėjų techninio ir taktinio parengtumo lygį, yra svarbiausia trenerio darbo kryptis dirbant tiek su jaunais, tiek ir su kvalifikuotais sportininkais. Pastaruoju metu tarp didelės metodinių sportinių žaidimų priemonių įvairovės svarbią vietą užima „Trenerio raktažodžių“ metodas, leidžiantis specializuotų komandų būdu efektyviai veikti žaidėjų veiksmų kokybę, kad būtų pasiekti aukšti sportiniai rezultatai. Kiekvieno atskirai žaidėjo individualaus techninio ir taktinio meistriškumo tobulinimas leidžia įvairinti komandos judėjimo veiksmus ir tokiu būdu įgyti pranašumą prieš varžovus. Atliekant judėjimo veiksmus didžiausia atsakomybė dėl jų kokybės tenka treneriui, kuris operatyviai patardamas padeda sportininkui efektyviau valdyti judesių struktūrą kaip treniruočių, taip ir varžybų veikloje ir kartu pasiekti didesnį sportinį meistriškumą.

Pateiktas inovatyvus būdas yra pakankamai efektyvus, tai patvirtinta ir eksperimento metu, ir gali būti taikomas dirbant su įvairių specializacijų bei kvalifikacijos žaidimų sporto šakų sportininkais.

Raktažodžiai: tinklinis, krepšinis, komandos, individualūs gebėjimai.

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SVEIKATA, REABILITACIJA IR TAIKOMASIS FIZINIS AKTYVUMAS
HEALTH, REHABILITATION AND ADAPTED PHYSICAL ACTIVITY

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7–8 klasių merginų ir vaikinų atletinio tapatumo, socialinių įgūdžių ir su sveikata susijusio fizinio pajėgumo sąsajos

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Santrauka

Tyrimo tikslas – nustatyti 7–8 klasių merginų ir vaikinų atletinio tapatumo, socialinių įgūdžių ir su sveikata susijusio fizinio pajėgumo sąsajas. Tyrimo objektas – 7–8 klasių merginų ir vaikinų atletinis tapatumas, socialiniai įgūdžiai ir fizinis pajėgumas. Tyrime dalyvavo 158 merginos ir 121 vaikinas. Tyrimas vyko 2017 m. keturiose Kauno miesto bendrojo ugdymo mokyklose. Fiziniam pajėgumui nustatyti buvo taikomi Eurofito testai: „Sėstis ir siekti“, „Šuolis į tolį iš vietos“, „Sėstis ir gultis“, „20 m ištvermės bėgimas šaudykle“. Naudotas Sportinio tapatumo klausimynas paaugliams (angl. Athletic Identity Questionnaire for Adolescents), kuris buvo sudarytas remiantis C. B. Anderson (2004) sukurtu sportinio tapatumo modeliu. Socialiniai įgūdžiai vertinti pagal adaptuotą R. E. Riggio ir H. S. Friedmano (1982) sudarytą Pagrindinių socialinių įgūdžių klausimyną.

Rezultatai. Nustatyta, kad 7–8 klasių merginų atletinis tapatumas yra 3,4 ± 0,6 balo, o vaikinų – šiek tiek didesnis – 3,5 ± 0,6 balo. Gauti abiejų lyčių paauglių aukščiausi atletinio tapatumo sportinės kompetencijos komponento vidurkiai (merginų – 3,8 ± 0,7; vaikinų – 4,0 ± 0,7), o mažiausi vidurkiai – mokytojų paskatinimo būti fiziškai aktyviam (merginų – 3,2 ± 1,2; vaikinų – 3,1 ± 1,2). Nustatyti aukščiausi merginų esminių socialinių įgūdžių (ESĮ) socialinio jautrumo (3,7 balo) bei socialinės kontrolės (3,7 balo) dėmenų vidurkiai; mažiausias yra emocinio ekspresyvumo vidurkis – 2,8 balo iš 5. Aukščiausias vaikinų vidurkis pasiektas tik pagal socialinės kontrolės komponentą (3,8 balo), o mažiausias – emocinio ekspresyvumo komponento (2,4 balo). Merginų „Sėstis ir siekti“ testo vidurkis lygus 22,6 cm, vaikinų – 21,3 cm. Merginų staigiosios jėgos rezultatas – 160,4 cm, o vaikinų – 176,4 cm. Merginų „Sėstis ir gultis“ testo vidurkis – 23,6 N/30s, vaikinų – 25,6 N/30s. Merginų „20 m ištvermės bėgimo šaudykle“ testo vidurkis – 1,9 min., o vaikinų – 3,1 min. Nustatytas stipriausias abiejų lyčių atletinio tapatumo ir socialinės kontrolės ryšys (merginų $r = 0,46$; $p < 0,05$; vaikinų $r = 0,34$; $p < 0,05$), silpniausias yra merginų atletinio tapatumo ir emocinio ekspresyvumo ryšys ($r = 0,29$; $p < 0,05$), o vaikinų – atletinio tapatumo ir emocinės kontrolės ryšys ($r = 0,13$; $p < 0,05$). Nustatytas merginų atletinio tapatumo ir visų fizinio pajėgumo testų rezultatų ryšys. ESĮ bendras balas stipriausiai koreliuoja su „Sėstis ir siekti“ testo rezultatais ($r = 0,34$; $p < 0,05$), silpniausias ryšys nustatytas su „Šuolio iš vietos į tolį“ testo rezultatais ($r = 0,25$; $p < 0,05$). Vaikinų atletinis tapatumas koreliuoja su „Sėstis ir siekti“, „Sėstis ir gultis“ testų rezultatais. Skirtingai nei merginų, vaikinų bendras ESĮ balas koreliuoja tik su „20 m ištvermės bėgimo šaudykle“ testo rezultatais.

Išvados. 7–8 klasių merginų ir vaikinų atletinis tapatumas yra aukštesnis nei vidutinis. Remiantis penkiabale sistema, merginos pasižymi gerais socialiniais įgūdžiais socialinės kontrolės ir socialinio jautrumo srityse, o vaikinai – tik socialinės kontrolės srityje. Paauglių lankstumo, staigiosios jėgos, liemens raumenų jėgos rodikliai yra šiek tiek žemesni nei vidutinė reikšmė, palyginti su Lietuvos 13–14 metų mokinių fizinio pajėgumo orientacinėmis skalėmis, o širdies ir kvėpavimo sistemos pajėgumas yra santykinai žemas. Merginų atletinis tapatumas teigiamai koreliuoja su visais Eurofito testais, o ESĮ bendras balas koreliuoja su tais pačiais testais, išskyrus „20 m ištvermės bėgimo šaudykle“ testą. Vaikinų atletinis tapatumas susijęs su lankstumu, raumenų ištverme, o ESĮ yra statistiškai reikšmingai susijęs tik su aerobine ištverme. Kuo socialinių įgūdžių bei atletinio tapatumo raiška geresnė, tuo geresnis yra fizinis pajėgumas.

Raktiniai žodžiai*: atletinis tapatumas, socialiniai įgūdžiai, fizinis pajėgumas, paauglystė.*

Įvadas

Paauglystėje sveikatą stiprinančio fizinio aktyvumo lygis yra itin sumažėjęs. Teigiama, kad pagal Pasaulio sveikatos organizacijos rekomendacijas pakankamai juda tik trečdalis Europos jaunimo (11, 13 ir 15 metų amžiaus). Daugelyje šalių labiau fiziškai aktyviais laikomi vaikinai nei merginos, tačiau ryškėja tendencija, kad su amžiumi tiek vaikinų, tiek

merginų fizinis aktyvumas mažėja (World Health Organization, 2015). Dėl neigiamų fizinio aktyvumo ir fizinio pajėgumo kitimo tendencijų paauglystėje tampa aktualus moksleivių socialinių įgūdžių raiškos vertinimas bei šių asmens fizinę ir psichosocialinę sveikatą atspindinčių veiksnių sąsajų nustatymas, nes, anot autorių, sėkmingas emocinis-socialinis vaiko vystymasis turi įtakos visam jo gyvenimui ir yra susijęs su pažinimo, bendravimo bei motorinių įgūdžių raida (National Scientific Council on the Developing Child, 2004). Žmogus sukurtas judėti, būti fiziškai aktyvus, bet per pastarąjį šimtmetį visuomenė, pasitelkusi savo intelektą bei moderniąsias technologijas, mechanizavo daugumą gamybos, gavybos procesų (Zumeris, 2012). Dėl to žmonijos fizinis aktyvumas mažėja, taip pat mažėja ir fizinis pajėgumas, skatinamas tolesnis lėtinių neinfekcinių ligų plitimas. Tyrimais įrodyta, kad geras fizinis pajėgumas suaktyvina fiziologinius procesus, kurie sietini su bendra asmens sveikata prisitaikant prie besikeičiančių sąlygų (Daniusevičiūtė et al., 2016). Didėjant mokinių amžiui, mažėja jų fizinis pajėgumas, o tai vienas iš žmogaus gerovės, fizinės būklės komponentų (Valintėlienė et al., 2012).

Šiuo metu yra siekiama, kad sportuojantis moksleivis arba sportininkas išsiugdytų socialinius įgūdžius, kurie asmeniui padės prisitaikyti šiuolaikiškame pasaulyje, rasti savo vietą, įveikti konfliktus, nepalūžti, atsispirti žalingiems poveikiams, o ne tik įgyti daugiau žinių ar sportinės veiklos gebėjimų (Šniras, Malinauskas, 2014). Ugdant socialinius įgūdžius mokomasi sąmoningai rūpintis sveikata, fizine parengtimi, fiziniu pajėgumu, būti fiziškai aktyviam (Grinkevičiūtė, Vyšniauskytė-Rimkienė, 2013). Atletinis tapatumas yra asmenybės suvokimas, kiek žmogus save sieja su fiziniu aktyvumu ar sportine veikla.

Ugdant aktyvios gyvensenos įpročius, kurie yra palankūs sveikatai, visam gyvenimui, labai svarbi yra atletinio tapatumo raiška (Houle, Brewer, Kluck, 2010). Atletinio tapatumo rodiklis gali parodyti, kaip nuo jo priklauso fizinis pajėgumas, todėl aktualu žinoti, kaip siejasi šie komponentai (Foster, Huml, 2017). Analizuojamą temą – atletinio tapatumo, socialinių įgūdžių ir su sveikata susijusio fizinio pajėgumo sąsajas – tiria Lietuvos bei užsienio mokslininkai. P. J. Teixeira ir kt. (2012) nustatė, kad moksleiviai, kurių stipriau išreikštas atletinis tapatumas, dažniau užsiima sportine veikla. Autorės V. Rakauskienė ir A. Dumčienė (2012) teigia, kad ryškesnį atletinį tapatumą turi fiziškai aktyvesni moksleiviai, palyginti su pasyviais bendraamžiais. T. Venckūnas ir kt. (2017) nustatė fizinio pajėgumo įvairiais laikotarpiais tendenciją Lietuvoje. Tyrimo tikslas – nustatyti 7–8 klasių merginų ir vaikinų atletinio tapatumo, socialinių įgūdžių ir su sveikata susijusio fizinio pajėgumo sąsajas.

Tyrimo organizavimas ir metodai

Tyrimas vyko dviem etapais 2017 m. gruodžio mėnesį. *Pirmojo etapo* metu atletiniam tapatumui ir socialiniams įgūdžiams nustatyti buvo atlikta anketinė apklausa raštu. Anketos buvo pildomos po kūno kultūros ir kitų mokomųjų dalykų pamokų, stebint pamoką vedančiam mokytojui ir tyrimą atliekančiam studentui. Atsakyti į anketos klausimus buvo skiriama 15 minučių, o kilus neaiškumams, paaiškinama. Atsakius į pateiktus klausimus, anketos iš karto surenkamos. Anketavimas vyko gruodžio 4–8 dienomis. *Antrojo etapo* metu buvo testuojami fizinio pajėgumo komponentai: lankstumas, staigioji jėga, liemens raumenų jėga, širdies ir kvėpavimo sistemos pajėgumas. Remiantis Eurofito testais (2017), kiekvienas fizinio pajėgumo testas buvo pritaikytas atitinkamam požymiui tirti. Tiriamąją imtį sudarė Kauno 7–8 klasių 158 merginos ir 121 vaikinas. Tyrimas vyko keturias dienas – 2017 m. gruodžio 18–21 d. Kauno bendrojo ugdymo mokyklų sporto salėse. Tyrimą stebėti buvo pakviestos kūno kultūros mokytojos, kurios užtikrino tvarką ir padėjo testuojant mokinius. Prieš kiekvieną testą mokiniai buvo su juo supažindinami, nusakoma testo eiga. Po trumpo testo pristatymo mokiniams buvo pademonstruota, kaip reikia atlikti testą. Testai buvo atliekami tokia seka:

1) „Sėstis ir siekti“ (lankstumas).
2) „Šuolis į tolį iš vietos“ (staigioji jėga).
3) „Sėstis ir gultis“ (liemens raumenų jėga).
4) „20 metrų ištvermės bėgimas šaudykle“ (širdies ir kvėpavimo sistemos pajėgumas).

Atletiniam tapatumui ir socialiniams įgūdžiams nustatyti atlikta anketinė apklausa raštu. 7–8 klasių mokinių atletinis tapatumas įvertintas pagal C. B. Anderson ir kt. (2007) sudarytą Atletinio tapatumo klausimyną paaugliams (angl. *Athletic Identity Questionnaire Athletic Identity Questionnaire for Adolescents – AIQ–Adolescent*). Klausimyną sudaro 40 teiginių, jis adaptuotas Lietuvoje (Rakauskienė, 2013). Savo pritarimą / nepritarimą teiginiams mokiniai įvertino pagal skalę nuo 1 iki 5,

kai: 1 – visiškai nesutinka su teiginiu, 2 – iš dalies nesutinka su teiginiu, 3 – nei sutinka, nei nesutinka, 4 – iš dalies sutinka, 5 – visiškai sutinka. Vertinti keturi pagrindiniai atletinio tapatumo komponentai:

1. Išvaizda (teiginiai: 1, 4, 7, 9, 17);

2. Sportinė kompetencija (teiginiai: 2, 5, 11, 14, 15, 18);

3. Fizinio aktyvumo svarba (teiginiai: 3, 6, 8, 10, 12, 13, 16, 19);

4. Socialinė kitų asmenų paskata būti fiziškai aktyviam (teiginiai: a + b + c):

a) tėvai (teiginiai: 20, 21, 22, 23, 24, 25, 26);

b) draugai (teiginiai: 27, 28, 29, 30, 31, 32, 33);

c) mokytojai (teiginiai: 34, 35, 36, 37, 38, 39, 40).

Atletinio tapatumo komponentams įvertinti pagal C. B. Anderson ir kt. (2007) pateiktas formules buvo išvedami vidurkiai nuo 1 iki 5 (kuo aukštesnis balas, tuo stipresnis atletinio tapatumo komponentas, kaip ir bendras atletinis tapatumas).

Paauglių pagrindiniams socialiniams įgūdžiams vertinti buvo naudojamas adaptuotas R. E. Riggio ir H. S. Friedmano (1982) sudarytas Pagrindinių socialinių įgūdžių klausimynas iš 24 teiginių, kurie vertinami pagal 5 balų skalę (Šniras ir Malinauskas, 2006). Kiekvienam įgūdžiui skirta po keturis teiginius. Buvo tiriami šeši socialiniai įgūdžiai: emocinis ekspresyvumas, emocinis jautrumas, emocinė kontrolė, socialinis ekspresyvumas, socialinis jautrumas bei socialinė kontrolė. Kiekvieno įgūdžio vertinimo balų vidurkis parodo jo lygį. Lygis suprantamas kaip įgūdžių, matuojamų balais, kokybės laipsnis: 1–1,4 balo – labai blogi įgūdžiai, 1,5–2,4 balo – blogi įgūdžiai, 2,5–3,4 balo – patenkinami įgūdžiai, 3,5–4,4 balo – geri įgūdžiai, 4,5–5 balai – labai geri įgūdžiai.

Matematinė statistika. Tyrimo duomenys buvo apdoroti ir analizuojami naudojant statistinį duomenų analizės paketą SPSS (*Statistical Package for Social Sciences*, 22.0 versija) bei *Microsoft Excel* 2010 programą. Buvo apskaičiuoti gautų rezultatų aritmetiniai vidurkiai, standartiniai nuokrypiai, minimalios ir maksimalios reikšmės, procentinė išraiška. Sąsajos tarp fizinio pajėgumo ir socialinių įgūdžių bei atletinio tapatumo buvo nustatomos taikant Pirsono (angl. *Pearson*) koreliacijos koeficientą (r). Rezultatai laikyti statistiškai reikšmingais, kai paklaidos tikimybės reikšmė yra $p < 0,05$, esant 95 proc. patikimumui.

Tyrimo rezultatai

Išanalizavus 7–8 klasių merginų ir vaikinų užpildytas atletinio tapatumo anketas buvo nustatytas tiriamųjų atletinis tapatumas ir jo komponentų raiška, išreikšta balais (žr. 1 lentelę).

1 lentelė

7–8 klasių merginų (n = 158) ir vaikinų (n = 121) atletinio tapatumo ir jo komponentų raiška (balais)

	Lytis	Minimali reikšmė	Maksimali reikšmė	Vidurkis ± Standartinis nuokrypis	p
Atletinis tapatumas	♀	1,9	4,8	3,4 ± 0,6	**0,05***
	♂	1,1	4,9	3,5 ± 0,6	
(1) Išvaizda	♀	1,0	5,0	3,7 ± 0,9	0,21
	♂	1,0	5,0	3,8 ± 0,8	
(2) Sportinė kompetencija	♀	1,7	5,0	3,8 ± 0,7	**0,04***
	♂	1,0	5,0	4,0 ± 0,7	
(3) FA svarba	♀	1,0	5,0	3,5 ± 0,9	**0,03***
	♂	1,0	5,0	3,7 ± 0,8	
(4) Bendras socialinis paskatinimas	♀	1,2	5,0	3,3 ± 0,8	0,62
	♂	1,0	5,0	3,3 ± 0,8	
(a) Tėvų paskatinimas	♀	1,3	5,0	3,5 ± 0,8	0,54
	♂	1,0	5,0	3,6 ± 0,8	
(b) Draugų paskatinimas	♀	1,0	5,0	3,2 ± 0,9	0,19
	♂	1,0	5,0	3,3 ± 0,9	
(c) Mokytojų paskatinimas	♀	1,0	5,0	3,2 ± 1,2	0,32
	♂	1,0	5,0	3,1 ± 1,2	

Pastaba: ♀ – merginos; ♂ – vaikinai.

FA – fizinis aktyvumas. Pirsono koreliacijos koeficientas r, kai $p < 0,05$*; $p < 0,01$**.

Iš gautų duomenų matyti, kad merginų atletinio tapatumo minimali reikšmė yra 1,9 balo, o maksimali – 4,8 balo, kai aukščiausias galimas balas yra 5. Vaikinų atletinio tapatumo minimali reikšmė yra 1,1 balo, o maksimali – 4,9 balo. Tiek merginų, tiek vaikinų atletinio tapatumo bendras balų vidurkis skiriasi minimaliai: merginų siekia 3,4 ± 0,6 balo, o vaikinų – 3,5 ± 0,6 balo. Visų, tiek merginų, tiek vaikinų, bendro socialinio paskatinimo komponentų maksimali reikšmė siekia aukščiausią įvertinimą – 5 balus. Išvaizdos, FA svarbos, draugų ir mokytojų paskatinimo minimali reikšmė yra 1 balas. Nustatytas statistiškai reikšmingas šių komponentų skirtumų lyties aspektu patikimumas: atletinio tapatumo ($p = 0,05$), sportinės kompetencijos ($p < 0,04$) ir FA svarbos ($p < 0,03$).

Toliau, 2 lentelėje, pateikiamas 7–8 klasių merginų ir vaikinų pagrindinių socialinių įgūdžių raiškos vertinimas.

