Razlike u zdravstvenim pokazateljima kod nogometaša mlađih i starijih od 30 godina

Tonći Grgurinović[1], Joško Sindik[2]
[1]*Poliklinika za medicinu rada i sporta sa medicinsko-biokemijskim laboratorijem Zagrebačkog športskog saveza, Zagreb, Hrvatska*
[2]*Institut za antropologiju, Zagreb, Hrvatska*

Korespondencija:
Doc. dr. sc. Joško Sindik, znanstveni suradnik
Institut za antropologiju, Zagreb, Hrvatska
e-mail: josko.sindik@inantro.hr

Differences in health indicators in football players younger and older than 30 years

Tonći Grgurinović[1], Joško Sindik[2]
[1]*Polyclinic for Occupational Health and Sports with clinical laboratory Zagreb Sports Association, Zagreb, Croatia*
[2]*Institute for Anthropological Research, Zagreb, Croatia*

Correspondence:
Joško Sindik, Assistant Professor, Scientific Associate,
Institute for Anthropological Research in Zagreb, Croatia
E-mail: josko.sindik@inantro.hr

Sažetak: Brojne studije pokazuju da širi opseg antropoloških karakteristika i pokazatelja zdravlja, bitno utječe na uspjeh u nogometu. Stalno praćenje ovih pokazatelja pruža trenerima podatke korisne za planiranje trenažnog procesa, prilagođenog konkretnim sportašima. Ova studija istražuje osnovne morfološke, fiziološke i zdravstvene (MFZ) pokazatelje odraslih nogometaša raznih razina sportske izvrsnosti. Cilj ove studije je utvrđivanje razlika u MFZ pokazateljima, kao i njihovu povezanost, u odnosu na dobnu skupinu sportaša. Utvrdit će se i različiti profili nogometaša, u odnosu na odabrane MFZ varijable. Ispitan je uzorak od 813 muških nogometaša, 362 u dobnoj skupini 17-30 godina (M±SD 21,48±3,51) i 451 starijih od 30 godina (43,84±9,17), iz zagrebačkih nogometnih klubova, koji su pristupili liječničkom pregledu na Poliklinici za medicinu rada i sporta. Pronađeno je nekoliko statistički značajnih razlika u MFZ karakteristikama između dvije dobne skupine, uglavnom u smjeru poželjnijih obilježja u mlađoj dobnoj skupini. Rezultati pružaju informacije važne za planiranje treninga, ali i za zdravstvenu preventivu.
Ključne riječi: morfologija, fiziologija, prevencija, profili

Abstract: Numerous studies show that wide range of anthropological characteristics and health indicators significantly affects the success in football. Therefore, constant monitoring of these indicators provides to the coaches the information useful for the planning of the training process, adjusted to concrete athletes. This study explores selected morphological, physiological characteristics and health (MPH) indicators of adult football players of various levels of sporting excellence. The aim of the study was to determine the differences in MPH indicators, as well as their correlation, stratified according to the age group of the athletes. The different profiles of players were identified, in relation to selected MPH indicators. A sample of 813 male players is examined, 362 in the age group 17-30 years (M±SD 21.48±3.51) and 451 aged over 30 years (43.84±9.17), from Zagreb football clubs, included in medical examination at the Clinic for Occupational Health and Sport. Several differences in MPH are found between two age groups, mainly in direction more desirable features in younger age group. The results provide important information for planning training, but also for health prevention measures.
Keywords: morphology, physiology, prevention, profiles.

Uvod

Prethodne studije su pokazale da sportaši s najboljim izvedbama u različitim sportovima imaju karakteristična antropološka obilježja, ovisno o zahtjevima pojedine vrste sporta i razine sportske izvrsnosti (Milanović, 1997). Stalno praćenje tih relevantnih svojstava, zajedno sa zdravstvenim stanjem sportaša, pruža vrijedne podatke za stvaranje odgovarajućeg trenažnog programa za određeni sport. Morfološke karakteristike i funkcionalne sposobnosti pokazale su se kao važni elementi u ukupnom antropološkom statusu sportaša. Međutim, još uvijek postoje ograničeni podaci o razlikama u tim značajkama u hrvatskim nogometnim klubovima, posebno u nižim stupnjevima natjecanja.