2 lentelė

7–8 klasių merginų (n = 158) ir vaikinų (n = 121) esminiai socialiniai įgūdžiai

	Lytis	Minimali reikšmė	Maksimali reikšmė	Vidurkis ± Standartinis nuokrypis	p
EE balas	♀	1,3	4,5	2,8 ± 0,7	**0,00****
	♂	1,0	4,8	2,4 ± 0,7	
EJ balas	♀	1,8	5,0	3,6 ± 0,7	**0,00****
	♂	1,0	5,0	2,8 ± 0,7	
EK balas	♀	1,5	5,0	3,3 ± 0,7	0,33
	♂	1,0	5,0	3,2 ± 0,8	
SE balas	♀	1,0	5,0	3,3 ± 0,8	0,65
	♂	1,0	5,0	3,2 ± 0,8	
SJ balas	♀	1,8	5,0	3,7 ± 0,7	**0,002***
	♂	1,0	5,0	3,4 ± 0,7	
SK balas	♀	1,5	5,0	3,7 ± 0,8	0,13
	♂	1,0	5,0	3,8 ± 0,7	
ESĮ bendras balas	♀	1,6	4,5	3,4 ± 0,5	**0,001****
	♂	1,1	4,8	3,1 ± 0,5	

Pastaba: ♀ – merginos; ♂ – vaikinai.

EE – emocinis ekspresyvumas; EJ – emocinis jautrumas; EK – emocinė kontrolė; SE – socialinis ekspresyvumas; SJ – socialinis jautrumas; SK – socialinė kontrolė; ESĮ – esminiai socialiniai įgūdžiai. Pirsono koreliacijos koeficientas r, kai $p < 0,05$*; $p < 0,01$**.

Tyrimo rezultatai parodė, kad didžiausi socialinių įgūdžių vidurkiai yra 7–8 klasių merginų ir vaikinų socialinio jautrumo (merginų – 3,7 balo; vaikinų – 3,4 balo) bei socialinės kontrolės (merginų – 3,7 balo; vaikinų – 3,8 balo) srityse. Tiek merginų, tiek vaikinų mažiausi vidurkiai nustatyti vertinant emocinį ekspresyvumą (merginų – 2,8 balo; vaikinų – 2,4 balo). Statistiškai reikšmingas skirtumų patikimumas lyties aspektu nustatytas pagal EE, EJ, SJ komponentus ir ESĮ bendrą balą.

Remiantis kelių skirtingų Kauno bendrojo ugdymo mokyklų 7–8 klasių merginų ir vaikinų atliktų Eurofito testų rezultatais, buvo nustatytas tiriamųjų su sveikata susijęs fizinis pajėgumas. Fizinio pajėgumo testų rezultatų minimalios ir maksimalios reikšmės, vidurkiai, standartiniai nuokrypiai ir Eurofito testų balai pagal orientacines skales pavaizduoti 3 lentelėje.

3 lentelė

7–8 klasių merginų (n = 158) ir vaikinų (n = 121) su sveikata susijusio fizinio pajėgumo testų rezultatai

Fizinio pajėgumo požymis	Eurofito testas	Lytis	Minimali reikšmė	Maksimali reikšmė	Vidurkis ± Standartinis nuokrypis	p
Lankstumas	„Sėstis ir siekti“ (cm)	♀	13,0	38,0	22,6 ± 4,7	**0,002****
		♂	12,0	32,0	21,3 ± 4,5	
	„Sėstis ir siekti“ (balas)	♀	2	8	4,8 ± 1,4	**0,00****
		♂	3	9	6,1 ± 1,2	
Staigioji jėga	„Šuolis į tolį iš vietos“ (cm)	♀	107,0	215,0	160,4 ± 18,8	**0,00****
		♂	144,0	230,0	176,4 ± 15,3	
	„Šuolio į tolį iš vietos“ (balas)	♀	0	10	4,8 ± 1,8	**0,00****
		♂	1	9	4,0 ± 1,2	
Liemens raumenų jėga	„Sėstis ir gultis“ (N/30s)	♀	9,0	36,0	23,6 ± 4,2	**0,00****
		♂	19,0	35,0	25,6 ± 2,9	
	„Sėstis ir gultis“ (balas)	♀	0	10	4,8 ± 1,8	0,47
		♂	2	8	4,7 ± 1,2	
Širdies ir kvėpavimo sistemos pajėgumas	„20 m ištvermės bėgimas šaudykle“ (min.)	♀	0,7	4,0	1,9 ± 0,8	**0,00****
		♂	1,0	4,3	3,1 ± 0,8	
	„20 m ištvermės bėgimas šaudykle“ (balas)	♀	0	5	2,6 ± 1,1	**0,00****
		♂	1	4	3,1 ± 0,8	

Pastaba: ♀ – merginos; ♂ – vaikinai. Pirsono koreliacijos koeficientas r, kai $p < 0,05$*; $p < 0,01$**.

Iš gautų duomenų matyti, kad 7–8 klasių merginų **lankstumo** testo „Sėstis ir siekti“ minimali reikšmė yra 13,0 cm ir pagal Eurofito orientacines skales prilygsta 2 balams iš 10. Taip pat buvo nustatyta ir maksimali reikšmė: 38 cm – tai atitinka 8 balus. Vaikinų to paties testo minimali reikšmė šiek tiek mažesnė – 12 cm (3 balai); maksimali – 32 cm (9 balai). Akivaizdu, kad merginos yra lankstesnės už vaikinus. Ištyrus merginų **staigiąją jėgą**, buvo pastebėta, kad minimali reikšmė yra 107,0 cm (2 balai), o maksimali net 215,0 cm (10 balų). Vaikinų minimali reikšmė daug didesnė nei merginų – 144 cm (1 balas); maksimali siekia 230 cm (10 balų). Vaikinų staigiosios jėgos rodikliai pranoksta merginų tyrimų rezultatus. Siekiant nustatyti merginų **liemens jėgą**, buvo atliktas „Sėstis ir gultis“ testas. Iš gautų duomenų (3 lentelė) matyti, kad merginų testų rezultatų minimali ir maksimali reikšmė svyruoja nuo 0 iki 10 balų, vaikinų nuo 2 iki 8 balų. Merginų ir vaikinų testo „Sėstis ir gultis“ rezultatų vidurkiai skiriasi nedaug. Merginų yra 4,8 ± 1,4 balo, o vaikinų 4,7 ± 1,2 balo. Norint nustatyti **širdies ir kvėpavimo sistemų pajėgumą**, buvo atliktas „Ištvermės bėgimo šaudykle“ testas, kurio metu paaiškėjo, kad 7–8 klasių vaikinai yra ištvermingesni nei merginos. Merginų ištvermės bėgimo šaudykle vidurkis yra 1,9 ± 0,38 min., tai atitinka 2,6 balo, o vaikinų – 3,1 ± 0,8 min. ir tai atitinka tiek pat balų. Nustatytas visų Eurofito testų, išskyrus „Sėstis ir gultis“ testo, išreikšto balais, statistiškai reikšmingas skirtumų patikimumas lyties aspektu.

4 lentelė

7–8 klasių merginų (n = 158) atletinio tapatumo sąsajos su esminiais socialiniais įgūdžiais ir jo komponentais

	Atletinis tapatumas (balas)	**Išvaizda**	**Sportinė kompetencija**	**FA svarba**	**Bendras socialinis paskatinimas**	**Tėvų paskatinimas**	**Draugų paskatinimas**	**Mokytojų paskatinimas**
EE	**0,29****	**0,29****	**0,23****	0,13	**0,28****	**0,25****	**0,30****	**0,20***
EJ	**0,37****	**0,19***	**0,28****	**0,25****	**0,31****	**0,29****	**0,31****	**0,26****
EK	**0,30****	0,07	**0,17***	**0,24****	**0,27****	**0,29****	**0,29****	**0,18***
SE	**0,42****	**0,34****	**0,41****	**0,29****	**0,33****	**0,29****	**0,38****	**0,23****
SJ	0,11	–0,06	0,05	0,13	0,13	0,09	0,05	0,10
SK	**0,46****	**0,45****	**0,46****	**0,42****	**0,32****	**0,36****	**0,42****	**0,15**
ESĮ (bendras balas)	**0,49****	**0,35****	**0,41****	**0,37****	**0,43****	**0,39****	**0,47****	**0,29****

Pastaba: FA – fizinis aktyvumas. EE – emocinis ekspresyvumas; EJ – emocinis jautrumas; EK – emocinė kontrolė; SE – socialinis ekspresyvumas; SJ – socialinis jautrumas; SK – socialinė kontrolė; ESĮ – esminiai socialiniai įgūdžiai. Pirsono koreliacijos koeficientas r, kai $p < 0,05$*; $p < 0,01$**.

Analizuojant 7–8 klasių merginų atletinio tapatumo ir esminių socialinių įgūdžių (ESĮ bendras balas) sąsajas buvo nustatytas statistiškai reikšmingas ryšys ($p < 0,05$). Iš gautų duomenų matyti, kad atletinis tapatumas yra statistiškai reikšmingai susijęs su atskirais esminių socialinių įgūdžių komponentais, ypač su socialinės kontrolės ($r = 0,46$; $p < 0,05$) ir socialinio ekspresyvumo ($r = 0,42$; $p < 0,05$) komponentais. Taip pat su emocinio jautrumo ($r = 0,37$; $p < 0,05$), emocinės kontrolės ($r = 0,30$; $p < 0,05$), emocinio ekspresyvumo ($r = 0,29$; $p < 0,05$) komponentais. Tačiau tarp atletinio tapatumo ir socialinio jautrumo komponentų statistiškai reikšmingo ryšio nerasta ($p > 0,05$) (žr. 4 lentelę).

5 lentelė

7–8 klasių vaikinų (n = 121) atletinio tapatumo sąsajos su esminiais socialiniais įgūdžiais ir jo komponentais

	Atletinis tapatumas (balas)	**Išvaizda**	**Sportinė kompetencija**	**FA svarba**	**Bendras socialinis paskatinimas**	**Tėvų paskatinimas**	**Draugų paskatinimas**	**Mokytojų paskatinimas**
EE	**0,28****	**0,27****	**0,22****	**0,26****	**0,18***	0,08	**0,21***	0,13
EJ	**0,20***	0,16	0,11	**0,19***	0,14	0,11	**0,22***	0,02
EK	0,13	**0,23***	**0,20***	0,09	0,07	0,13	0,02	0,03
SE	**0,18***	**0,28****	**0,25****	**0,20***	0,04	0,09	0,09	–0,03
SJ	**0,19***	0,10	0,14	0,07	**0,18***	0,16	0,14	0,15
SK	**0,34****	**0,27****	**0,34****	**0,26****	**0,22***	**0,21***	**0,29****	0,06
ESĮ (bendras balas)	**0,31****	**0,31****	**0,30****	**0,25****	**0,20***	**0,19***	**0,22***	0,09

Pastaba: FA – fizinis aktyvumas. EE – emocinis ekspresyvumas; EJ – emocinis jautrumas; EK – emocinė kontrolė; SE – socialinis ekspresyvumas; SJ – socialinis jautrumas; SK – socialinė kontrolė; ESĮ – esminiai socialiniai įgūdžiai. Pirsono koreliacijos koeficientas r, kai $p < 0,05$*; $p < 0,01$**.

Analizuojant 7–8 klasių vaikinų atletinio tapatumo ir esminių socialinių įgūdžių (ESĮ bendras balas) sąsajas buvo nustatytas statistiškai reikšmingas ryšys ($p < 0,05$). Gauti duomenys rodo, kad atletinis tapatumas yra statistiškai reikšmingai susijęs su atskirais esminių socialinių įgūdžių komponentais, ypač su socialinės kontrolės ($r = 0,34$; $p < 0,05$), emocinio ekspresyvumo ($r = 0,28$; $p < 0,05$), taip pat su emocinio jautrumo ($r = 0,20$; $p < 0,05$), socialinio ekspresyvumo ($r = 0,18$; $p < 0,05$) komponentais. Deja, tarp atletinio tapatumo ir emocinės kontrolės statistiškai reikšmingo ryšio nebuvo nustatyta ($p > 0,05$) (žr. 5 lentelę).

6 lentelė

7–8 klasių merginų (n = 158) ir vaikinų (n = 121) su sveikata susijusio fizinio pajėgumo ir atletinio tapatumo sąsajos

Fizinio pajėgumo testai	**Fizinio pajėgumo požymis**	**Atletinis tapatumas (balas)**	
		Merginos	**Vaikinai**
Testas „Sėstis ir siekti“ (cm)	Lankstumas	**p**	**p**
		0,00**	**0,001****
Testas „Sėstis ir siekti“ (balas)		**0,00****	**0,003****
„Šuolio į tolį iš vietos“ testas (cm)	Staigioji jėga	**0,001****	0,28
„Šuolio į tolį iš vietos“ testas (balas)		**0,00****	0,93
Testas „Sėstis ir gultis“ (N/30s)	Liemens raumenų jėga	**0,00****	**0,003****
Testas „Sėstis ir gultis“ (balas)		**0,00****	**0,005****
„20 m ištvermės bėgimo šaudykle“ testas (min.)	Širdies ir kvėpavimo sistemos pajėgumas	**0,00****	0,26
„20 m ištvermės bėgimo šaudykle“ testas (balas)		**0,00****	0,21

Pastaba: Pirsono koreliacijos koeficientas r, kai $p < 0,05$*; $p < 0,01$**.

Gauti tyrimo rezultatai, pateikti 6 lentelėje, parodė, kad merginų atletinis tapatumas yra statistiškai reikšmingai susijęs su visais fizinio pajėgumo Eurofito testų „Sėstis ir siekti“, „Šuolis į tolį iš vietos“, „Sėstis ir gultis“, „20 m ištvermės bėgimas šaudykle“ rezultatais. Statistiškai reikšmingas ryšys nustatytas ir tarp visų testų rezultatų, išreikštų balais ($p < 0,05$). Vaikinų atletinis tapatumas koreliuoja su Eurofito testais „Sėstis ir siekti“ bei testu „Sėstis ir gultis“.

7 lentelė

7–8 klasių merginų (n = 158) ir vaikinų (n = 121) su sveikata susijusio fizinio pajėgumo ir esminių socialinių įgūdžių sąsajos

Fizinio pajėgumo testai	**Fizinio pajėgumo požymis**	**Esminiai socialiniai įgūdžiai (balas)**	
		Merginos	**Vaikinai**
Testas „Sėstis ir siekti“ (cm)	Lankstumas	**p**	**p**
		0,00**	0,20
Testas „Sėstis ir siekti“ (balas)		**0,00****	0,21
„Šuolio į tolį iš vietos“ testas (cm)	Staigioji jėga	**0,002***	0,46
„Šuolio į tolį iš vietos“ testas (balas)		**0,002***	0,65
Testas „Sėstis ir gultis“ (N/30s)	Liemens raumenų jėga	**0,001****	0,09
Testas „Sėstis ir gultis“ (balas)		**0,001****	0,20
„20 m ištvermės bėgimo šaudykle“ testas (min.)	Širdies ir kvėpavimo sistemos pajėgumas	0,08	**0,005****
„20 m ištvermės bėgimo šaudykle“ testas (balas)		0,07	**0,01****

Pastaba: Pirsono koreliacijos koeficientas r, kai $p < 0,05$*; $p < 0,01$**.

7 lentelėje pateikti 7–8 klasių merginų ir vaikinų esminių socialinių įgūdžių ir fizinio pajėgumo testų rezultatų duomenys parodė, kad merginų ESĮ bendras balas teigiamai koreliuoja su visais Eurofito testais ($p < 0,05$), išskyrus „20 m ištvermės bėgimo šaudykle“ testą ir atitinkamai jo balą. Stipriausias ryšys nustatytas su „Sėstis ir siekti“ testu ir jo balu ($p < 0,05$). Skirtingai nei merginų, vaikinų bendras ESĮ balas koreliuoja tik su jų aerobinės ištvermės komponentu, t. y. „20 m ištvermės bėgimo šaudykle“ testo rezultatais.

Tyrimo rezultatų aptarimas

Įvertinus tyrimo rezultatus matyti, kad 7–8 klasių merginų (n = 158) atletinis tapatumas, išreikštas balais, yra 3,4 balo. Merginas būti fiziškai aktyvesnes labiausiai skatina tėvai – 3,5 balo (atletinio tapatumo komponentas „kitų paskatinimas būti fiziškai aktyviam“). Mokslininkės V. Indriūnienė ir J. Čepelionienė (2014) savo tyrime atskleidė, kad 13–16 metų merginų atletinis tapatumas buvo 3,34 balo – šiek tiek žemesnis nei šiame atliktame tyrime. Nors bendras merginų socialinis paskatinimas būti fiziškai aktyvioms buvo žemiausiai įvertintas iš visų atletinio tapatumo komponentų, nustatyta, kad labiausiai merginas būti fiziškai aktyvesnes skatina taip pat tėvai – 2,89 balo (Indriūnienė, Čepelionienė, 2014). Tyrime įvertintas vaikinų atletinis tapatumas ir jo vidurkis buvo 3,5 ± 0,6 balo, t. y. aukštesnis už vidutinį ir netgi arčiau aukšto balo. Paaugliai aukščiausiu balu įvertino atletinio tapatumo komponentą – savo dalyvavimą fizinėje veiklo-

je, o žemiausiu balu buvo įvertintas mokytojų arba kitų suaugusiųjų paskatinimas būti fiziškai aktyviam. K. Mackelės ir R. Gruodytės-Račienės (2016) atliktame tyrime 8 klasių bendras vaikinų atletinis tapatumas įvertintas 3,7 ± 0,5 (šiek tiek aukštesniu balu nei mūsų gauti rezultatai). Jų tyrime vaikinai aukščiausiu balu įvertino savo sportinę kompetenciją, o mažiausiu balu, kaip ir mūsų tyrime, buvo įvertintas mokytojų arba kitų suaugusiųjų paskatinimas būti fiziškai aktyviam. T. M. Sabato ir kt. (2016) atliktu tyrimu nustatyta, kad ankstyvoje paauglystėje labai svarbus yra aplinkinių paskatinimas būti fiziškai aktyviam. P. J. Teixeira ir kt. (2012) nustatė, kad mokiniai, pasižymintys stipriau išreikštu atletiniu tapatumu, save dažniausiai realizuoja užsiimdami sportine veikla, yra fiziškai aktyvesni. Mokslininkės V. Rakauskienė ir A. Dumčienė (2012) teigia, kad fiziškai aktyvesni mokiniai pasižymi ryškesniu atletiniu tapatumu, palyginti su mažiau fiziškai aktyviais bendraamžiais.

Šiuo tyrimu nustatyta 7–8 klasių merginų socialinių įgūdžių raiška. Tyrimo rezultatai parodė, kad didžiausios socialinių įgūdžių vidutinės vertės pasiektos pagal socialinio jautrumo (3,7 balo) bei socialinės kontrolės (3,7 balo) kriterijus. Mažiausia vidutinė tirtų socialinių įgūdžių nustatyta vertė yra emocinio ekspresyvumo kriterijaus (2,8 balo). Vaikinų esminiai socialiniai įgūdžiai buvo įvertinti aukštesniu balu nei vidutinis, t. y. 3,1 balo, socialinė kontrolė buvo įvertinta aukščiausiu balu, o emocinis ekspresyvumas – mažiausiu balu. Š. Šniro ir R. Malinausko (2006) atlikto tyrimo, kurio tikslas buvo įvertinti miestų ir rajonų krepšinio sporto mokyklų mokinių socialinių įgūdžių raišką, rezultatai rodo, kad labai panašiu balu buvo įvertinti bendri esminiai paauglių vaikinų socialiniai įgūdžiai, o tiek aukščiausiu, tiek žemiausiu balu buvo įvertinti tie patys ESĮ komponentai. Š. Šniro atliktame empiriniame tyrime „Bendrojo ugdymo mokyklų paauglių socialinė kompetencija“ (2013) pagrindžiamas efektyvaus socialinių įgūdžių ugdymo per sportinę veiklą poveikis asmenybės tobulėjimui. Tai gali padėti užkirsti kelią negatyvioms psichologinėms aplinkybėms, kurios gali negatyviai veikti sportinius pasiekimus.

Įvertinus Klaipėdos 6-ų klasių merginų (Šarkauskienė ir Avižonienė, 2015) ir mūsų tirtų 7–8 klasių merginų staigiąją jėgą („Šuolis į tolį iš vietos“ testas), gauti rezultatai rodo, kad Klaipėdos merginų rezultatas yra 154,2 cm, t. y. mūsų tiriamųjų staigioji jėga didesnė (160,4 cm). Testo „Sėstis ir gultis“ rezultatai rodo, kad Klaipėdos merginų rezultatas atitinkamai yra 22,5 N/30s. O šiame tyrime tiriamųjų – 23,6 N/30s. Rezultatai atskleidė, kad mūsų tiriamųjų pilvo raumenų jėga labiau išlavinta. Remiantis atlikto tyrimo duomenimis matyti, kad merginų širdies ir kvėpavimo sistemos pajėgumas yra santykinai žemas. Siekiant nustatyti merginų širdies ir kvėpavimo sistemos pajėgumą buvo atliktas „Ištvermės bėgimo šaudykle“ testas, kurio metu paaiškėjo, kad 7–8 klasių merginų ištvermės bėgimo šaudykle vidurkis yra 1,9 ± 0,38 min., tai atitinka 2,6 balo. Moksliniais tyrimais (Tønnessen et al., 2015) nustatyta, kad lytinio brendimo metais merginų ištvermės didėjimo tempas lėtėja. Tyrimo tikslas buvo kiekybiškai įvertinti 11–18 metų amžiaus atletinio bėgimo ir šokinėjimo disciplinų veiklos rezultatus, nustatyti progresavimo skirtumus, kurie priklauso nuo amžiaus, disciplinos ir lyties. Tyrimas atliktas Norvegijoje, tyrimo imtis 100 sportininkų, kurių amžius nuo 11 iki 18 metų. Rezultatai rodo, kad vyriškos ir moteriškos lyties sportininkai beveik vienodai atlieka pratimus iki 12 metų amžiaus. Santykinis metinis moterų veiklos rodiklis laipsniškai mažėja per analizuojamą amžiaus periodą. Brendimo metu merginos pradeda gaminti didesnį cirkuliuojančio estrogeno ir kitų moterų lytinių hormonų kiekį. Palyginti su vyriškos giminės asmenimis, merginos susiduria su mažiau išreikštu augimo spartumu ir mažesniu raumenų masės padidėjimu, tačiau nuolat didėja riebalų masė ir taip sumažėja raumenų galios ir viso kūno masės santykis (Tønnessen et al., 2015). Remiantis B. H. Ghanbari ir kt. (2013) atliktais moksliniais tyrimais, galima teigti, kad dėl reguliarių ištvermės pratimų pagerėja kvėpavimo funkcija: didėja kvėpavimo raumenų jėga bei galingumas, gyvybinė plaučių talpa, maksimalioji ventiliacija, susidaro palankesnės sąlygos raumenų darbui, gali padidėti kvėpuojamasis tūris, o kvėpavimo dažnis – sumažėti. Išanalizavus mūsų tirtų 7–8 klasių merginų su sveikata susijusio fizinio pajėgumo rezultatus ir palyginus su Lietuvos 11–18 metų merginų Eurofito testų rodikliais matyti, kad 13–14 metų merginų testų „Sėstis ir siekti“ (22,5 cm), „Šuolio į tolį iš vietos“ (158,5 cm) ir „Pilvo raumenų jėgos“ (23,2/30s) vidurkiai yra labai artimi mūsų gautiems rezultatams. Tačiau mūsų tirtų 7–8 klasių merginų „20 m ištvermės bėgimo šaudykle“ testo rezultatų vidurkis daug prastesnis (1,9 min.) už bendraamžių merginų (3,6 min.) (Gruodytė-Ra-

čienė et al., 2017). G. Tomkinson ir kt. (2017) tarptautinio tyrimo tikslas buvo nustatyti 9–17 metų vaikų ir jaunuolių „20 m ištvermės bėgimo šaudykle“ testų rezultatus bei įvertinti 50 šalių tiriamųjų FITNESSGRAM kriterijaus standartus sveikos širdies, ištvermės, lyties ir amžiaus aspektais. Šiame tyrime dalyvavo 114 206 tiriamieji (vaikinai ir merginos). Nustatyti 13–14 metų merginų „20 m ištvermės bėgimo šaudykle“ testo rezultatai parodė, kad šių tiriamųjų ištvermės rodikliai yra daug didesni (3,75 min.) nei mūsų tirtų 7–8 klasių merginų (1,9 min.). Vertinant su sveikata susijusio fizinio pajėgumo testų rezultatus buvo nustatyta, kad aukščiausiu balu, palyginti su Lietuvos 11–17 metų mokinių Eurofito testų orientacinėmis skalėmis (Gruodytė-Račienė et al., 2017), buvo įvertintas vaikinų lankstumas, t. y. Eurofito testas „Sėstis ir siekti“ – 21,3 cm; vidutiniu balu įvertinta vaikinų raumenų ištvermė, t. y. testas „Sėstis ir gultis“ – 25,6 N/30s; panašiu balu įvertinta ir paauglių jėga, t. y. Eurofito testas „Šuolis į tolį iš vietos“ – 176,4 cm. Prasčiausiai įvertintas „20 m ištvermės bėgimo šaudykle“ testas – 3,2 min., kuris parodo širdies ir kvėpavimo sistemos ištvermę. Lyginant mūsų tyrime gautus duomenis su kitų autorių gautais rezultatais buvo remtasi 2017 m. atlikta studija – 30 Europos šalių vaikų ir paauglių (9–17 metų amžiaus) fizinio pajėgumo vertinimu Eurofito testais (n = 2 779 165) (Tomkinson et al., 2017). Kaip teigia autoriai, fizinė būklė yra svarbus geros sveikatos rodiklis, o Eurofito testai yra populiariausias būdas įvertinti moksleivių fizinį pajėgumą visoje Europoje. „Sėstis ir siekti“ testu (cm), kuris parodo lankstumą, buvo įvertintas – 18,2 cm (reprezentuoja 27 šalių rezultatus; tiriamųjų n = 25 302). Testas „Šuolis į tolį iš vietos“ (cm) parodo asmens staigiąją jėgą – gautas rezultatas – 181,4 cm, įtrauktos 29 šalys (tiriamųjų n = 24 061). Testas „Sėstis ir gultis“ (N/30 s) parodo raumenų ištvermę – įvertinimas – 23; įtrauktos 23 šalys (tiriamųjų n = 29 024); „20 m ištvermės bėgimo šaudykle“ testas (min.) rodo širdies ir kvėpavimo sistemos ištvermę ir įvertintas 6,5 balo; įtrauktos 24 šalys (tiriamųjų n = 28 262) (Tomkinson et al., 2017). Taigi, palyginus rezultatus, matyti, kad dviejų testų, kurie parodo lankstumą ir raumenų ištvermę („Sėstis ir siekti“ bei „Sėstis ir gultis“), mūsų tiriamųjų rezultatai buvo šiek tiek geresni nei studijos, kurioje aprašyti 30 Europos šalių reprezentuojantys rezultatai. Tačiau mūsų tiriamųjų staigiosios jėgos ir širdies ir kvėpavimo sistemos ištvermės („Šuolis į tolį iš vietos“ ir „20 m ištvermės bėgimo šaudykle“ testų) rodikliai buvo smarkiai prastesni. C. M. Nightingale ir kt. (2016) nustatė, kad vaikų fizinis pajėgumas priklauso nuo lyties bei etninės grupės. Merginų fizinis pajėgumas žemesnis už vaikinų. Nustatyta, kad Didžiojoje Britanijoje gyvenančių Pietų Azijos vaikų fizinis pajėgumas yra mažesnis, palyginti su baltaisiais europiečiais; priešingai, juodaodžių Afrikos ir Karibų jūros regiono vaikų fizinio pasirengimo lygis yra aukštesnis nei europiečių. Tirti 1 625 9–10 metų amžiaus vaikai iš Pietų Azijos, Užsachario (Juodosios) Afrikos ir Karibų jūros regiono bei europiečiai (baltieji) (Nightingale et al., 2016). 1992–2012 m. Lietuvos vaikų ir paauglių fizinio pajėgumo bei kūno kompozicijos kaitos tendencijas ištyrė T. Venckūnas ir kt. (2017). Tirta 16 199 mokinių. Eurofito testai buvo naudojami pusiausvyros, lankstumo, raumenų galios ir jėgos, judrumo, širdies ir kraujagyslių sistemos pajėgumo rodikliams gauti. Taip pat tirti mokinių antropometriniai duomenys – kūno masės indeksas. Rezultatai parodė, kad bendras fizinis mokinių pajėgumas nuo 1992 iki 2002 m. sumažėjo, o nuo 2002 iki 2012 m. fizinio pajėgumo bendra kitimo tendencija ir toliau buvo neigiama. Tačiau kai kurie fizinio pajėgumo komponentų rodikliai gerėjo. Taip pat nustatyta, kad didėjo mokinių kūno masės indeksas, nors ir nenustatyta, kad tai turėjo įtakos fizinio pajėgumo pokyčiams. Teigiamos vikrumo ir raumenų jėgos tendencijos matomos prieš 2002 m. Tačiau nuo 2002 iki 2012 m. šios tendencijos sumažėjo. Iki 2012 m. didėjo mokinių pusiausvyra. Jei bendroji neigiama fizinio pajėgumo tendencija tęsis, tai pakenks būsimų suaugusiųjų gerovei ir gali sukurti rimtą ekonominę naštą visuomenei (Venckūnas et al., 2017).

7–8 klasių merginų atletinis tapatumas teigiamai koreliuoja su visais Eurofito testais, o esminių socialinių įgūdžių bendras balas koreliuoja su tais pačiais testais, išskyrus „20 m ištvermės bėgimo šaudykle“ testo rezultatus ($p < 0,05$). Tiriant paauglių vaikinų atletinio tapatumo ir jų su sveikata susijusio fizinio pajėgumo sąsajas buvo nustatytas statistiškai reikšmingas paauglių vaikinų atletinio tapatumo ir lankstumo ryšys, t. y. Eurofito testo „Sėstis ir siekti“ rezultatai; taip pat atletinio tapatumo ir mokinių raumenų ištvermės ryšys, t. y. „Sėstis ir gultis“ testas. Tačiau tarp kitų su sveikata susijusių fizinio pajėgumo Eurofito testų ir atletinio tapatumo nebuvo nustatyta statistiškai reikšmingo

ryšio (p > 0,05). Tyrimo rezultatai atskleidė, kad paauglių vaikinų esminiai socialiniai įgūdžiai (ESĮ) yra statistiškai reikšmingai susiję tik su jų aerobine ištverme (t. y. Eurofito testu „20 m ištvermės bėgimas šaudykle“). Autorių F. P. Crawley ir kt. (2017) atlikti tyrimai rodo, kad fiziniai pratimai lavina sveiko kūno vystymąsi, gerina protą bei socialinius įgūdžius. D. K. Willson ir kt. (2017) atliktų tyrimų duomenimis, pozityvi šeimos, mokyklos, bendruomenės, sveikatos priežiūros įstaigų aplinka yra labai svarbi, siekiant pagerinti jaunimo su sveikata susijusius elgesio pokyčius. Subjektyvus pasitenkinimas gyvenimu yra svarbus bendras gerovės rodiklis. Jauni žmonės, kurie teigia, kad santykiai su tėvais ar globėjais yra geri, yra labiau patenkinti savo gyvenimu ir turi mažiau fizinių ar psichologinių nusiskundimų. Pavyzdžiui, merginos, kurioms lengva pasikalbėti su savo tėvais, jaučia didesnį pasitenkinimą gyvenimu ir yra labiau patenkintos savo išvaizda. Pasaulinė sveikatos organizacija pažymi, jog šeimos parama yra susijusi su teigiama paauglių emocine gerove ir jie rečiau įgyja sveikatai žalingų įpročių (World Health Organization, 2016). Mokyklos aplinka taip pat svarbi paauglių pasitenkinimui gyvenimu. Sėkmė moksle teigiamai veikia pasitenkinimą gyvenimu, o kiti veiksniai, tokie kaip patyčios, kelia riziką sveikatai ir yra susiję su mažu pasitenkinimu gyvenimu. Didesnis pasitenkinimas savo gyvenimu gali sumažinti neigiamą streso poveikį ir slopinti psichopatologinį elgesį (Huebner et al., 2004).

Išvados

1. 7–8 klasių merginų ir vaikinų atletinis tapatumas, remiantis penkiabale sistema, yra aukštesnis nei vidutinis.

2. 7–8 klasių merginos pasižymi gerais socialiniais įgūdžiais socialinės kontrolės ir socialinio jautrumo srityse, o vaikinai – tik pagal socialinės kontrolės komponentą.

3. 7–8 klasių paauglių lankstumas, staigioji jėga, liemens raumenų jėga yra šiek tiek žemesni nei vidutinės reikšmės, palyginti su Lietuvos 13–14 metų mokinių fizinio pajėgumo orientacinėmis skalėmis, o širdies ir kvėpavimo sistemos pajėgumas yra santykinai žemas.

4. 7–8 klasių merginų atletinis tapatumas teigiamai koreliuoja su visais Eurofito testais, o esminių socialinių įgūdžių bendras balas koreliuoja su tais pačiais testais, išskyrus „20 m ištvermės bėgimo šaudykle“ testą. Nustatytas atletinio tapatumo ir su sveikata susijusio fizinio pajėgumo sąsajų statistiškai reikšmingas atletinio tapatumo ir lankstumo ryšys. Taip pat vaikinų atletinis tapatumas yra susijęs su jų raumenų ištverme. Paauglių vaikinų esminiai socialiniai įgūdžiai (ESĮ) yra statistiškai reikšmingai susiję tik su jų aerobine ištverme. Kuo socialinių įgūdžių bei atletinio tapatumo raiška geresnė, tuo geresnis fizinis pajėgumas.

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THE LINKS BETWEEN ATHLETIC IDENTITY, SOCIAL SKILLS AND HEALTH-RELATED PHYSICAL FITNESS OF 7–8TH GRADE SCHOOLCHILDREN

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SUMMARY

Research aim was to identify links among athletic identity, social skills and health-related physical fitness of 7–8th grades' students (girls and boys). Research object: athletic identity, social skills and physical fitness of 7–8th grades' students (girls and boys). 158 female students and 121 male students participated in the survey, accomplished in 2017, it was carried out in four secondary schools in Kaunas. "Eurofit" tests: "Sit and reach", a "Standing broad jump", "Sit up", "20 meter shuttle run'' were used to identify health-related physical fitness

of schoolchildren. Athletic Identity Questionnaire for Adolescents (Anderson et al., 2007) was used and it was based on C. B. Anderson (2004) athletic identity model. Aiming to assess social skills, adapted Riggio & Friedman (1982) basic social skills questionnaire (Šniras and Malinauskas, 2006) was used.

Results: 7–8th grades girls' athletic identity is 3.4 ± 0.6, boys' results seems to be a little bit higher (3.5 ± 0.6). Both genders adolescents' highest averages of score identity were reached in sport competence (girls 3.8 ± 0.7; boys 4.0 ± 0.7) lowest – at teachers encouragement to be physically active (girls 3.2 ± 1.2; boys 3.1 ± 1.2). Girls essential social skills (ESS) highest averages were reached in social sensitiveness (3,7) as well in social control (3.7) fields; lowest average – in emotional expressiveness (2.8 out of 5). Boys highest averages were reached in social control field (3.8) and the lowest – in emotional expressiveness (2.4). Test "Sit and reach" average is 22.6 and 21.3 cm in girls and boys, respectively. "Standing broad jump" test result of girls is 160,4 cm, boys – 176.4 cm. "Sit up" average of schoolgirls is 23,6 N/30s, schoolboys – 25.6 N/30s. "20 meter shuttle run'' average of girls is 1.9 min., boys – 3.1 min. The strongest relation is established in both genders between athletic identity and social control (schoolgirls $r = 0.46$; $p < 0.05$; schoolboys $r = 0.34$; $p < 0.05$) the weakest relation in girls is between athletic identity and emotional expression ($r = 0.29$; $p < 0.05$), talking about boys – athletic identity and emotional control ($r = 0.13$; $p < 0.05$). Identified relation between athletic identity and all physical fitness tests results of schoolgirls. Total score of ESS have the strongest correlation with test "Sit and reach" ($r = 0.34$; $p < 0.05$), the lowest relation with "Standing broad jump" test ($r = 0.25$; $p < 0.05$). Athletic identity of boys has correlation with Eurofit tests "Sit and reach" and "Sit up". Unlike girls, ESS score of boys have correlation only with "20 meter shuttle run''.

Conclusions: athletic identity of 7–8th grade girls and boys is higher than average (in 5 grade scale). Girls have good social skills in social control and social sensitivity areas, boys – just in social control. Flexibility, explosive power and trunk muscle strength of teenagers is little lower than average, comparing it to Lithuania 13–14 years pupil's physical fitness referential scales, and cardiovascular capacity is relatively low. Girls' athletic identity positively correlates with all Eurofit tests. Common score of ESS correlates with same tests, except 20 meter shuttle run. Boys' athletic identity correlates with flexibility and muscular endurance. ESS of teenagers boys are statistically significantly related to aerobic endurance. The better expression of social skills and athletic identity, the better is physical fitness.

Keywords: athletic identity, social skills, physical fitness, adolescence.

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Anabolic agents in elite sport: accent on side effects (review)

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Summary

Under current conditions with noticeably increased competition between the leading sports countries on the global stage, the greatest success is achieved, as a rule, by representatives of the country, in which the latest achievements of science and technology are best used. The level of modern sport development, those overloads that the athletes experience are so high that any attempts to stop using medicinal preparations reflect the views of not even yesterday, but the day before yesterday. Over the past 15–20 years, the volume and intensity of training and competitive loads have increased by 2–3 times, and representatives of many sports events have almost reached the limit of the human body physiological capacities. That having been said, the nutritional inadequacy of athletes' diets, the need for recovery and preventive measures, body adaptation to intensive physical and psychoemotional loads as well as frequent climate and time zone changes necessitate the usage of pharmacological preparations contributing to work capacity increase and accelerating the recovery processes after significant loads. Unfortunately, this has led to widespread usage of doping in general and anabolic steroids, in particular.

Anabolic means are the substances the action of which is aimed at intensification of anabolic (synthetic) processes in the body, i.e. substances accelerating formation and regeneration of structural parts of cells, tissues and muscular structures. Non-Olympic sports events representatives and the youth not engaged in professional sport tend to use steroid doping as well. The prevalence of usage of banned substances and methods remains high, reliable high-precision methods for the detection of many of them are absent, and athletes, not knowing the pitfalls of taking anabolic agents, continue to use them on a mass scale, which can cause both immediate and remote negative effects on health and quality of life. Therefore, every new attempt to explain potential health and life quality hazards is a step forward in the fight against doping.

This review presents modern classification of anabolic agents, headlines their action mechanism and details side effects of using representatives of all three groups of banned drugs including those recently synthesized. It is emphasized that the use of anabolics may not only lead to deprivation of medals won illegally, but cause immediate and delayed negative influences on the athlete's body further resulting in deterioration of social adaptation, loss of health and, possibly, life itself.

Keywords: *sport, doping, WADA Prohibited List, anabolic agents, androgenic anabolic steroids, athlete health.*

Problem statement

The level of modern sport development, those overloads that the athletes experience are so high that attempts to refuse to use allowed pharmacological ergogenic aids at all reflect the views of not even yesterday, but the day before yesterday. It is known that over the past 15–20 years, the volume and intensity of training and competitive loads have increased significantly, and representatives of many sports events have come close to the limit of the human body physiological capacities (Maravelias et al., 2005). According to Julian Savulescu, Professor of Oxford University (Great Britain), "… *humanity has exhausted nature inherent capacities of the body. After Ben Johnson only nine athletes managed to run 100 m faster than 9.8 seconds, and he set his record back in 1988. Only two of them are still doping unspotted.*" (Savulescu et al., 2013). The above necessitates application of allowed pharmacological preparations of ergogenic character, however, in many cases the process of elite athletes' preparation is not without the use of WADA banned anabolic means.

Anabolic means are the substances the action of which is focused on intensification of anabolic (synthetic) processes in the body, i.e. substances accelerating formation and regeneration of structural parts of cells, tissues and muscular structures (Frati

et al., 2015). The use of steroids or more precisely androgenic anabolic steroids (AAS) was widely spread among the Olympic athletes in 70–80s of the last century. In November 1990, all anabolic steroids were ranged to a class of controlled dangerous substances (CDS) by American legislation (Gosetti et al., 2013). As of today, the prevalence of usage of banned substances and methods remains high, reliable high-precision methods for the detection of many of them are absent, and athletes, not knowing the pitfalls of taking anabolic agents, continue to use them on a mass scale, which can cause both immediate and remote negative effects on health and quality of life (Geyer et al., 2014).

In view of the aforesaid, the **objective** of the given review of scientific and methodological literature was the formation of ideas about anabolics as a prohibited means, mechanism of their biological action and side effects that occur during their usage and produce negative impacts on the health of athletes.