Introduction

Previous studies revealed that athletes with the best performance in different sports have distinctive anthropological characteristics, depending on the demands of the type of sports and the level of sports excelence (Milanović, 1997). Constant monitoring of these relevant characteristics, together with health status of the athletes, provides valuable data for the creation of adequate training program for the certain sport. Morphological characteristics and functional abilities are proven to be important elements in overall anthropological status of an athlete. However, there is still a limited data on differences in these features in Croatian football clubs, especially in lower ranks of competitions.

Vrhunski nogometaši moraju prilagoditi višestrukim fizičkim zahtjevima igre, te moraju posjedovati razumno visoku razinu u svim područjima fizičke izvedbe (Reillyly i sur., 2000). Antropometrijske (AN) i fiziološke (FI) karakteristike nogometaša unutar važan su dio cjelovitog praćenja talentiranih mladih igrača. Među ovim karakteristikama, neke su pod jakim genetskim utjecajima (npr. visina i maksimalni unos kisika), dok su ostale uglavnom okolinski određene i osjetljive na učinke treninga (Reillyly i sur., 2000). U studiji nogometnih momčadi na kraju grčkog prvenstva, rezultati ukazuju na to da osobine FI mogu igrati važnu ulogu u izvedbi vrhunskih nogometaša, pogotovo tjelesne masnoće (%), brzina trčanja, najveći okretni moment ekstenzora koljena i sposobnost vertikalnog skoka (Kalapotharakos i sur., 2006). Procjena sezonske varijacije u AN i FI varijablama u španjolskom profesionalnom nogometnom timu otkrila je da profesionalni nogometaši imaju dobru kondiciju od početka do kraja španjolske lige (s visokim VO2max), dok su promjene u VOmax ovise o početnim vrijednostima (Casajus , 2001).

Kondicijski trening (KT) smanjuje simpatičku aktivaciju i oksidativni stres. KT prigušuje srčanu simpatičku modulaciju i srčanu hipertrofiju, koja je povezana sa smanjenjem oksidativnog stresa i povećanjem bioraspoloživosti dušikova oksida (NO) (Bertagnolli et al., 2008). U studiji utjecaja KT na krvne lipide, krvni tlak i funkciju dimenzije šupljine lijeve klijetke, između nogometaša i nesportaša, razina sistoličkog krvnog tlaka kod nogometaša bila je znatno niži od kontrolne skupine (p < ,05), dok su sistolički (LVSP) i dijastolički (LVDP) promjeri lijevog ventrikula nogometaša bili značajno viši naspram kontrolne skupine (Gokhan et al., 2013). Slobodne masne kiseline u krvi povećale su se progresivno tijekom igre, djelomično kompenzirne progresivnim smanjenjem mišićnog glikogena, dok se umor također povremeno pojavljuje tijekom utakmice (Bangsbo i sur., 2006).

Među relevantnim značajkama u fizičkim zahtjevima za igrače tijekom igre, postoje velike individualne razlike, koje se odnose na FI kapacitete i taktičku ulogu u timu (Bangsbo i sur., 2006). Pozicijska uloga igrača odnosi se na njegove FI kapacitete. Vezni igrači (VI) i braniči imaju najviše maksimalne unose kisika (> 60 ml x kg (-1) x min (-1)) i najbolji su u intervalnim testovima tjelovježbe. S druge strane, VI obično imaju najnižu snagu mišića (Reillyly et al., 2000). VI trče više u niskoj brzini nego braniči ili napadači, dok je udaljenost koju pretrče velikom brzinom ista u početku, kao na kraju meča (Bangsbo, 1994). Međutim, osim FI zahtjeva tijekom utakmice u vezi s ukupnom udaljenosti koju igrač pretr-