Structure and mechanism of anabolic steroids action

Anabolics traditionally top the WADA list of prohibited substances. In WADA list 2015 it is Class S1. "Anabolic agents", which includes three groups of prohibited substances: AAS proper, endogenous anabolic steroids when administered exogenously and "other anabolic agents". Despite stringent prohibition by the International Olympic Committee, elite athletes in their zeal to gain victories quite frequently resort to anabolic steroids use during preparation, thus making a choice between health and the Olympic gold in favour of the latter.

All anabolic steroids (AS) are based on a tetracyclic hydrocarbon that has a radical methylation $–CH_3$ in position 13, sometimes in position 1, 7, 10; of crucial importance is the presence of different length radical in position 17 determining the duration of action of this or that anabolic steroid, to a great extent. Direct correlation between radical length and duration of action is explained by the fact that its elongation results in increased lipid solubility and intensity of depot formation in subcutaneous tissue. It is just availability of radical methylation $–CH_3$ in position 17 that confers hepatotoxic properties to anabolic steroids (Busardò et al., 2015).

AS usage is associated with drastic increase of body ability to absorb proteins – protein requirement may increase more than threefold, up to 300 g per day. Accordingly, the proportion of fats and carbohydrates decreases leading to impairment of metabolic processes (Grandys et al., 2012). Increase of anabolic steroids dose above therapeutic one provides only slight enhancement of anabolic action along with sharp rise in side effects manifestation (Hajimoradi, Kazerani, 2013).

The influence of anabolic steroids on protein metabolism is related, above all, to the impact on cell genetic apparatus. Anabolic steroids penetrate directly into the cell nucleus through cell membranes and inhibit protein synthesis gene depressor. This leads to protein synthesis intensification in the cell: the synthesis of both matrix protein and RNA and DNA enhances (Marqueti et al., 2012; Pomara et al., 2015). Besides, permeability of cell membranes to amino acids, micronutrients and carbohydrates tends to increase along with elevation of glycogen synthesis rate. Use of AS intensifies the activity of pentose phosphate cycle where the parts of protein molecules are synthesized from carbohydrates. Anabolic steroids improve carbohydrate metabolism, increase insulin action as well as reduce blood sugar content. Besides, they may potentiate the action of endogenous somatotropin (growth hormone) that further enhances the anabolic effect.

All researchers note an increase of liver protein synthesis as a consequence of AS usage, however, in 5% of the followed up patients treated with these drugs, jaundice has developed as a result of cholestatic hepatitis, which disappeared after steroid hormones withdrawal. Practitioners note liver pains in almost 70% of cases of AS usage caused by biliary retention in bile ducts (Ross, 2014). While using prohibited anabolics the observed body mass gain occurs at the expense of not only muscular tissue but the increase of viscera mass – liver, heart, kidneys, etc. (Luciano et al., 2014; Maravelias et al., 2005) as well, which produces adverse effects on health, although being expressed to a lesser extent than the body mass increase.

Classification of anabolic androgenic steroids

Anabolic androgenic steroids (AAS) are subdivided into *endogenous*, i.e. inherent in the body, but administered exogenously, and *exogenous*, not inherent in it initially. This subdivision is pretty speculative as far as even Professor Charles Kochakian, a world renowned expert in this field

and the pioneer in the creation of synthetic steroids has never been able to clearly divide AAS into exogenous and endogenous during the period of 25 years (Kochakian, Yesalis, 2008), and here is why. The term "anabolic steroids" is commonly used to denote synthetic androgenic steroids, other than testosterone derivatives, however both names are used alternately. It is known that the main male sex hormone testosterone and its analogs possess anabolic activity. Anabolic activity of this or that preparation is determined in relation to anabolic activity of testosterone, which is taken as a unit. Androgenic activity is expressed in a similar way relative to androgen activity of testosterone, whereas the ratio of anabolic to androgenic activity is called the anabolic index (Gunina, 2015). Pronounced androgenic action of these compounds prevents their usage as health anabolic aids. In this respect, new steroid compounds close in structure to androgens but possessing a selective anabolic activity along with simultaneously less evident androgenic action were synthesized. These compounds were called anabolic steroids. A widely recognized review published under authorship of Dr. C. R. Braun of the Columbia Hospital of Ohio State University (USA) discusses numerous effects of the natural steroids – anabolic that are necessary for tissue construction and androgenic leading to masculinization (Braun, 2013), which corresponds to findings of other American scientists (Shahidi, 2001).

It should be noted that scientists have invested great efforts in order to obtain a purely anabolic preparation without side effect of androgens. The molecules of steroids were subjected to a wide variety of changes, which led to the creation of a number of new AAS. Substances were obtained with either increased or decreased androgenic and anabolic activity. Structural changes of some steroids resulted in even higher androgenicity and reduced anabolic activity (Robles-Diaz et al., 2015). Despite all efforts the scientists failed to create a "pure anabolic" with dissociated anabolic and androgenic features.

The main representative of AAS is a male sex hormone testosterone that has a direct influence on most tissues acting through specific androgen receptor. In muscle cells, it probably acts directly on androgen receptors, the density of which there is much lower as compared to other, more androgen sensitive tissues. Anabolic effect of most modern anabolic preparations significantly exceeds that of testosterone (Mhillaj et al., 2015). Consequently, all these preparations produce side effects peculiar for testosterone to a greater extent: retention of sodium, potassium, sulphates, phosphates and water, increased muscle growth in response to physical load, increased aggressiveness and libido, etc. (Isidori et al., 2005).

Synthetic derivatives of testosterone entering the body affect hypothalamus and hypophysis inhibiting hormone release and terminating testosterone production by testes, which influences seminal fluid production and thus, destroys the natural closed system of internal regulation. After cessation of synthetic steroid use, even in case of therapeutic usage, the body natural functions may not recover (Srinath, Dobs, 2014), especially when high doses of anabolic steroids were used as is the case with the athletes (Gunina, 2015).

Side effects of anabolic steroids

The mechanism of AS impact on the body is multifaceted, and the range of side effects during their long-term and even short-term usage is extremely wide (Table). For instance, it has been demonstrated that anabolic steroid use may contribute to disorders of thyroid gland function, activity of gastrointestinal tract up to the development of the hemorrhages (Vanberg, Atar, 2010). AS usage is associated with the decrease of sexual activity and progressive mental changes with unpredictable mood fluctuations, increased excitability, irritation, development of aggressive behaviour or depression (Ahrens et al., 2012).

Table

Mechanism of action, efficiency and side effects of anabolic steroids

Characteristics	Mechanism of action	Efficiency	Side effects
A group of different in structure and origin means able to enhance the processes of protein and other substances synthesis in the body. Anabolic steroids are synthetic derivatives of testosterone with reduced androgenic and preserved anabolic activity. In addition to anabolic steroids proper, this class includes *"*other anabolic agents*"* (zeranol, zilpaterol, clenbuterol), selective androgen receptor modulators (andarine and ostarine) that have been synthesized recently, and whose negative effects and long-term side effects have been insufficiently studied.	The most peculiar feature of anabolic steroids is their ability to enhance the synthesis of nucleic acids and protein, as well as structural elements of body cells; stimulation of amino acids absorption in the small intestine. Activate the production of insulin-like growth factor 1 and erythropoietin, as well as anabolic processes in the bone marrow (antianemic action). Increase appetite and weight gain. Positively affect nitrogen metabolism; inhibit the removal of potassium, sulfur and phosphorus required for protein synthesis; promote calcium fixation in the bones.	Activation of repair processes in bone and muscle tissue. Increase of strength indices, muscle volume, decrease of body fat content, breathing stimulation, increase of endurance and muscle capillarization. Work capacity increase, intensification of regenerative reactions and regeneration processes after traumas.	Synthetic derivatives of testosterone entering the body affect hypothalamus and hypophysis inhibiting hormone release and terminating testosterone production by testes. Lead to ligament damage (Achilles tendon rupture); tissue fluid retention, cardiovascular system dysfunction, mental disorders, liver damage, virilisation (in women), development of gynecomastia, decrease in testicle volume and quantity of sperm, infertility (in men), premature growth cessation in children and adolescents, manifested in cessation of epiphyseal plate growth in the bones; development of malignant tumours. After cessation of synthetic steroid preparation use the body natural functions may not recover.

Marked shifts in character and behavior often lead to serious consequences: break up with friends, family breakdown, appearance of prerequisites for making socially negative and even dangerous actions ("steroid rage"). According to some observations, complete discontinuation of AS is often accompanied by depression, which is considered as a manifestation of mental dependence on anabolics, similar to dependence on narcotic drugs (Mhillaj et al., 2015).

Anabolic steroids cause disorders of carbohydrate and fat metabolism, reducing resistance to glucose and increasing that to insulin, which is accompanied by drop in blood sugar, sometimes being of a critical nature. Usage of tableted forms of AS increases insulin secretion, which contributes to the onset of type II diabetes mellitus (Srinath, Dobs, 2014.). In addition, the development and/or rapid progression of atherosclerosis and other cardiovascular system diseases may occur (Thomas et al., 2012).

AS usage promotes intensive growth of muscle mass, which significantly exceeds the growth and development of respective tendons, ligaments and other connective tissues. This leads to ruptures of ligaments during heavy physical loads, the occurrence of inflammatory diseases and joint capsule, the development of tendon degeneration. Reduced viscosity of muscle tissue, due to water and sodium retention, causes a decrease of muscle elasticity (subjectively evaluated as "delayed onset muscle soreness" or "stiffness"), leads to inability to develop full-fledged muscular efforts. All this causes a predisposition to injuries of the muscular system and ligamentous apparatus during training and competitions.

It is also known that the use of AAS can lead to neoplasm development in the athletes – liver cancer (hepatocellular carcinoma) and gynecomastia (Rahnema et al., 2014, Teng et al., 2015). Less important for the prognosis and quality of life are such negative effects of steroids as virilization (hirsutism in women), the appearance of acne, fluid retention in tissues (Hajimoradi, Kazerani, 2013). Women should also be mindful of the potential virilizing effects of AAS (coarsening of the voice, irregular periods, changes in skin structure, trichauxis and enlargement of the external genitalia). However, up to now, the side effects of all the numerous, known to date, AAS have not been fully studied.

Anabolic steroids in adolescents may induce irreversible changes: cessation of long bone growth (closure of growth zones), followed by the development of short stature, precocious sexual development, the phenomenon of virilization and gynecomastia (Hajimoradi, Kazerani, 2013), which indicates absolute inadmissibility of steroids usage by young athletes.

In addition to the AAS proper, "other anabolic agents" also belong to the class S1 of prohibited anabolic agents: zeranol, zilpaterol, clenbuterol, selective androgen receptor modulators; the latter include, in particular, andarine and ostarine,

recently synthesized and insufficiently studied in terms of their acute and remote negative effects on the body (Thevis et al., 2015), as well as tibolone. It is noteworthy that tibolone, which is mainly used for treatment of postmenopausal symptoms in women, can be successfully replaced with a nontoxic herbal preparation (based on the extract of Actaearacemosa, the rattleweed, better known as cimicifuga), since the action of the active components of the latter has quite comparable direction and efficiency with chemical substance tibolone (Ross SM, 2014).

The most common representative of "other anabolic agents" group in sport is clenbuterol. This substance does not belong to the steroid hormones proper, but the mechanisms of its influence on the body are compared with those of steroids. First of all, clenbuterol has a powerful anti-catabolic effect, i.e. it reduces the percentage of protein degrading in muscle cells and promotes an increase in the number and volume of muscle cells. Clenbuterol has a number of side effects, ranging from the occurrence of tremor, sweating, insomnia, anxious feelings to the appearance of tachycardia and seizures, which substantiates its ban for unauthorized use in sport according to the criterion of "harm/benefit" (Thieme, Hemmersbach, 2010). As concerns andarine, first included in the Prohibited List in 2015, it is a preparation developed by "GTX.Inc" company for treatment of such diseases as muscle atrophy, osteoporosis and benign prostatic hypertrophy. Andarine prevents the occurrence of side effects of antiandrogen drugs and prevents the development of prostatic hyperplasia. This property of local blocking of dihydrotestosterone binding to the receptors deprives the andarine of such negative side effects as premature hair loss or prostate enlargement, which are so characteristic of other anabolic drugs of steroid nature. Ostarine is a new representative of this group of AAS class (Enobosarm, GTx-024, MK-2866). This active substance, now undergoing clinical trials, belongs to the class of selective androgen receptor modulators (Thevis et al., 2015). Ostarine was developed by "Merck & Company" and "GTX Inc." pharmacological giants for treatment of muscular atrophy and osteoporosis. In the course of clinical trials it has been found that the level of testosterone in men not only fails to increase, but tends to decrease. Besides, a decrease in the level of high-density lipoproteins has been shown with an invariable level of low-density lipoproteins, which is indicative of increased risk of cardiovascular pathology development. Increased level of liver marker enzymes has been also noted, which may indicate the impairment of liver function.

Conclusion

Therefore, numerous data of modern scientific literature demonstrate that despite an obvious increase of sports results as a consequence of anabolic agents usage, their acute and especially long-term negative effects on athlete body are extremely high. The widest range of side effects of these pharmacological substances does not stand up to analysis according to "harm/benefit" ratio as the most important criterion for their inclusion in the WADA Prohibited List. It is the side effects, which develop during the use of anabolic agents by both young and skilled athletes that should become the object of focused attention of coaches, sports physicians and officials as well as mass media for the purpose of maintaining athletes' health, quality of life and the life itself. In this light, a number of new initiatives have been recently implemented to coordinate the anti-doping strategy in sport at the international level, including the development of new analytical methods for studying the steroid profile of athletes.

The widest range of anabolic steroids side effects according to "harm/ benefit" criterion fully justifies their inclusion in the WADA Prohibited List and requires close attention on the part of sports and medical community to prevent the use of steroids by athletes, and especially the young, due to the threat of quality life deterioration and the risk of fatal outcomes.

One should bear in mind that the correct way of life, the competent use of training and permitted extra-training ergogenic aids, balanced rational nutrition, adequate to load intensity, sports event specifics and the period of preparation application of recovery means will help athletes to succeed honestly without the use of anabolic steroids.

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ANABOLINĖS MEDŽIAGOS ELITINIAME SPORTE: ŠALUTINIO POVEIKIO EFEKTAS (APŽVALGA)

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SANTRAUKA

Tarptautinėje sporto arenoje, nuolat didėjant konkurencijai tarp didžiųjų valstybių, dažniausiai sėkmingai pasirodo tų šalių sportininkai, kuriose daugiau taikomi naujausi mokslo ir technologijų laimėjimai. Šiuolaikinio sporto išvystymo lygis, dideli krūviai, kuriuos patiria sportininkai, neįmanomi be farmakologijos preparatų, medicininio aprūpinimo. Per pastaruosius 15–20 metų treniruočių ir varžybų krūvių apimtis ir intensyvumas padidėjo 2–3 kartus ir daugumos sporto šakų atstovų jis pasiekė kritinę žmogaus organizmo fiziologinių galimybių ribą. Be to, esant neracionaliai mitybai, nepakankamam atsigavimo ir reabilitacijos procedūrų kiekiui, dideliems psichoemociniams krūviams, dažnai klimatinių ir laiko juostų kaitai kelionės metu vis labiau didėja farmakologinių preparatų, didinančių darbingumą ir skatinančių atsigavimo procesus po krūvių, poveikis. Todėl šiuo aspektu dopingas ir anaboliniai steroidai, deja, labai paplito.

Anaboliniai preparatai – tai medžiagos, kurių veikla nukreipta į anabolinių (sintetinių) procesų stiprinimą organizme. Šios medžiagos skatina ląstelių, audinių, raumenų struktūros susidarymą ir atsinaujinimą. Neolimpinių jėgos sporto šakų sportininkai ir jaunimas, lankantis treniruočių sales, taip pat vartoja steroidinį dopingą. Draudžiamų preparatų vartojimas ir metodų taikymas pakankamai paplitęs, o sportininkai, nežinantys anabolinių medžiagų vartojimo pavojaus, masiškai juos vartoja ir tai gali turėti neigiamų pasekmių sveikatai ir gyvenimo kokybei tiek artimiausiu metu, tiek ir tolesnėje ateityje. Todėl kiekvienas bandymas išsiaiškinti galimą žalą sportininko sveikatai ir jo gyvenimui yra žingsnis pirmyn kovojant su dopingo vartojimu.

Apžvalginiame straipsnyje pateikta naujausia anabolinių preparatų klasifikacija, nušviestas jų veikimo šalutinis efektas.

Darbe akcentuojama, kad anabolinių preparatų vartojimas gali nutraukti sportininko karjerą, taip pat gali tapti negatyvios įtakos organizmui priežastimi tiek tuo metu, tiek ir tolesnėje ateityje, sukelti sportininko socialinės adaptacijos problemų, pavojų sveikatai bei gyvybei.

Raktažodžiai: sportas, dopingas, WADA draudžiami preparatai, anaboliniai preparatai, anaboliniai steroidai, sportininko sveikata.

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The combined effect of dietary supplement "Leptin Manager" and power fitness exercises on weight loss in women with different *LEPR* (rs1137101) genotypes

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Summary

The aim of this study was to establish the effect of combined action of the dietary supplement "Leptin Manager™" and the power fitness program on weight loss in women with different genotypes of the 1st and the 2nd period of mature age. The study involved 62 overweight women (BMI≥25).The experimental group consisted of 21 women, who participated in the power fitness training program while simultaneously administering the drug "Leptin Manager" (manufactured by Xymogen, USA). The control group consisted of 17 women, who were engaged in power fitness and did not take the drug, and 24 women, who were not engaged in power fitness. The duration of the study was three months. The training method was based on the CrossFit system, functional training, included using machines (block and lever devices) according to the Full-body system in each training. The Q223R polymorphism of the leptin receptor gene (LEPR) was determined by the polymerase chain reaction in real time. Leptin indicators in Q allele carriers were twice higher than in R/R-genotype carriers ($p = 0.045$). Combined effect of the training program of power fitness and the use of the drug "Leptin Manager" resulted in more significant changes of anthropometric indices of the body composition of overweight women when compared with the control group. The most drastic changes in the body composition occurred in women with the R/R genotype of the LEPR gene. The usage of the drug "Leptin Manager" reduced leptin levels: in the experimental group by 33.4% ($p < 0.05$), meanwhile in the control group by 6.1%.

Conclusion. The Q223R polymorphism of the LEPR gene can be a molecular genetic marker of leptin resistance. Q allele Q223R polymorphism of the LEPR gene facilitates the development of obesity. R alleles and the R/R-genotype of the LEPR gene help reducing leptin levels after exercise. The usage of "Leptin Manager" combined with physical activity reliably decreases leptin levels when compared with the control group.

Keywords: *leptin, power fitness, leptin receptor gene polymorphisms, "Leptin Manager", overweight.*

Introduction

Today, one of the most pressing problems is overweight and obesity. Worldwide there is a trend toward increased prevalence of this disease. 39% of the world's population over age of 18 have excess body weight and 13% are obese. According to the report, made by the World Health Organization in 2017, the number of people, suffering from obesity, increased in many European countries. Obesity is becoming an epidemic and leads to a significant deterioration of human health. In industrialized countries, almost 50% of the population are overweight with 30% of them suffering from obesity. In Ukraine, every fourth woman and every sixth man are overweight. In total, about 15–20% of our country's population are obese.

It is believed that 77% of the intensity of metabolism and the predisposition to overweight are determined genetically with only 23% dependent on the environment and individual lifestyle (Wardle, 2008). Today, genetic factors are considered to be significant contributors to the pathogenesis of obesity (from 30 to 70%) (Rankinen, Bouchard, 2007; Bouchard, 2008). Such indicator as waist circumference depends on genetic factors by 60%, since the body mass index – by 40%.

Obesity can be conditioned both mono-genetically and poly-genetically, that is, obesity can be caused by one or several genes. The latest map of genes that contributes to obesity – "The Human Obesity Gene Map: The 2005 Update" (published in the journal "OBESITY") contains a list of 11 genes, whose mutation leads to obesity, 50 loci, which are inherited, according to Mendel's laws. In addition, this map contains 253 loci that affect obesity (Rankinen, Bouchard, 2007).

Studies, conducted in the UK, aiming to assess the contribution of each allele, which increases

the body mass index to the probability of obesity, obtained data, suggesting that even obesity, largely inherited genetically, can be reduced by 40% due to physical activity (Li et al., 2010). The researchers found each allele that increases the body mass index to increase obesity 1.158 times in physically inactive people, and 1.166 times – in physically active people. The development of obesity is also influenced by epigenetic factors that determine the efficiency of gene expression (Dunstan et al., 2017). Most genes are inactive; it is the state, controlled by methyl groups.

According to modern scientific data, one of the causes of obesity is resistance to leptin, which is a hormone of saturation. As an adipocyte-dependent hormone leptin plays a key role in appetite regulation by limiting food consumption and stimulating metabolism to support energy balance (Lenard, Berthoud, 2008). Leptin acts through a leptin receptor, belonging to the first class of the family of cytokine receptors.

The potential cause of leptin resistance is thought to be leptin receptor gene polymorphisms (*LEPR*). The gene was found to contain 23 thousand polymorphisms. Four of these cause a pathogenic effect and shortage of leptin receptors. The Q223R polymorphism as leptin resistance has been established in most studies. Even though, changes in leptin levels during exercise have been previously researched, changes in its concentration in blood after power fitness workouts under the influence of the drug "Leptin Manager" have not been studied yet. If the effectiveness of weight loss in women with different genotypes in terms of Q223R polymorphism of the *LEPR* gene is established, it will help us personalize and customize the training process in the case of obesity.

The effect of exercises on changes of hormone levels, involved in the regulation of energy metabolism, has been demonstrated in studies of leptin, nestaphin-1, and irisin levels (Bostrom et al., 2012). But the results of studies on the effect of exercises on leptin are unconvincing, since some researchers have determined the decrease of leptin levels (Voss, 2016), others have established the increasing of leptin levels (Uysal et al., 2017), and some others have found no change (Ozcelik et al., 2005).

30-minute-long aerobic exercises twice a day (in the morning and evening) for three consecutive days caused changes in leptin levels both in trained and untrained persons. But post-workout individual fluctuations in leptin levels were not related to the direct stress effect of workouts, but rather to changes in the energy balance of the people, who exercised. Therefore, after the morning training, the level of leptin increased in 13% of subjects and decreased in 16% of subjects. After the evening workout, it increased in 30% of subjects and decreased in 20% of subjects (Algul et al., 2017). The study casts doubt on the assertion that leptin is a hormone, induced by physical exercises.

According to Estonian researchers' data, leptin and insulin levels in the group of overweight individuals are significantly higher than in people with normal body weight. The leptin level was inversely correlated with VO_2 max in both groups: the higher leptin level, the lower the VO_2 max. The level of leptin correlates with physical activity. The higher physical activity, the lower leptin level. Low physical activity in the group of overweight individuals is related to the leptin level in their blood (Remmel et al., 2017).

Year-long aerobic exercises in untrained persons without excess body weight caused unreliable fluctuations in both men and women due to the fact that the adipose tissue in these individuals changed only slightly (Salehzadeh, Agaziyev, 2011).

Several polymorphisms of leptin gene (*LEP*) and leptin receptor (*LEPR*) are associated with the development of obesity (Rojano-Rodriguez et al., 2016). These variants can modify the effect of regular physical exercise on various characteristics, connected with obesity, such as glucose homeostasis (Lakka et al., 2004).

Some scientific studies assert that the polymorphisms of this gene are related to the most informative genetic markers of metabolic pathways of maintaining the energy balance and body composition changes in response to training programs, along with such markers as polymorphisms of *FTO*, *MC4R*, *ACE*, *PPARG*, *LEP*, *ADRB2*, and *ADRB3* genes (Leońska-Duniec et al., 2016). Some of these polymorphisms have been thoroughly studied. The variants of the *LEPR* gene were found to influence the activity of the leptin receptor.

Q223R (rs1137101) is characterized by the substitute of adenine with guanine in position 668 in exon 6 and results in the replacement of

glycine with arginine in position 223 in a protein (Gln223Arg). Another way of notatin is c.668A > G (Q/R). It was established that the above-mentioned polymorphism affects the ability of the receptor to bind to leptin (Sook-Ha, Yee-How, 2014). The minor allele frequency (MAF) is varied in different studies. In addition, in different studies different alleles are called minor ones. Japanese scientists have shown that Q223R is associated with levels of physical activity. Thus, individuals with the RR-genotype demonstrated a shorter time of motor activity and longer inactive time (Murakami et al., 2014). Q223R along with rs 1137100 (K109R) indicated an association with the body mass index (BMI) and the degree of obesity in Indonesian residents. G allele is associated with bigger percentage of muscle mass than in participants with the AA-genotype. In addition, G allele contributed to favourable changes in the percentage of hypodermic fat in response to power fitness trainings (Wardle et al., 2008).

Among those individuals, who have a higher body weight index, R-genotypes are more common. Other studies established that FTO rs9939609 and *LEPR* rs1137101 polymorphisms of parents affect the body weight and BMI of new born babies (Marginean et al., 2016). Thus, the Q223R can serve a molecular genetic marker of leptin resistance and can contribute to the development of obesity.

However, the association of these markers with obesity has ethnic implications. Thus, the informational value of these markers in connection with obesity was not confirmed among the Malaysians (Sook-Ha, Yee-How, 2014). Nonetheless, LEP A19G, G2548A, *LEPR* K109R, and Q223R were found to have a synergistic effect on obesity. Studies on the Mexican population (Rojano-Rodriguez et al., 2016) concluded that neither rs1137101 nor rs 1137100 are associated with obesity, but C allele of T/C polymorphism (rs 1805134) is characterized by such association.

The purpose of this study was to establish the efficiency of the combination of the diet supplement "Leptin Manager™" and the power fitness program on body weight loss in women with different genotypes of the 1st and 2nd period of mature age.

Material and methods

The study involved 62 people. The experimental group (EG) consisted of 21 women with excess body weight (BMI ≥ 25, age 36–55), who participated in the power fitness program while consuming the drug "Leptin Manager". The control group (CG) consisted of 17 women, who were engaged in power fitness without taking the drug, and 24 women, who were not engaged in power fitness.

For the molecular-genetic analysis we used DNA samples, obtained by rinsing out the epithelial cells of the oral cavity. The DNA was sampled with the help of a universal probe. The oral cavity had been washed with 0.9% NaCl before collecting the material. DNA was isolated from the buccal epithelium using a set of reagents, DiatomTM DNA Prep (Biokom).

The Q223R polymorphism of the *LEPR* gene was determined in real-time by PCR method with the help of the device "7500 Fast Real-Time PCR" (Applied Biosystems, USA) using TaqMan®Master Mix (2x) (Thermo Fisher Scientific, USA) (assay C_8722581_10). Leptin was measured by the enzyme immunoassaying immunosorbent method based on the sandwich principle using Leptin Sandwich reagents, produced by the firm DRG Germany on the Tecan Sunrise immune enzyme analyser (Austria). Research material was received from blood samples, taken from the peripheral vein, taken in the morning at rest on empty stomach without prior physical activity.

The measurements of different body parts were taken with the help of a centimetre tape: breast circumference, shoulder circumference, forearm circumference, waist circumference, abdominal circumference, and hip circumferences. The body mass index (BMI) was calculated as well. Body composition was determined using "TANITA Body Composition Analyser BC-418" using the bioelectric impedance method. The following parameters were determined: fatty tissue (%), fat mass (kg), fat-free body mass (kg), total water content (kg).

The study lasted for three months (from November to December, 2017) in the fitness club "Interfit", Kyiv. The research program included a preliminary examination of participants, questionnaires, measurement of anthropometric indicators, circumferences and body composition (ratio of body fat and muscle mass), genetic analysis, and the fitness classes program during the period of three months. All participants gave their informed consent to participate in the project and received recommendations for healthy diet as well as individualized training recommendations and the drug "Leptin Manager", which was designed for a 12-week treatment course (weekly). Collection of blood

samples and buccal epithelium and determination of body composition by bioimpedansometry method with the help of the "Tanita" device were carried out on the basis of the research institute of the National University of Physical Education and Sports. DNA isolation and detection of genetic polymorphisms were occurred in the laboratory of the General and Molecular Physiology Department of O.O. Bohomolets Institute of Physiology of the National Academy of Sciences of Ukraine.

The whole training process was divided into three weeks: easy, medium, and intensive weeks. The training method was based on the CrossFit system, a functional training, and included simulators (block and weight accessories) under the Full-body system in each training. All participants followed the rules of a healthy diet. They had 5–6 meals (including snacks) per day.

The drug "Leptin Manager" (produced by Xymogen, USA) is a dietary supplement with one capsule consisting of 15 mg of ascorbic acid and 80 mg of ORALVISC® formula (registered trademark), submitted by a mixture of glucuronic acid and other glycosaminoglycans. The drug target is fat cells. It influences adipogenesis and expression of genes of adipogenic markers in multipotent cells. It affects the level of leptin and other cytotoxic chemokines in serum and synovial fluid as well as facilitates body weight loss.

Results and discussion

Analysis of the frequency of Q/R polymorphism in the leptin receptor gene (*LEPR*) (rs1137101) revealed that, in a group of women with excess body weight, the incidence of this polymorphism is higher than in the European population. Therefore, in our studies, the frequency of the Q/Q genotype was 25%, Q/R – 57%, and R/R – 19%. The frequency of Q allele was 0.53, whereas R was 0.46. According to the NCBI and ESEMBL databases, the incidence of the A (Q) allele worldwide is 0.415, however, different populations have different frequency of this allele. Thus, according to the Quebec Family Study, the frequency of the Q allele in the British population is 0.56, in the Danish – 0.56, in the American – 0.54, and in the French – 0.56. In more closed communities, this allele is less common: 0.15 for the Japanese and 0.25 for the Pima Indians. Therefore, the frequency of Q alleles in our sample was somewhat lower, compared to the European population, which can be due to the principle of enrolling women in our studies according to the criterion of excess body weight.

When measuring the level of leptin in venous blood by the ELISA method, we established that the concentration of leptin in the blood of women with excess body weight is characterized by wide variability of this indicator within the range from 3.55 to 41.86 ng × ml^{-10} with an average value of 12.1 ± 7.8 ng × ml^{-10}. That is twice higher than the average percentage for women with normal body weight.

Since the reference values of normal blood leptin level in women is considered the range from 3,63 to 11,09, all women were divided into three groups: "normal leptin level", "above-normal leptin level ", and "below-normal leptin level". Assuming that the normal leptin content varies from 3.63 to 11.09, 4% of women had "below the norm" of leptin levels, and 36% – "above the norm". Although, most researchers point out that obese women have a high leptin levels (Walsh, 2012), we have not received confirmation in our studies. The reasons for such high variability of leptin parameters can be unaccounted factors, namely, the effect of polymorphisms of the leptin gene itself and post-splicing processes.

The results of the study of leptin blood concentrations demonstrate a lower level of leptin in women with the genotype R/R (Fig.1). This peculiarity represents the tendency and is statistically unreliable. However, the comparison of leptin indexes in Q allele women-carriers (Q/Q- and Q/R-genotypes) with those of R/R-type carriers showed that leptin percentage in women-carriers of Q alleles is twice higher than in women-carriers of the R/R-genotype ($p = 0.045$). This pattern indicates that Q allele can contribute to the development of leptin resistance. The phenomenon we have established contradicts previously established postulates that R allele facilitates the development of leptin resistance (Sook-Ha, Yee How, 2014; Marginean et al., 2016). But these differences can be explained by ethnic characteristics, since most of these patterns were discovered on island populations.

In the group of women with genotype Q/Q, 50% of women had above-normal leptin levels; among women with Q/R genotype, 33.3% of them had above-normal leptin levels; among women with the R/R genotype, 11% of test subjects had above-normal leptin levels. In women with Q/Q genotype the average value of BMI was 30.78 ± 3.11, in

women with the genotype Q/R – 31.37 ± 5.8, and in women with the genotype R/R – 27.4 ± 2.72. In Q allele carriers (Q/Q- and Q/R-genotypes), BMI was significantly lower than in carriers of the R/R-genotype ($p = 0.04$).

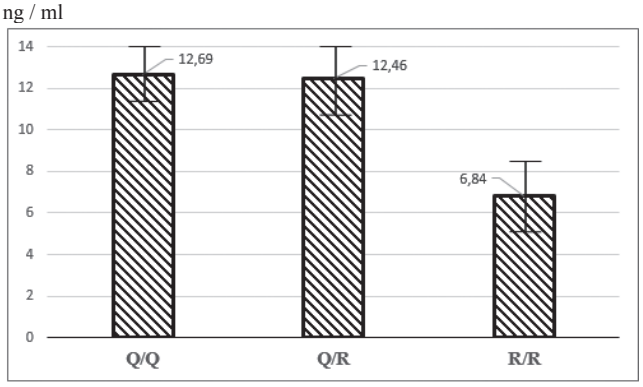

Fig. 1. Leptin levels in women with different *LEPR* gene genotypes

Even though the level of leptin depends on the polymorphism of the *LEPR* gene, there is no direct dependence, since other genetic and metabolic factors can influence this indicator. Therefore, when discussing the role of leptin levels as a marker of genetic deficiency of leptin receptors, it should be mentioned that leptin levels in blood serum in obese individuals change disproportionately, indicating that it cannot be used as a marker of leptin receptor deficiency.

The Pearson's pair correlation coefficient (r) between leptin levels and BMI is 0.702, whereas between leptin and body weight it is 0,648, and between leptin and adipose tissue it is 0.73. It indicates that there is a linear link between the anthropometric indexes and the level of leptin. More precisely, there is a strong connection between leptin, BMI, and the percentage of adipose tissue as well as close link between body weight and leptin levels.

Thus, this study established a close linear connection between leptin levels and indicators such as body mass index ($r = 0.7$) and adipose tissue content ($r = 0.73$); a moderate relationship between leptin levels and body weight ($r = 0.65$). Women, who are carriers of Q allele and Q/Q-genotype, have higher levels of leptin than R/R-genotype carriers. In women with the R/R-genotype, "above normal" leptin levels are 39% less common than in carriers of the Q/Q-genotype.

It was proven that, even though leptin levels change under the influence of physical activity, these changes are not proportional to the intensity or duration of physical activity, but rather reflect individual metabolic features. In our study, in all subjects of both the control and the experimental group, leptin levels changed in various ways. In total, leptin levels decreased by 2.92 ng/ml, which constituted 13% of the baseline level.

Under the influence of the drug "Leptin Manager", there was a tendency toward normalization of leptin levels in subjects with higher-than-average leptin levels. In the experimental group, which took medicine and practiced workout, leptin levels decreased by 3.85 ± 0.25 ng/ml, which constituted 33.4% ($p < 0.05$). And in the control group leptin level was 0.49 ± 0,3 ng/ml lower, which constituted 6.1% of the baseline level (Fig. 2).

In the experimental group, in women with Q/Q-genotype leptin level increased by 0.14 ng / ml; in women with Q/R-genotype, it decreased by 5.47 ng/ml and, in women with the R/R-genotype, it decreased by 1.4 ng/ml, which constitutes 21.2 %. That is, the R allele and the R/R-genotype contribute to a decline of leptin level after exercise. In all groups after three months of trainings, body composition indicators changed in the direction of normalization. A wide variability of individual anthropometric indicators was observed.

In the control group, body weight decreased by an average of 2 kg, BMI decreased by 4%, the percentage of fat decreased from 32 to 29% (i.e., by 3%), the percentage of visceral fat did not decrease. Whereas in the experimental group, body weight decreased by 5%, the percentage of fat decreased from 36 to 34% (i.e., 2%), the percentage of visceral fat decreased by 2% due to increasing the percentage of muscle mass.

The results of changes of the indicators under the influence of physical activity have shown that the most significant changes occurred in the experimental group.

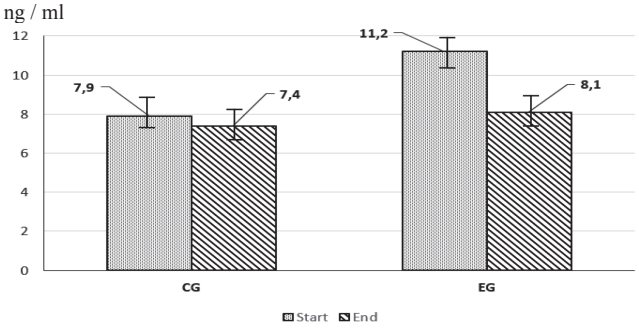

Fig. 2. Leptin level changes in control and experimental groups after 3-months power fitness trainings

In subgroups of women, who were divided by the genotype in the experimental group, physical activity and drug intake, resulted in similar changes in direction, but different in amplitude. Body mass in women with Q/Q-genotype decreased by 5.8%, in women with Q/R genotype – by 4%, and in women with R/R genotype – by 6.1%. The BMI decreased in women with Q/Q-genotype the most (by 7%). The biggest changes in the percentage of fat mass occurred in women with the R/R- genotype. The biggest changes in the percentage of visceral fat were noticed in women with R/R- genotype (17%). Thus, the most drastic changes in body composition were observed in women with the R/R-genotype.

Conclusions

1. The causes for alimentary obesity include hypodynamia, genetic factors, incorrect nutrition, and bad eating habits. The contribution of genetic factors to the development of obesity is estimated to be from 30 to 70%. A number of leptin gene polymorphisms (*LEP*) and the leptin receptor (*LEPRs*) is associated with the development of obesity. Q223R polymorphism of the *LEPR* gene can be viewed as a molecular and genetic marker of leptin resistance and can contribute to the development of obesity.

2. Leptin level in women with excess body weight varies within a wide range that exceeds the norm both for low concentrations and for high concentrations. 4% of women had "below-normal leptin level", and 36% had "above-normal level".

3. The study revealed a close linear link between leptin levels and such indicators as body mass index ($r = 0.7$), adipose tissue content ($r = 0.73$) and a moderate connection between leptin levels and body weight ($r = 0.65$). Women-carriers of Q allele and Q/Q-genotype have higher leptin levels than R/R carriers. In women with R/R-genotype, "above normal" leptin levels are 39% less common than in women with the Q/Q-genotype.

4. Physical activity resulted in a slight decrease in leptin levels: in the experimental group – by 33.4% ($p < 0.05$) and in the control group by 6.1%. R alleles and the R/R-genotype of the *LEPR* gene contribute to reduction of leptin levels after exercise. The use of the drug "Leptin Manager" leads to a possible decrease of leptin levels compared to those in the control group.

5. The combined effect of the power fitness program and the use of the drug "Leptin Manager" lead to more significant changes in anthropometric indicators and body composition of women with excess body weight in comparison with the control group. The most drastic changes in body composition occurred in women with the R/R-genotype of the *LEPR* gene.

Further research will determine the effect of this drug on the expression of genes, which control fat and carbohydrate metabolism. That will make it possible to develop recommendations for the use of this drug by individuals with excess body weight and obese individuals, who have above-normal leptin level, and will help customize the medication for individuals with different genotypes.

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MAISTO PAPILDO „LEPTIN MANAGER“ IR JĖGOS TRENIRAVIMO PRATIMŲ KOMPLEKSINIS POVEIKIS SKIRTINGO GENOTIPO SVORĮ MAŽINANČIOMS MOTERIMS

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SANTRAUKA

Tyrimu buvo siekiama nustatyti maisto papildo „Leptin Manager“ ir svorio metimo jėgos treniruočių kompleksinį poveikį moterims, turinčioms skirtingą 1-ojo ir 2-ojo brendimo genotipą. Tyrime dalyvavo 62 moterys, turinčios 2-ojo brendimo genotipą ir antsvorį (KMI ≥25, 36–55 metų). Eksperimentinę grupę sudarė 21 moteris, dalyvaujanti jėgos treniruočių programoje ir vartojanti papildą „Leptin Manager“ (gamintojas: *Xymogen*, JAV). Kontrolinę grupę sudarė 17 moterų, kurios dalyvavo jėgos lavinimo programoje ir papildo nevartojo, ir 24 moterys, kurios nedalyvavo jėgos lavinimo programoje. Tyrimo trukmė – 3 mėnesiai. Treniruotės buvo paremtos krosfito sistema (angl. *crossfit system*), funkcinėmis treniruotėmis ir treniruokliais (angl. *block and lever devices*), vadovaujantis viso kūno lavinimo principu. Leptino receptoriaus geno (*LEPR*) Q223R polimorfizmas buvo nustatytas polimerazės grandininėje reakcijoje realiuoju laiku. Leptino rodikliai moterų Q alelių nešėjuose yra dvigubai didesni, palyginti su moterimis, kurios yra R/R genotipo nešėjos ($p = 0,045$). Kompleksinis jėgos lavinimo treniruočių programos ir „Leptin Manager“ preparato vartojimo poveikis davė daug reikšmingesnių pokyčių antropometriniams rodikliams ir antsvorį turinčių moterų kūno sudėčiai, palyginti su kontrolinės grupės rezultatais. Didžiausi kūno sudėties pokyčiai pasireiškė moterims, kurių yra *LEPR* geno R/R genotipas.