Top-level football players have to adapt to the multifactorial physical demands of the game, and must possess a reasonably high levels within all areas of physical performance (Reillyly et al., 2000). Anthropometric (AN) and physiological (PH) characteristics of football players within are important part of a holistic monitoring of talented young players. Among these characteristics, some are under strong genetic influences (e.g. height and maximal oxygen intake) while the others are largely environmentally determined and susceptible to training effects (Reillyly et al., 2000). In the study of football teams at the end of the Greek championship, the findings suggest that PH characteristics may play an important role for top-level football performance, especially body fat (%), running velocity, peak torque of knee extensors and vertical jump ability (Kalapotharakos et al., 2006). The evaluation of seasonal variation in AN and PH variables in a Spanish professional football team revealed that professional football players have good fitness from the beginning to the end of the Spanish League (with a high VO2max), while the changes in VO2max depend on the initial values (Casajus, 2001).

Exercise training (ET) decreases sympathetic activation and oxidative stress. ET attenuates cardiac sympathetic modulation and cardiac hypertrophy, which were associated with reduced oxidative stress and increased nitric oxide (NO) bioavailability (Bertagnolli et al., 2008). In the study of the effects of ET on blood lipids, blood pressure and left ventricular cavity dimensions function between football players and non-athletes, mean systolic blood pressure levels of football players were significantly lower than control group (p<.05). Left ventricular systolic and diastolic diameters of football players were significantly higher than control group (Gokhan et al., 2013). Blood free-fatty acids (FFAs) increase progressively during a game, partly compensating for the progressive lowering of muscle glycogen, while fatigue also occurs temporarily during matches (Bangsbo et al., 2006).

Among relevant features, there are major individual differences in the physical demands of players during a game, related to PH capacity and tactical role in the team (Bangsbo et al., 2006). Positional role of a player is related to his/her PH capacity. Midfield players (MP) and full-backs have the highest maximal oxygen intakes (> 60 ml x kg (-1) x min (-1)) and perform best in intermittent exercise tests. On the other hand, MP tend to have the lowest muscle strength (Reillyly et al., 2000). MP run more at low speed than defenders and forwards, while the distance covered at high run speed is the same in

či tijekom nogometne utakmice, onima i druge energetski zahtjevne aktivnosti, odnosno uklizavanje, skakanje, ubrzanje i okretanje (Bangsbo, 1994). Međutim, svi ovi FI zahtjevi nisu isti za igrače različitih dobnih skupina.

Stoga, glavni cilj ove studije bio je utvrditi razlike u MFZ pokazateljima, između dvije dobne skupine nogometaša. Drugo, u odnosu na odabrane MFZ pokazatelje, utvrdit će se različiti profili igrača, koji zahtijevaju drukčiji kineziološki tretman (drugačiji program trenažnog procesa), s ciljem postizanja veće razine sportske izvrsnosti, ili diferencirane mjere prevencije zdravlja. Treće, odredit će se odnos između različitih MFZ pokazatelja, posebno za svaku dobnu skupinu igrača.

Metoda

Ispitanici

Analizirani su podaci reprezentativnog uzorka od 813 nogometaša aktivno angažiranih u nogometnim klubovima različitog natjecateljskog stupnja u Gradu Zagrebu i Zagrebačkoj županiji, od toga 362 u dobnoj grupi 17-30 godina (M±SD)(21,48±3,51) i 451 starijih od 30 godina (43,84±9,17). Nogometaši su pristupili liječničkom pregledu u Poliklinici za medicinu rada i sporta Zagrebačkog športskog saveza s medicinsko-biokemijskim laboratorijem u Zagrebu (PMRS) tijekom 2011. i 2012. godine, po principu uvrštavanja prvog liječničkog pregleda (u slučaju da je sportaš obavio više pregleda u navedenom razdoblju). U dobnoj skupini 17-30 godina pregledana je sportska kategorija seniora, koji su svi aktivni sportaši-natjecatelji, dok su u dobnoj skupini iznad 30 godina, uz populaciju seniora aktivnih natjecatelja, ispitani i nogometaši koji sudjeluju u veteranskim nogometnim natjecanjima. Dobna skupina iznad 30 godina definirana je kao jedinstven (homogen) uzorak zbog činjenice da većina ispitanih nogometaša zapravo igra u nižim stupnjevima natjecanja, u kojima su funkcionalna i ostala natjecateljska opterećenja podjednaka kao u veteranskim natjecanjima.