Papildo „Leptin Manager“ vartojimas sumažino leptino lygį: eksperimentinėje grupėje – 33,4 proc. ($p < 0,05$), kontrolinėje grupėje – 6,1 proc.

Išvada. Leptino geno Q223R polimorfizmas gali būti traktuojamas kaip atsparumo leptinui molekulės genetinis žymuo. Q alelės *LEPR* geno Q223R polimorfizmas lemia nutukimo vystymąsi. Po treniruotės *LEPR* geno R alelės ir R/R genotipas padeda sumažinti leptino lygį. „Leptin Manager“ vartojimas kartu su fizine veikla, tikėtina, sumažina leptino lygį organizme, palyginti su kontrolinės grupės rezultatais.

Raktiniai žodžiai: leptinas, jėgos treniravimas, leptino receptoriaus geno polimorfizmai, „Leptin Manager“, antsvoris.

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Gene-profiling power supply for athletes of high qualification. The example of biathlon

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Summary

In the presented article, the possibilities of carrying out the gene-profiling of the power supply process in biathlon, as an example, are considered. The results of genotyping of 31 biathlon-athletes of high qualification on a panel of six polymorphic markers of genes, involved in energy supply processes (ACE, PPARA, PPARGC1A, PPARD, PPARGC1B, and PPARG2),was given. The research was conducted in compliance with necessary ethical criteria: obtaining informed consent from athletes and ensuring the confidentiality of personal information.

In the examined group of biathlon-athletes, the prevalence of allele frequencies was observed: 67.74% D allele of the ACE gene; 77.42% G allele of the PPARA gene; 56.45% Ser allele of the PPARGC1A gene; 74.20% T allele of the PPARD gene; 95.16% C allele of the PPARG2 gene;100.00% C allele of the PPARGC1B gene.

Establishing the genetic potential of each athlete allows determining or refining the molecular mechanisms of inheritance and expanding the theoretical and methodological basis of the process of sports training. At the same time, having determined the differences in the distribution of genotypes in groups of highly qualified athletes, engaged in various sports, it is possible to carry out with confidence the genetic prognosis of success in the group of reserve athletes.

Based on the results of earlier conducted research, analysis of the world experience – an algorithm for managing the selection process of the reserve group athletes and subsequent optimization of their training process – is proposed.

Keywords: *gene-profiling, power supply, athlete of high qualification, biathlon.*

Introduction

Modern approaches to the selection of athletes and the individualization of their training process must necessarily take into account their genotypic characteristics. The identification of genetic marker allows predicting the patterns of development of the physical qualities of athletes, and the investigation of the influence of genetic determinacy on training process helps to define approaches to the development and correction of training programs for athletes taking into account their genetic polymorphisms (Elferink-Gemser et al., 2011; Tucker, Collins, 2011; Рыбина, 2013; Ahmetov et al., 2015; Yevdaliuk et al., 2015).Genetic researches of contenders, before the beginning of sports activity, provide possibility to receive recommendations for choosing specialization in sports. Genetic testing makes possible to determine the perspectives of active athletes at the stages of the improvement and enhance athletes' selection process for representative teams of different levels as it serves as an objective scientific argument in disputable situations. Moreover, genetic analysis data aim to predict possible changes in health status of future athletes and their potential for sport longevity (Tucker, Collins, 2011; Ahmetov et al., 2015; Кручинскийет al., 2015; Рыбина, 2016). Genetic research data can also be useful in correction of training process in relation to the direction and correlation of the types of training loads, particularly in giving recommendations, based on the identified physiological risk factors of athletes in accordance with genotype (Rankinen et al., 2010; Ahmetov et al., 2015; Bouchard, 2015). At the same time, the exploration of the dynamic changes of physical qualities at different stages of athletes' training process with different variants (polymorphisms) of gene(s) showed the need for a differentiated approach to athletes of different polymorphic groups (Рыбина, 2013; Шепелевичет al., 2013; Ahmetov et al., 2015).

As a result of the analysis of an international experience and data of our research, a control algorithm of the selection process of athletes has been developed. Let us consider these opportunities on the example of biathlon.

Biathlon is one of the most popular winter sports in the Republic of Belarus. Specificity of biathlon is the combination of running on skis and shooting from two positions. The particularities in the movements and muscle activity are feature superiors of the individuality of biathlon-athletes. The same speed of movement can be achieved with a different combination of length and frequency of steps. The best option of technique is the one, characterized by the least energy costs. The energy potential of an athlete and the efficiency of its realization are the main limiting factors in the level of sport achievements in skiing races and biathlon (Манжосов, 1986; Мищенко, 1990; Wilkilson et al., 2008; Рыбина, Ширковец, 2015).

It is well known that the most significant factors, affecting sport results, are the energy capabilities of athletes (their aerobic and anaerobic productivity); speed-strength qualities; morpho-functional indicators and inherited abilities (skeletal body size, morphotype, muscular fibre composition, joint flexibility, heart rate in working out the standard submaximal load, maximum aerobic productivity, some elementary demonstration of speed, and the results of a series of motor tests) (Безуглая, 2016; Рыбина, 2016).

The aerobic way of energy supply (metabolism) is the main energy source for biathlon athletes, and its importance is growing with an increase of the length of the competitive distance. Anaerobic metabolic way is necessary to overcome the hills as well as for the development of high speed in various sections of the route (Мищенко, 1990; Drozdovska, Tyrtyshnyk, 2015; Рыбина, Ширковец, 2015).

In the view of foregoing, the achievement of high results in any kind of motor activity depends on many factors, mainly, the maximum correspondence of the individual characteristics of a personality to the requirements of the selected sport. Consequently, the most important condition for the effective selection of advanced athletes is the awareness of particular sport and their requirements for athletes of high qualification.

The effectiveness of training top-level athletes is determined not only by the organization of the training process, moreover, the strategy of increasing the intensity of training loads to improve their technical and physical training, is now almost exhausted and requires the search and development of knowledge about individual limits of physical and reserve abilities of the athlete, in other words, its genetically pre-deterministic qualities (Мищенко, 1990;Ахметов, 2009; Рыбина, 2013; Ahmetov et al., 2015; Drozdovska, Oleshko, 2016). In our opinion, the way out from this situation is a focus on parameters and indicators with a high degree of inherited determinacy that have the stability of individual developmental ranks and do not comply with generally organized influence in the training process (Шепелевич et al., 2013; Кручинскийет al., 2015, 2017).

Let us consider the features of polymorphisms of some genes that influence the processes of energy supply of training and competitive activity as the most important.

Receptors that activate peroxisome proliferation *(PPARs)* are a family of nuclear receptors, belonging to the superfamily of steroid receptors (Tucker, Collins, 2011; Ahmetov, 2015; Кручинский et al., 2015). They play an important role in the regulation of energy supply for athletes as well as ensure the interaction of nervous, humoral, and energy processes during change of environmental factors or homeostasis parameters. The range of biological functions of *PPARs* is very wide. *PPAR* regulates the expression of genes, involved in the process of steroidogenesis, angiogenesis, tissue remodelling, regulation of the cell cycle, apoptosis, and metabolism of lipids and carbohydrates. Thus, the *PPARA* gene is located in chromosome 22 at the locus q13.31 and is expressed in tissues, where the enhanced metabolism of fats takes place, notably, in the muscles, liver, heart, and brown fat. *PPARAs* act as activators of oxidation of fatty acids. Expression of *PPARA* is controlled by stress stimulus, glucocorticoids, and insulin. It is also activated by fatty acids, eicosanoids, carbaprostacyclin, nonsteroidal anti-inflammatory drugs, and leukotriene B. The main function of the *PPARA* protein is the regulation of lipid metabolism, glucose, and energy homeostasis as well as body weight by regulating the expression of genes, involved in peroxisomal and mitochondrial oxidation. *PPARA* regulates genes, responsible for the metabolism of fatty acids, and mediates the balance between cellular fatty acids and glucose metabolism, especially in metabolic or physiological stresses. During physical activity of aerobic nature, the growth of utilization of fatty acids takes place due to an increase of the *PPARA* gene expression and a cascade of regulated genes that ultimately improve the oxidative capacity

of skeletal muscles. It is known that, with a low expression of the *PPARA* gene, the capacity of tissues of efficient β-oxidation of fatty acids decreases and tissue metabolism moves on a glycolytic method of getting the energy. Among the examined *PPARA* polymorphisms, the G/C polymorphism of the seventh intron G2528C can be distinguished. The prevalence of rare C allele in the European population is 20%. This replacement of guanine by cytosine leads to a decrease in the expression of the *PPARA* gene, as a result, the regulation of lipid and carbohydrate metabolism is impaired.

The *PPARG* gene is localized on chromosome 3p25 locus (Ahmetov et al., 2015; Кручинский et al., 2015). As a result of alternative splicing from this, the gene of four transcripts is formed, differing at the 5-end with a different number of untranslated exons: *PPARG1, PPARG2, PPARG3,* and *PPARG4*. The functions of this transcription factor are the regulation of genes, connected with fat accumulation, the differentiation of adipocytes and myoblasts, sensitivity to insulin, and osteoblast and osteoclasts activity. The most studied polymorphism of the *PPARG* gene is Pro12Ala that causes the replacement of nucleotide C by G at the 34th position of exon B that leads to the replacement of proline by alanine at amino acid position 12 of the *PPARG2* isoform. The Pro12Ala polymorphism leads to a decrease of the affinity and reduce in *PPARG* activation by ligands. The rare Ala allele's frequency varies from 1% Chinese to 25% Europeans. With the Ala/Ala genotype, a lower level of insulin resistance and a lower risk of hyperglycaemia in type 2 diabetes than the Pro/Pro genotype carriers as well as a lower risk of myocardial infarction were observed. Moreover, the homozygotes (Pro/Pro genotype) have a higher risk of developing type 2 diabetes in cases of misbalancing glucose tolerance. A meta-analysis of 30 different researches with a reference set of 19,136 people showed that the carriers of the Ala allele have a larger body mass index than the Pro/Pro homozygotes, i.e., they lose weight harder in passing to a hypocaloric diet, but they quickly gain weight after the finishing diet.

The *PPARD* gene is located on chromosome 6p21.1-p21.2 and is actively expressed in fat tissue and in slow muscle fibres of skeletal muscles (Elfernik-Gemser et al., 2011; Ahmetov et al., 2015). The gene product –*PPARD* protein that regulates the expression of genes, involved in fatty acid oxidation and cholesterol metabolism, – is an important factor in insulin sensitivity. The target genes of the transcriptional factor *PPARD* in muscle tissues are the genes of oxidative metabolism, mitochondrial respiration, and thermogenesis genes, determining the functions of slow muscle fibres, brown and white fat tissues. Among the allelic variants of the *PPARD* gene, T294C polymorphism of the untranslated part of the fourth exon is the most interesting. The frequency of minor allele C in the European population is 21.7%. The *PPARD* transcriptional activity formed by 39% of the mutant allele C is higher than the T allele. In addition, the replacing of nucleotide T to C leads to the formation of a new determinant point with transcriptional factors, intensifying *PPARD* expression. It is shown that the presence of the C allele of the *PPARD* gene promotes greater fat catabolism and reduces the risk of obesity to a certain extent. The homozygotes CC have an increased level of low density lipoproteins and a low level of high density lipoproteins in the blood.

The peroxisome proliferator-activated receptor gamma coactivators (encoded by *PPARGC1A* and*PPARGC1B*) are transcriptional coactivators of PPAR family that regulates genes, involved in energy metabolism. *PPARGC1A* interacts and regulates the activity of the cAMF-dependent transcriptional factor (CREB) and nuclear respiratory factors. This provides a direct link between external physiological stimuli and the regulation of mitochondrial biogenesis, and this is the main mechanism that regulates the differentiation of muscle fibres. *PPARGC1A* also takes part in the control of blood pressure, regulates cellular cholesterol metabolism and the development of obesity. *PPARGC1B* gene stimulates the activity of transcription factors and nuclear receptors, including the estrogenalpha-receptor, nuclear respiratory factor 1, and glucocorticoid receptors. The encoded protein may be involved in fat oxidation, a non-oxidative metabolism of glucose as well as the regulation of energy usage and the development of pre-diabetes and type 2 diabetes. The Arg292Ser (+102605C>A) allelic variationin exon 5 of this gene increases the risk of obesity.

The *ACE* gene is localized in chromosome 17; it encodes the amino acid sequence of the angiotensin converting enzyme that catalyses the proteolytic cleavage of angiotensin I into angiotensin II (Elfernik-Gemser et al., 2011; Рыбина, 2013; Шепелевичет al.,

2013; Ahmetov et al., 2015). The ACE gene contains a I/D polymorphisminintron 16. In the case of the *DD* genotype, the concentration of the c-AMF is increased, which causes the participation of the allele D in vasoconstriction, blood pressure, association with arterial hypertension, degradation of bradykinin, the main vasodilator. It has been found that the allele D is associated with the prevalence of fast muscle fibresand with physical qualities such as speed, strength, rapidity as well as the increase in explosive strength and velocity qualities in response to anaerobic loads. The increase of fast glycolytic muscle fibres is accompanied by powerful short-term reductions, which ensure the performing of high-intensity exercises. The homozygous genotype *DD*, generating angiotensin II in elevated levels, is a factor in the synthesis of structural proteins in the heart cells, which provoke cardiac hypertrophy under prolonged loads.

At the moment, the sports activity is a complex of training process and medical-biologic support of athletes at all stages of a long-term preparation (Maron, Klues, 1994; Corrado et al., 2003; Безуглая, 2016).

In the view of foregoing, the purpose of this research is to analyse the frequencies of the polymorphic markers of the genes, involved in the energy supply of high qualification biathlon-athletes.

Material and methods

The research involved 31 biathletes of high qualification (sport masters and international sport masters).

The selection of biological material for subsequent research and the analysis of the material were preceded by an information procedure for the research and a written confirmation agreement for participation. Polymerase chain reaction (PCR) was used to detect the I/D of the *ACE* gene. The genotyping of the *PPARA* gene G2528C, *PPARGC1A* gene Gly482Ser, *PPARD* gene +294T/C, *PPARGC1B* the Arg292Ser, and *PPARG*of the Pro12Ala variants were carried out by PCR, followed by the restriction endonuclease (TaqI, MspI, BslI, ApaI, BstUI). The visualization of the results of genotyping was carried out using a UV trans-illuminator of the gel-documentation system (*Vilberlaurmat*, France). Fragments of DNA and DNA marker appeared in the form of luminous bands, when the gel was irradiated with a UV lamp. DNA markers were verified by the presence of amplified fragments as well as their size (Ахметов, 2009).

Statistical evaluation of the genotyping was carried out by computer program *Statistica v. 8.0* for Microsoft Exel 2007. The χ^2 criterion with the Yates correction or the exact Fisher test was used in a pairwise comparison of the frequencies of alleles and genotypes between analysed groups. The difference between two comparative values was considered statistically significant when $p < 0.05$.

To analyse the results of genotyping, the following genotypes of biathlon-athletes were graded by the most favourable genotypes for the process of energy supply: II genotype of *ACE*, GG genotype of *PPARA*, CC genotype of *PPARD*, CC genotype of*PPARG2*, GlyGlygenotype of *PPARGC1A* – 2 points; heterozygous genotypes – 1 point; homozygous unfavourable genotype – 0 points.

Results and discussion

The distribution of genotypes and alleles of researched polymorphisms are presented in Table 1.

Table 1

The genotype and allele frequencies of the biathlon-athletes group

Polymorphisms	Genotype/ allele	Frequencies, n (%)
1	2	3
I/D *ACE*	DD	14 (45.16)
	ID	14 (45.16)
	II	3 (9.68)
	D	42 (67.74)
	I	20 (32.26)
G2528C *PPARA*	GG	20 (64.52)
	GC	8 (25.80)
	CC	3 (9.68)
	G	48 (77.42)
	C	14 (22.58)
Gly482Ser *PPARGC1A*	Gly/Gly	1 (3.23)
	Gly/Ser	25 (80.64)
	Ser/Ser	5 (16.13)
	Gly	27 (43.55)
	Ser	35 (56.45)
+294T/C *PPARD*	TT	17 (54.84)
	CT	12 (38.71)
	CC	2 (6.45)
	T	46 (74.20)
	C	16 (25.80)
Arg292Ser *PPARGC1B*	CC	31 (100.00)
	CA	-
	AA	-
	C	62 (100.00)
	A	-
Pro12Ala *PPARG2*	CC	28 (90.32)
	CG	3 (9.68)
	GG	-
	C	59 (95.16)
	G	3 (4.84)

In the researched group of biathlon-athletes, the prevalence frequency of minor alleles was: the *ACE* allele D – 67.74%, *PPARA* allele G –77.42%, *PPARGC1A* allele Ser – 56.45%, *PPARD* allele T allele – 74.20%, *PPARG2*allele C – 95.16%, and *PPARGC1B* allele C – 100.00%.

Next, the genetic profile of the energy supply process was constructed from tested polymorphisms (Fig. 1). In this case, the results of genotyping of the *PPARGC1B* gene polymorphism were not taken into account, because only one genotype was identified during the research.

In principle, the results, obtained by us, do not contradict published studies of foreign authors (Corrado et al., 2003; Elfernik-Gemser et al., 2011; Tucker, Collins, 2011).

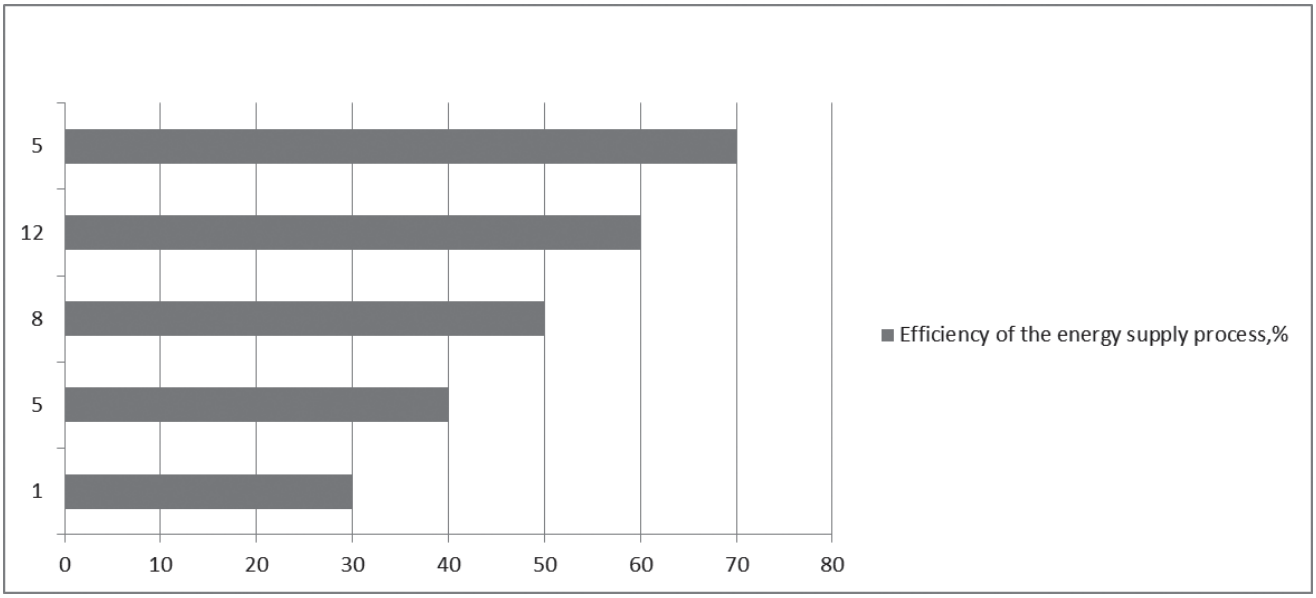

Fig. 1. Distribution of genetic profile results in the studied group of biathlon-athletes

Obviously, the majority of athletes in the researched group showed the effective energy supply processes that are quite understandable by their high level of sports qualification.

For the research, we have considered polymorphisms of genes that were involved in cardiovascular system, carbohydrate and lipid metabolism, energy metabolism, affecting the muscle and fat mass, and, therefore, associated with physical activity. Obtained results in the research of the genetic predisposition of biathlon-athletes demonstrated the possibility of this scientific and methodical approach to optimization and individualization of training. The presented results lead us to conclude that the gene-profiling allows to choose a biathlon specialization for beginners as well as to improve the training of highly qualified athletes.

The effectiveness in sport activities is a symbiosis of environmental influences and genetically determined abilities as well as qualities of the athletes. Having information on genetically determined characteristics within the reaction norm and information on anthropometry and component composition of the body and their dynamics under the influence of high physical loads, the trainer and athlete are able to achieve high results.

Consequently, the determination of the genetic potential of each athlete makes it possible to define or refine the molecular mechanisms of inheritance and expand the theoretical and methodological basis of the process of sport training. At the same time, having determined the differences in the allocation of genotypes in groups of highly qualified athletes, engaged in various sports, it is possible to carry out with confidence the genetic prognosis of success in the group of reserved athletes.

The presented results of genotyping of highly qualified biathlon-athletes for estimating the effectiveness of their energy supply for training and competitive activities demonstrated the possibility of influencing practically on all stages of training of high-class athletes. This example is an illustration of the analysis of both world experience and our

research. Based on the results, we developed an algorithm for managing the selection process of the reserve athletes group and subsequent optimization of their training process (Рыбина, 2015; Безуглая, 2016).

At the first stage, it is recommended to perform genotyping to obtain a basic information on the predisposition of athletes to speed-strength training or endurance training as well as for theestimation of the nervous system potential. This process includes the following operations: a questioning; a buccal test (epithelium of inner surface of cheek) for sampling of biomaterial for investigation (an extract DNA from buccal epithelium); an identification of polymorphisms according to selected (depending on the task) gene panel by polymerase chain reaction and other molecular genetic methods.

As a result, the coach receives the primary information that is the basis for further selection and orientation work. In this case, genetically examined athletes are divided into three groups. For example, the *ACE* gene polymorphism allocation is: the first group consists of applicants, who by their genotype fully correspond to the sport, for example, athletes with a II homozygous genotype are appropriate to ski races and biathlon; the second group includes athletes, who have found a complete discrepancy, i.e., applicants with a homozygous variant *DD;* and the third group is composed of all other athletes, who have a heterozygous *ID* genotype. Accordingly, the athletes of the second group are considered as applicants after all the others and the athletes of the first group – as primal.

It should be emphasized that the results of genotyping are not a strict contraindication to selection as success in various activities since it is determined by a complex of abilities and even a number of indicators, negatively affecting the results, as well as can be compensated by a high level of development of other qualities. In this context, the results of genotyping should help coaches in identifying potentially advanced athletes, who should not be "lost" at early stages.

At the second stage, athletes are estimated according to medical and biological criteria. Their health status, anthropological features of development (accelerated-delayed), functional capabilities of aerobic energy supply system, data of muscle biopsy (is not performed in the Republic of Belarus), level of specialized perceptions – complex psycho-physiological (sense of time, sense of pace, feeling of developed efforts, feeling of snow in skiers and biathletes, etc.) characteristics, efficiency of work, capacity to transfer loads and efficient recovery, availability of reserve capabilities of the body to maintain and possibly enhance previously achieved level of adaptation are taken into account.

At the third stage, athletes are estimated according to psychological and pedagogical criteria. We have taken into account the state of the art of performing various special preparatory exercises.

These aspects were settled as criteria: the effectiveness of movements that, in most cyclic sports, is evidenced by their low tempo with a long step length and high speed when passing short segments; the level of development of physical qualities (speed-strength, various types of endurance, flexibility, and coordination abilities) with particular attention paid to the rate of their growth from one stage of preparation to another; and personality-mental qualities (mental reliability, motivation, will, aspiration for leadership, resistance to stressful situations during competitions, the ability to tune into an active competitive struggle, the ability to mobilize forces in acute competition, the mental stability in performing volumetric and intense training work, the ability to control effort, pace, speed, direction of movement; distribution of strength in the process of competition as well as the ability to show the highest results in the most important competitions, surrounded by strong competitors).

The final decision to involve a child in sports is to be based on a comprehensive assessment of all the listed selection criteria, rather than taking into account one or two characteristics.

Conclusion

The effectiveness in sport activities is a symbiosis of environmental influences and genetically determined properties as well as the qualities of a person. Athlete's body is able to achieve high results with the knowledge of its size, its proportions, genetically determined within the norm of reaction, and under the influence of high physical loads.

Our results can be used to design better selection and training processes in order to allow athletes achieving their full potential.

This significantly expands the theoretical and methodological base of the sports training and

allows making the transition from the recruitment system in sport sections to the targeted selection of potentially successful athletes already at the stage of improving sports skills.

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DIDELIO MEISTRIŠKUMO BIATLONININKŲ ENERGIJOS GAMYBOS GENŲ PROFILIAVIMAS

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SANTRAUKA

Darbo tikslas – ištirti didelio meistriškumo biatlonininkų energijos gamybos proceso genų profiliavimo galimybes. Darbe pateikiami 31 didelio meistriškumo biatlonininko 6 polimorfinių markerių sistemos rinkinys, veikiantis energijos gamybos procese (*ACE*, *PPARA*, *PPARGC1A*, *PPARD*, *PPARGC1B* ir *PPARG2*). Tyrimai atlikti laikantis reikiamų etikos reikalavimų, asmeninės informacijos konfidencialumo.

Tyrimo rezultatai parodė, kad dažniausiai randami aleliai yra: *ACE* geno D alelis (67,74 proc.), *PPARA* geno G alelis (77,42 proc.), *PPARGC1A* geno Ser alelis (56,45 proc.), *PPARD* geno T alelis (74,20 proc.), *PPARG2* C alelgeno alelis (95,16 proc.), *PPARGC1B* geno C alelis (100 proc.).

Atlikti šios sportininkų grupės DNR tyrimai parodė pakankamai efektyvią energijos gamybą – tai patikimai patvirtinama aukštu jų sportinės kvalifikacijos lygiu. Kiekvieno sportininko genetinio potencialo tyrimas leidžia nustatyti arba patikslinti paveldimumo molekulinį mechanizmą ir papildo teorinę ir metodinę sportinio rengimo duomenų bazę. Nustačius įvairių sporto šakų sportininkų genotipų pasiskirstymo skirtumus, galima atlikti patikimą jaunųjų sportininkų genetinę prognozę.

Remiantis kitų pasaulio šalių mokslininkų tyrimų rezultatų analize ir šio darbo autorių atliktų tyrimų duomenimis, buvo sukurtas jaunųjų sportininkų atrankos algoritmas, leidžiantis geriau optimizuoti jų treniruočių procesą.

Raktažodžiai: genų profiliavimas, energijos gamyba, didelio meistriškumo sportininkas, biatlonas.

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Athlete's cardio-vascular system's functional state before and after use of pharmaceutical drugs

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Summary

The research was carried out before and after use of complex of pharmaceutical products, that included adaptogen "Pantocrine Forte", amino acid complex "Tavamine" and enterosorbent "Polyphepanum" by track and field athletes and handball players. Administration of pharmaceutical products caused rebuilding of mechanisms of heart rate's vegetative regulation, central hemodynamics component and myocard's bioelectric activity affected by sportsmen's optimal level of fitness state's achievement.

The aim of the research is to study the influence of pharmaceuticals on the functional state of the cardiovascular system of athletes and handball players.

To characterize the systemic circulation was used hardware-software complex "Impercard-M". The following parameters were studied: HR (bpm) – heart rate; SAP, DAP, APmean. (mmhg), – respectively, systolic, diastolic, mean blood pressure; SV (ml) – stroke volume; CO (l/min) – cardiac output, TPR (dyn×s×cm^{-5}) – total peripheral resistance, LV filling pressure (mmhg) – pressure filling the left ventricle, cardiac index, l/(min×м^2).

The study of bioelectric activity of a heart was carried out to determine the level of functional reserve of metabolism, the level of myocardial hyperfunction on the device "Poly-Spectrum 8E/LLC".

To assess the bioelectric activity of the heart, the time and amplitude parameters of the functional state of the myocardium were used: the duration of the intervals P (ms), p–Q (ms), QRS (ms) respectively, intracardiac, atrial-ventricular and intraventricular conductivity; Q–T (ms) – electrical systole; angle of alpha in degrees (axis QRS, °).

To study the parameters of heart rate variability the software and hardware complex "Poly-Spectrum" was used. The main characteristics were determined: Mo (ms) – mode, AMo (%) – mode amplitude, dRR (ms) – variational scale, SDNN (ms) – standard deviation of RR intervals, stress index (relative units) – voltage index of regulatory systems, HF (%) – high frequency (High Frequency), LF (%) – low frequency (Low Frequency)), LF/HF – criterion of sympatho-vagus balance, the ratio of activity levels of the central and autonomous circuits of regulation, VLF (%) – very low frequency waves (Very Low Frequency).

The study involved 10 athletes and 9 handball players aged from 17 to 21 years, with 1st category qualification, Candidates for Master of sport. The selected group of athletes with different orientation of the training process.

The study was conducted before and after the use of a complex of drugs, which included the adaptogen "Pantocrine Forte", amino acid complex "Tavamine" and enterosorbent "Polyphepanum". These drugs were taken in a certain dosage for 10 days.

On the basis of the study of the impact of pharmaceuticals on the state of the cardiovascular system, the manifestation of economization of heart activity (a tendency to reduce heart rate, SAP, DAP and mean AP) was observed in two groups of patients.

The above data indicate that the use of pharmacological drugs has caused the restructuring of the mechanisms of autonomic regulation of heart rate, the central level of hemodynamics and bioelectric activity of the myocardium, while achieving the optimal level of training of athletes.

Keywords: *cardiovascular system, central hemodynamic, electrocardiography, heart rate variability, athlete, complex of drugs.*

Introduction

The high efficiency of the trained athlete is due to the improvement of adaptation and regulation mechanisms at all levels of functioning, as well as developing changes in it. At the same time, it is known that high performance suggests an individual optimal level and balance of regulatory systems that provide hemodynamics, metabolic and energy reactions in muscle activity (Граевская, Долматова, 2004; Corrado et al., 2009; Гаврилова,Земцовский, 2010).

Athletes' usage of drugs is aimed at expanding the adaptive capacity of the body to physical loads and accelerates the recovery process. The choice of certain drugs depends on the period of preparation and the need to obtain the level of training that will successfully achieve a certain result (Сучковидр.

1990; Сейфулла, 1999; Макарова, 2003; Furlanelloet al., 2011; Gunina, Sheyko, 2018).

In recent years, sports science is characterized by the active development and implementation in practice of a large number of pharmacological drugs to improve physical work capacity and accelerate the recovery process, starting with youth sports. It is necessary to focus attention on the fact that the use of drugs by athletes is only one of the elements of the overall system of impact on the adaptation of the body to physical loads (Платонов, 2015).

Pharmacological effects on the body of the athlete should not be constant, and coincide with the time when the load has already caused some adaptive changes in the organism's. Complex restorative drugs should be directed, first, to the maintenance of energy and plastic resources, and, secondly, to the partial elimination or detoxification of metabolic products.

The main task of pharmacological support of athletes at the recovery stage is the removal of toxins from the organism's, formed during heavy physical activity, as well as drug therapy of overstrain of various systems and organs. During the period of intense physical activity, the task of strengthening protein synthesis in the organism, saturation of the diet with full-fledged proteins and carbohydrates is put forward to the fore. In the pre-competition and competition periods, the most important tasks are the creation of energy depots in the organism's, prevention of infectious diseases, maintenance of immunological status (Сучковидр., 1990; Сейфулла, 1999; Макарова, 2003).

Thus, the main tasks of pharmacological support in a particular period of preparation of the athlete is dictated by the direction and volume of training and competitive loads, the degree of tension of certain systems of the body.

The aim of the research is to study the influence of pharmaceuticals on the functional state of the cardiovascular system of athletes and handball players.

Material and methods

To characterize the systemic circulation was used hardware-software complex *"*Impercard-M*"*. The following parameters were studied: HR (bpm) – heart rate; SAP, DAP, APmean. (mmhg), – respectively, systolic, diastolic, mean blood pressure; SV (ml) – stroke volume; CO (l/min) – cardiac output, TPR (dyn×s×cm^{-5}) – total peripheral resistance, LV filling pressure (mmhg) – pressure filling the left ventricle, cardiac index, l/ (min×m^2).

The study of bioelectric activity of a heart was carried out to determine the level of functional reserve of metabolism, the level of myocardial hyperfunction on the device *"*Poly-Spectrum 8E/LLC*"*.

To assess the bioelectric activity of the heart, the time and amplitude parameters of the functional state of the myocardium were used: the duration of the intervals P (ms), p–Q (ms), QRS (ms) respectively, intracardiac, atrial-ventricular and intraventricular conductivity; Q–T (ms) – electrical systole; angle of alpha in degrees (axis QRS, °).

To study the parameters of heart rate variability the software and hardware complex *"*Poly-Spectrum*"* was used. The main characteristics were determined: Mo (ms) – mode, AMo (%) – mode amplitude, dRR (ms) – variational scale, SDNN (ms) – standard deviation of RR intervals, stress index (relative units) – voltage index of regulatory systems, HF (%) – high frequency (High Frequency), LF (%) – low frequency (Low Frequency), LF/HF – criterion of sympatho-vagus balance, the ratio of activity levels of the central and autonomous circuits of regulation, VLF (%) – very low frequency waves (Very Low Frequency).

Regular sports training changes the functional the state of the whole organism's, but the main limiting link in the system transport of oxygen in sports activities is the cardiovascular system, the most a significant contribution to the functional tension of the organism's makes the system of support of myocardial contractile function.

Due to the fact that the cardiovascular system is limiting to achieve sports results, changes in the bioelectric activity of the heart, Central hemodynamics occur quite early and are manifested in the form of violations of repolarization, arrhythmias and a decrease in myocardial contractility. We have chosen such methods of control as electrocardiography, heart rate variability and Central hemodynamics study.

The study involved 10 athletes and 9 handball players aged from 17 to 21 years, with 1st category qualification, Candidates for Master of sport.

The study was conducted before and after the use of a complex of drugs, which included the adaptogen *"*Pantocrine Forte*"*, amino acid complex *"*Tavamine*"* and enterosorbent *"*Polyphepanum*"*. These drugs were taken in a certain dosage for 10 days.

Pantocrine-antler extract of red deer, refers to the group of adaptogens/ in other words, substances that contribute to the development of a state of non-specifically increased resistance, manifested in an increase in efficiency, increased resistance to a wide range of damaging factors. The active principle of this drug is a complex of biologically active substances – lipids, amino acids, nucleic acid bases, peptides and microelements (calcium, magnesium, iron, sodium, potassium, phosphorus). Pantocrine was taken inside 200 mg, 30 minutes before eating, 2 times a day.

Tavamine is a complex drug containing L-leucine, L-isoleucine, L-valine and taurine, belonging to the group of hepatoprotectors. Leucine, isoleucine and valine are essential amino acids with branched-chain hydrocarbon, that make up 42% of all amino acids of muscle tissue, they are active building blocks of muscle, during training they are used for energy. Tavamine was taken inside 200 mg, 2 times a day.

Taurine is a sulfur-containing amino acid formed in the body from cysteine, it can be found in the heart muscle, central nervous system, leukocytes, skeletal muscles, it is necessary for the metabolism of fats, maintain normal cholesterol, normal metabolism of sodium, potassium, calcium and magnesium. Taurine prevents the release of potassium from the heart muscle. Taurine was taken inside 250 mg, 30 minutes before eating, 2 times a day.

Polyphepanum is a natural enterosorbent on the basis of lignin. Lignin (from lat. lignum-wood, wood) is a substance that characterizes the stiffened walls of plant cells. A complex polymer compound found in vascular plant cells and some algae. In medicine, lignin is used as a drug, providing enterosorbent, detoxification, antidiarrheal, antioxidant, hypolipidemic and complexing action. Polyphepanum was taken inside one hour before taking other drugs 50 g 2 times a day.

Statistical processing of the material was carried out using the program STATISTICA: descriptive statistics. The normality of the sample distribution was estimated using the Shapiro-Wilka criterion. Determination of the significance of differences was carried out using Student's criterion (t).

Results and discussion

The analysis of central hemodynamics parameters before the course of pharmaceuticals revealed hyperkinetic and normokinetic type of blood circulation in athletes. After the use of drugs, there is a tendency to increase the hyperkinetic type of blood circulation. At the same time, there was a decrease in the level of blood pressure, both systolic and diastolic, but not beyond the physiological norm (Table 1).

Table 1

Average group indexes of central hemodynamics, bioelectric activity of the heart and heart rate variability among representatives of track and field athletics before and after the use of pharmaceuticals

Indexes	Before use of pharmaceutical products X±S	After use of pharmaceutical products X±S
Central hemodynamics		
SAP, mmhg	129.0 ± 14.0	119.0 ± 10.0
DAP, mmhg	8.0 ± 5.0	73.0 ± 8.0
HR, bpm	57.0 ± 11.0	55.0 ± 9.0
SV, ml	103.6 ± 51.5	116.6 ± 39.3
CO, l/min	6.7 ± 2.8	6.6 ± 2.8
Cardiac index, l/(min×м^2)	4.4 ± 1.4	5.2 ± 1.5
TPR, dyn×s×cm^{-5}	1008.2 ± 463.1	805.2 ± 258.8
LV filling pressure, mmhg	18.8 ± 3.0	18.8 ± 2.3
Bioelectric activity of a heart		
P, ms	114.8 ± 11.9	113.8 ± 8.9
PQ, ms	156.8 ± 21.9	155.2 ± 22.3
QRS, ms	107.9 ± 6.7	108.4 ± 6.8
QT, ms	400 ± 17.3	407.4 ± 17.9
QTc, ms	616.9 ± 150.9	632.7 ± 163.0
axis QRS, °	70.7 ± 28.5	65.55 ± 27.5
Heart rate variability		
Mo, мс	1063.1 ± 348.2	1148.4 ± 184.7
AMo, %	29.6 ± 13.1	25.4 ± 7.4
Stress index, relative units	28.9 ± 23.1	24.2 ± 18.4
dRR, ms	550.8 ± 196.6	480.1 ± 174.2
VLF, %	39.7 ± 26.6	39.3 ± 17.7
LF, %	20.2 ± 10.0	21.4 ± 9.5
HF, %	38.4 ± 21.1	58.8 ± 58.8
LF/HF	0.8 ± 0.7	0.6 ± 0.3
SDNN, ms	91.2 ± 25.2	93.5 ± 28.2

It will be observed that if the athletes before the course of pharmaceuticals was defined the vertical position of the electric axis of the heart or the deviation of the electric axis of the heart to the right, then both the vertical and horizontal position of the electric axis of the heart was recorded. Negative waves T as an indicator of metabolic disorders in the heart muscle before the use of pharmaceuticals, were identified among 4 athletes in the allocation of TavL (lateral region), and after the use of drugs there was a tendency to normalize this indicator.

The primary examination of almost all athletes involved in athletics revealed the normotonic type

of regulation of the heart rate with a predominance of parasympathetic effects on the background of a distinct dominance of autonomous mechanisms of regulation with a moderate effect of breathing on the heart rate. After a course of pharmaceuticals, the activity of the sympathetic link of regulation increased.

The high functional state of the physiological sports heart in the examined athletes should be regarded as a manifestation of the formation of a long-term adaptive reaction, ensuring the implementation of previously inaccessible in its intensity of physical work, corresponding to the period of training.

Comparative analysis of the central hemodynamics of handball players revealed a tendency to reduce systolic, diastolic and mean blood pressure (Table 2). At the same time, there was a tendency to reduce heart rate after the use of pharmaceuticals. As can be seen from Table 2, the indicator of SV remained at the same level.

Sinus bradycardia was observed among 5 athletes, the rest of the heart rate was registered within the physiological norm. In athletes, sinus bradycardia is considered as an indicator of fitness only to a certain level. Bradycardia that is less than 40 reductions per minute should be considered as a consequence of fatigue, infectious and toxic effects, especially in combination with other deviations on the ECG (Eckel et al., 2014; Oja et al., 2017). With frank bradycardia, athletes may experience migration of the rhythm source, i.e., the movement of the rhythm driver from the sinus node to the atrioventricular and back.

It is noteworthy that the majority of athletes (5) observed normokinetic type of blood circulation, 4 – hyperkinetic.

According to the majority of authors studying types of blood circulation, in hyperkinetic type the heart works in the least economical mode and the range of compensatory possibilities of this type is limited. In this type, there is a high activity of the sympathetic-adrenal system. The tendency to the formation of hyperkinetic blood circulation with high rates of the CO due to the increase in heart rate against the background of increased TPR indicates a great stress of adaptive mechanisms and is considered by many authors as a pathology (Граевская, Долматова, 2004; Гаврилова, Земцовский, 2010).

Table 2

Average group indexes of central hemodynamics, bioelectric activity of the heart and heart rate variability among representatives of handball before and after the use of pharmaceuticals

Indexes	Before use of pharmaceutical products X±S	After use of pharmaceutical products X±S
Central hemodynamics		
SAP, mmhg	121.0 ± 90	117.0 ± 12.0
DAP, mmhg	78.0 ± 6.0	75.0 ± 8.0
APmean., mmhg	92.0 ± 5.0	89.0 ± 7.0
HR, bpm	62.0 ± 12.0	59.0 ± 12.0
SV, ml	121.11 ± 27.35	122.00 ± 34.48
CO, ml/min	7533.33 ± 2029.77	7328.88 ± 2707.67
Cardiac index, l/×м^2)	3.63 ± 1.00	3.27 ± 1.45
TPR, dyn×s×cm^{-5}	1086.44 ± 473.76	1100.83 ± 435.30
LV fillingpressure,mmhg	18.86 ± 2.33	18.72 ± 1.87
Bioelectric activity of a heart		
P, ms	113.77 ± 12.41	115.11 ± 8.76
PQ,ms	151.22 ± 21.48	150.77 ± 23.56
QRS, ms	110.00 ± 9.36	110.11 ± 9.37
QT, ms	406 ± 23.51	404.44 ± 33.92
QTc, ms	400.33 ± 18.64	392.88 ± 26.22
axis QRS, °	64.11 ± 37.67	65.00 ± 36.23
Heart rate variability		
Mo, ms	1058.66 ± 218.83	1097.33 ± 198.07
AMo, %	35,66 ± 16.37	29.27 ± 10.16
Stress index, relative units	68.68 ± 92.98	41.61 ± 36.56
dRR, ms	399.88 ± 165.09	463.78 ± 190.54
VLF, %	45.66 ± 17.02	36.11 ± 13.93*
LF, %	23.88 ± 12.63	27.55 ± 6.94
HF, %	30.55 ± 11.94	36.22 ± 15.29*
LF/HF	0.94 ± 0.84	0.99 ± 0.74
SDNN, ms	66.22 ± 25.15	93 ± 49.35

Note: * *– accuracy of differences at $p < 0.05$*

The most favorable from the point of view of adaptation to physical loads is considered to be the normokinetic type of blood circulation, contributing to increased efficiency.

Thus, it is obvious that in the conditions of physiological rest in handball players with normokinetic type of blood circulation, the necessary level of blood supply is maintained, primarily due to the high specific peripheral resistance, and in hyperkinetic itis maintained due to the increase in

SV. This means that, depending on the type of blood circulation, the mechanisms of maintaining the same level of homogeneous index (blood pressure) are different.

In a state of rest in handball recorded normal ECG(5 athletes). Sharply frank arrhythmia was defined among 2 athletes. It is known that sinus arrhythmia is a periodic change in the rhythm of cardiac cycles associated with the phases of respiration. The difference between long and short intervals does not exceed 0.16 C. the Severity of respiratory arrhythmia is one of the important indicators of the functional state of the heart. It is considered to be sharp when the fluctuations in the duration of RR reach 0.3 ms or more. In these cases, the arrhythmia indicates a violation of the regulation of the sinus node, which may be a sign of overtraining (Баевский, Мотылянская, 1986; Флейшман, 1999; Parekh, Lee, 2005).

Ectopic rhythm was revealed among 2 athletes.

It should be noted that handball players revealed normal duration of atrial and ventricular conduction. However, 1 athlete had atrioventricular conduction at the upper limit of the norm. The duration of the Q–T interval, characterizing the electrical system of the ventricles, was observed in all athletes within the normal range.

It will be observed that 6 handball players had a vertical position of the electric axis, 2 had normal, 1had a sharp deviation of the electric axis of the heart to the left.

Special attention is given to the appearance of ECG signs of overstrain of the myocardium. A negative wave T was found in 1 handball player in the lead avL (side area) and 1 athlete was observed reduced, two-humped wave T in the leads V_2-V_3 (front-city area). These changes are associated, apparently, with metabolic disorders in the heart muscle due to physical and nervous overload (Chuiko, 2011; Riebe et al., 2015; Drezner, et al., 2016, 2017; Zorzi et al., 2018).

It will be observed that on the basis of the Romhilt-Estes and Cornell criteria, 1 athletes showed signs of left ventricular hypertrophy, which is considered as an adaptive change (Fletcher et al., 2013).

After the use of pharmaceuticals, no significant changes were detected according to the ECG.

We have found a tendency to increase the activity of the humoral canal regulation of the heart rate after the use of pharmaceuticals. At the same time, the analysis of stress index and AMo indicates a tendency to reduce the centralization of heart rhythm control and the activity of the sympathetic autonomic nervous system. In addition, increased vagal influence on the heart rhythm.

Normotonic type of heart rate regulation with the predominance of parasympathetic modulations was observed in 6 athletes, and 1 had frank vagotony. Sharply franked vagotony is considered as a condition on the verge of norm and pathology, requiring serious adjustment of training loads. 1 handball players was determined sympathetic type.

Similar results on the predominance of autonomous circuit activity and parasympathetic effects were obtained in the analysis of respiratory waves (HF).

The value of LF component testified to the normal activity of regulatory mechanisms providing local and general adaptation of the vascular system to changes in stroke volume and cardio outputamong 5 athletes. 1 handball player showed moderate, 2 – a sharp increase and 1 – a moderate weakening of the activity of the vasomotor center.

At the same time, along with these changes, 2 athletes showed a moderate decrease and 2 a sharp decrease in the level of activity of the energy-metabolic link of regulation, which indicated a decrease in functional reserves for the restoration of disturbed homeostasis. 2 handball players have a moderate increase in the activity of the VLF component.

After taking pharmaceuticals, there was a tendency to normalize the activity of the vasomotor center. The activity of the sympathetic subcortical center decreased significantly ($p < 0.05$). It is known that the values of VLF reflects cerebral ergotropic effects on the lower levels and allow us to judge about the functional state of the brain at psychogenic and organic pathology of the brain. There is evidence that VLF is a sensitive indicator of metabolic processes control and well reflects the energy deficit States. Thus, VLF parameters characterize the influence of higher vegetative centers on the cardiovascular subcortical center and can be used as a reliable marker of the degree of connection of autonomous (segmental) levels of regulation of blood circulation with supra-segmental, including pituitary-hypothalamic and cortical levels.

It should be noted a significant increase in the power of the respiratory waves of the heart

rate ($p < 0.05$). The enhancement of respiratory waves (HF) can be considered as activation of the cardioinhibitor center; the activity of the pacemaker and vasomotor centers is weakened, which may be associated with a decrease in control by higher levels of regulation or inhibition of the modulator center as a result of changes or strong reflex effects.

Conclusion

1. On the basis of the study of the impact of pharmaceuticals on the state of the cardiovascular system, the manifestation of economization of heart activity (a tendency to reduce heart rate, SAP, DAP and mean AP) was observed in two groups of patients.

2. According to the results of this study, in the vast majority of cases, the main indicators of the athletes' ECG were within the limits that are considered to be physiological. At the same time, 1 handball player showed changes, indicating a violation of the repolarization processes, requiring correction of the training process. There were no significant electrocardiographic changes after the course of pharmaceuticals. Among 4 athletes from athletics, were diagnosed with metabolic disorders in the heart muscle before the use of pharmaceuticals, and after the use of drugs, there was a tendency to normalize this indicator.

3. The tendency to decrease the centralization of the heart rhythm control and the activity of the sympathetic autonomic nervous system was revealed in handball players, and vagal effects on the heart rhythm increased. The predominance of HF components of spectral analysis indicates a good condition of athletes. The activity of the sympathetic subcortical center significantly decreased.

4. After the course of pharmaceuticals, athletes have increased the activity of the sympathetic link of regulation.

The above data indicate that the use of pharmacological drugs has caused the restructuring of the mechanisms of autonomic regulation of heart rate, the central level of hemodynamics and bioelectric activity of the myocardium, while achieving the optimal level of training of athletes.

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SPORTININKŲ ŠIRDIES IR KRAUJAGYSLIŲ SISTEMOS FUNKCINĖ BŪKLĖ PRIEŠ VAISTŲ VARTOJIMĄ IR BAIGUS JUOS VARTOTI

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SANTRAUKA

Buvo atliktas lengvosios atletikos sportininkų ir rankinio žaidėjų tyrimas prieš vaistų – adaptogeno „Pantocrine Forte“, aminorūgščių komplekso „Tavamine“ ir enterosorbento „Polyphepanum“ – vartojimą ir baigus juos vartoti. Farmaciniai produktai padėjo atstatyti sportininkų širdies ritmo vegetacinius mechanizmus, o centrinė hemodinamika ir miokardo bioelektrinė veikla pasiekė optimalų fizinio pasirengimo lygį.

Tyrimo *tikslas* – ištirti medikamentų įtaką lengvaatlečių ir rankinio žaidėjų širdies ir kraujagyslių sistemos funkcinei būklei.

Siekiant charakterizuoti sisteminę apytaką, buvo naudojamas programinės ir techninės įrangos kompleksas „Impercard-M“ ir tiriami šie parametrai: širdies ritmas (dūžiai per minutę), sistolinis, diastolinis ir optimalus kraujospūdis (mmHg), kraujo perpompavimas (ml), širdies minutinis tūris, bendras periferinis atsparumas (dyn×s×cm^{-5}), kairiojo skilvelio prisipildymo slėgis, širdies indeksas (l/min×m^2).

Širdies bioelektrinės veiklos tyrimas įrenginiu „Poly-Spectrum 8E/LLC“ buvo atliktas siekiant apibrėžti metabolizmo funkcinio rezervo ir miokardinės hiperfunkcijos lygį. Kad būtų galima įvertinti širdies bioelektrinį aktyvumą, buvo pasitelkti miokardo funkcinės būklės laiko ir amplitudės parametrai: intrakardinio, prieširdžio ventrikulinio ir intraventrikulinio laidumo intervalų trukmė (ms), elektrinis susitraukimas (ms), *alpha* kampas laipsniais (intraventrikulinė ašis, °).

Siekiant ištirti širdies ritmo svyravimus, buvo pasitelkta „Poly-Spectrum“ programinė ir techninė įranga. Nustatytos šios pagrindinės charakteristikos: režimas (ms), režimo amplitudė (%), nuokrypio skalė (ms), standartinis intervalų nuokrypis (ms), reguliavimo sistemų įtampos indeksas, aukšti dažniai (%), žemi dažniai (%), simpatinės nervų sistemos ir *Vagus* nervo balansas, centrinio ir autonominio reguliacijos mechanizmų aktyvumo lygių santykis, labai žemo dažnio bangos (%).

Tyrime dalyvavo 10 lengvaatlečių ir 9 rankinio žaidėjai, kurių amžius buvo 17–21 metai. Visi tiriamieji priklausė pirmai kvalifikacinei kategorijai ir buvo kandidatais gauti Sporto meistro vardą. Tyrimas buvo atliekamas prieš vaistų komplekso vartojimą ir baigus vartoti. Skirtų vaistų, kurie atskiromis dozėmis buvo vartojami 10 dienų, sąrašą sudaro: adaptogenas „Pantocrine Forte“, aminorūgščių kompleksas „Tavamine“ ir enterosorbentas „Polyphepanum“.

Remiantis medikamentų įtakos širdies ir kraujagyslių sistemai tyrimu, dviejose pacientų grupėse buvo pastebėtas širdies veiklos taupumo (širdies ritmo, sistolinio, diastolinio ir optimalaus kraujospūdžio susilpnėjimo tendencija) pasireiškimas. Anksčiau pateikti duomenys įrodo, kad vaistų vartojimas sukelia autonominio širdies ritmo reguliacijos mechanizmų, centrinio hemodinamikos lygio ir bioelektrinės miokardo veiklos persitvarkymo procesus siekiant optimalaus sportininkų pasirengimo lygio.

Raktiniai žodžiai: širdies ir kraujagyslių sistema, centrinė hemodinamika, elektrokardiografija, širdies ritmo pakitimai, sportininkas, vaistų kompleksas.

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11-oji Baltijos šalių sporto mokslo konferencija

Baltijos šalių sporto mokslo asociacijos veikla tęsiasi jau antrąjį dešimtmetį. Estijoje, Tartu universitete, 2018 m. balandžio 25–27 d. įvyko 11-oji Baltijos šalių sporto mokslo konferencija. Jos rengėjai buvo Tartu universitetas (TU) kartu su Baltijos sporto mokslo asociacija, Estijos aktyvaus gyvenimo klasteriu, Socialinių ir sveikatos mokslų doktorantų mokykla bei Tartu universiteto Projektų skyriumi. Konferencijos *tikslas* – skleisti Europos ir pasaulio sporto mokslo naujoves, dalytis naujausių tyrimų rezultatais. *Uždaviniai*: sporto mokslo plėtojimas Baltijos šalyse; doktorantūros ir magistrantūros studijų kokybės derinimas; jaunųjų mokslininkų rengimas; įvairių sporto renginių organizavimas, bendradarbiavimas su nacionalinėmis ir tarptautinėmis sporto ir su juo susijusiomis organizacijomis. Kaip įprasta, konferencija darbą pradėjo Baltijos šalių sporto mokslo asociacijos tarybos posėdžiu, kuriame daugiausia dėmesio buvo skirta asociacijai priklausančių universitetų mokslinių publikacijų, atspausdintų *Web of Science Thomson Reuters* duomenų bazėje, apžvalgai. Pažymėtina, kad 2017 m. buvo gana produktyvūs – didelę pažangą šioje srityje padarė Lietuvos sporto universitetas, paskelbęs 78 publikacijas, bei Latvijos sporto pedagogikos akademija (LSPA), taip pat padidinusi tokių publikacijų skaičių. Šio posėdžio metu buvo išrinktas naujas asociacijos prezidentas. Eilės tvarka prezidentu buvo išrinktas Estijos atstovas – Tartu universiteto prof. Jaakas Jürimäe. Pasikeitė ir viceprezidentai: viceprezidentu iš Latvijos tapo prof. Juris Grants (LSPA), iš Lietuvos – prof. Audronius Vilkas (LEU). Įvyko pokyčių ir tarybos narių sąraše: LSU prof. Albertą Skurvydą pakeitė prof. Aivaras Ratkevičius, TU prof. Vello Heiną pakeitė doc. Andre Koka.

Į konferencijos programą šiais metais buvo įtraukta 112 pranešimų, iš kurių 38 buvo žodiniai ir 36 stendiniai. Jaunieji mokslininkai parengė 32 pranešimus, plenariniuose posėdžiuose buvo perskaityti 6 pranešimai. Palyginimui galima pažymėti, kad 2017 m. Kaune vykusioje konferencijoje buvo gauta 152 pranešimai. Svarbu pažymėti, kad Tartu vykusios konferencijos rengėjai šį kartą didesnius reikalavimus kėlė pranešimų kokybei, o ne jų kiekybei. Be Baltijos šalių mokslininkų, šiais metais konferencijoje dalyvavo pranešėjai iš JAV, Vokietijos, Ispanijos, Suomijos, Lenkijos, Turkijos ir kt.

Konferencijos plenariniame posėdyje buvo perskaityti šeši pranešimai. Prof. Inigo Mujika iš Ispanijos Baskų universiteto skaitė pranešimą apie jėgos didinimą ištvermę lavinančiose treniruotėse. Kitą pranešimą skaitė JAV Teksaso universiteto prof. Markas Lochbaumas, kuris kartu dirba ir Lietuvos edukologijos universitete. LEU doc. dr. Aušra Lisinskienė su savo podoktorantūros studijų moksliniu vadovu prof. M. Lochbaumu yra laimėję Lietuvos mokslo tarybos dvejų metų trukmės podoktorantūros projektą, finansuojamą Europos Sąjungos struktūrinių fondų lėšomis. Jų vykdomų mokslinių tyrimų tikslas yra sukurti apklausos priemonę, kuri leistų įvertinti trenerio–sportininko–tėvų tarpasmenius santykius sportinės veikos kontekste. Profesorius konferencijoje pristatė temą „Pasiekimų tikslai ir sporto patirtis – tai, ką mes žinome ir ką turime padaryti“, kurioje atskleidė motyvacijos sporte aspektus, plačiai sporto tyrimuose nagrinėjamos pasiekimų teorijos kontekste. Pranešimo metu sukurta itin jauki ir motyvuojanti atmosfera, sužadinusi klausytojų aktyvumą. Nestokota humoro jausmo ir visiems dalyviams buvo perteikta amerikietiška nuotaika. Po pranešimo vykusios aktyvios diskusijos leidžia daryti išvadą, kad tema klausytojams buvo aktuali ir įdomi. Paminėtina, kad doc. dr. A. Lisinskienė, Lietuvos edukologijos universiteto dėstytoja, tyrėja, podoktorantūros stažuotoja, vadovavo socialinius sporto pedagogikos ir sporto vadybos klausimus nagrinėjančios sekcijos darbui, kur buvo pristatomi edukaciniai sporto aspektai. Prof. Simonas Perikles iš Vokietijos Mainco Johanes Gu-

tenbergo universiteto kalbėjo apie genetinius markerius sporto moksle. Baltijos šalims atstovavo trys pranešėjai: Tartu universiteto mokslininkė Aave Hannus ir kalbėjo apie vieno atvejo projektų tyrimų supratimą ir nesupratimą. Mokslininkė iš Latvijos sporto pedagogikos akademijos Aleksandra Čuprika pristatė pranešimą apie žmonių įtraukimo į masinį sportą problemas. Pranešėjas iš Lietuvos sporto universiteto Tomas Venckūnas kalbėjo apie adaptaciją prie intervalinių treniruočių vartojant antioksidantus.

Kaip ir kiekvienais metais, Baltijos šalių konferencijos metu vyko jaunųjų mokslininkų konkursas, kuriame atlikti tyrimai buvo pristatyti keturiose sekcijose. Šiemet buvo pristatyti 32 žodiniai pranešimai. Pirmojoje sekcijoje, kur buvo nagrinėjami treniravimo mokslo klausimai, geriausiu pranešimu pripažintas Latvijos sporto pedagogikos akademijos doktoranto Igorio Siminaičio pranešimas apie respiracinės depresijos efektą triatlonininkų organizmo funkcijoms parengiamuoju laikotarpiu. Antrojoje sekcijoje, nagrinėjusioje socialinius sporto pedagogikos aspektus ir sporto vadybą, geriausiu buvo pripažintas Ispanijos Murcijos katalikiškojo San Antonio universiteto jaunosios mokslininkės Marijos de la Trinidad Morales Belando pranešimas apie jaunųjų krepšininkų atakų ir baigiamųjų veiksmų skirtumus, kuriuos lemia kamuolio svoris. Fizioterapijos, sveikatos bei fizinio aktyvumo sekcijoje geriausiu pripažintas Tartu universiteto doktorantės Margot Bergmann pranešimas apie asmenų, turinčių trauminį nugaros smegenų pažeidimą, liemens raumenų tonuso ir gyvybinės plaučių talpos santykį ir jų sveikatos kontrolę. Sporto fiziologijos, biochemijos ir medicinos klausimus nagrinėjančioje sekcijoje geriausiai įvertintas LSU doktoranto Mindaugo Kvedaro pranešimas apie raumenų silpnėjimą senstant ir atliktą tyrimą apie kalorijų mažinimo įtaką. Jaunųjų mokslininkų konkurse šį kartą dalyvavo tik doktorantai.

12-oji Baltijos šalių sporto mokslo konferencija numatyta vykdyti 2019 m. balandžio 24–26 d. Vilniuje, Vytauto Didžiojo universitete.

Prof. habil. dr. Kazys Milašius
Konferencijos mokslinio komiteto narys