Varijable i postupci

Podaci su prikupljeni pregledom arhive ambulante Poliklinike za medicinu rada i sporta Zagrebačkog sportskog saveza s medicinsko-biokemijskim laboratorijem (PMRS) u Zagrebu. U analizu su uključeni svi podaci prikupljeni od svih nogometaša u dobi od 17 do 30 te 30 i više godina, koji su pristupili liječničkom pregledu tijekom 2011. i 2012. godine, uvažavajući etičke principe Helsinške Deklaracije.

Prikupljeni su podaci o sljedećim obilježjima: tjelesna visina (cm), tjelesna masa (kg), indeks tjelesne mase

the beginning as in the end of a match (Bangsbo, 1994). However, except PH demands on the player during the match related with total distance run during the football match, a player is engaged in other energy demanding activities, i.e. tackling, jumping, accelerating and turning (Bangsbo, 1994). However, all these PH demands are not the equal for the players in different age groups.

Hence, the main aim of this study was to determine the differences in the MPH indicators, between two age groups of football players. Secondly, in relation to selected MPH indicators, different profiles of players will be determined, who require different kinesiological treatment (different ET program), in order to achieve higher levels of sporting excellence, or differentiated measures of health prevention. Thirdly, the relationship between different MPH indicators will be determined, separately for each age group of players.

Methods

Subjects

The data of a representative sample of 813 male football players who are actively engaged in football clubs of different competitive level within the City of Zagreb and Zagreb County are analyzed, of which 362 in the age group 17-30 years (M ± SD) (21.48±3.51) and 451 old over 30 years (43.84±9.17). The players have joined the medical examination at the POHS in 2011 and 2012, according to the principle of including the first medical examination (in case the athlete performed more hits in the mentioned period). In the age group 17-30 years, the sports category of seniors who are all active athletes-competitors were examined, while in the age group above 30, the population of seniors whoi are active competitors, as well as the participants in veteran football competitions, were examined. The age group over 30 is defined as a single (homogeneous) sample, due to the fact that the majority of players are actually playing in lower ranks of competition, in which the functional and other loadings are in fact similar as in veteran competitions.

Variables and procedures

Data are collected by reviewing medical records from Polyclinic for Occupational Health and Sports of Zagreb Sports Association with Laboratory of Medical Biochemistry in Zagreb (POHS). The analysis included all data, collected of all players aged 17 to 30 and over age of 30, who have joined the medical examination during 2011 and 2012, taking into account the ethical principles of the Declaration of Helsinki.

The data on the following characteristics are collected: body height (cm), body weight (kg), Body Mass

(ITM), vitalni kapacitet (l) pluća, fizikalni pregled pluća, elektrokardiogram (ECG), puls mirovanja (otk./min.), arterijski sistolički i dijastolički krvni tlak (mmHg), hemoglobin (g/l), hematokriti (l/l), leukociti (fl), trombociti (fl), sedimentacija eritrocita (mm/h), dob sportaša (godine), pripadnost nogometnom klubu.

Vitalni kapacitet pluća je mjeren standardnim postupkom mjerenja forsiranog izdisaja nakon maksimalnog udisaja u 3 pokušaja (uzima se u obzir najviša postignuta vrijednost vitalnog kapaciteta) na uređaju Schiller Spirovit SP1, Schiller AG, made in Switzerland. Uredan nalaz pluća je definiran fizikalnim pregledom : inspekcijskim (prsni koš simetričan, dobro sveden, obostrano dobro respiratorno pomičan), perkutorno urednim plućnim zvukom, auskultacijski urednim šumom disanja (dominantno vezikularno, osim iznad velikih bronha i traheje gdje poprima obilježja bronhovezikularnog disanja) uz urednu frekvenciju disanja od 16-18 udisaja /min.

EKG snimanje je obavljeno standardnim pozicioniranjem elektroda pomoću 6 perifernih odvoda (3 standardna bipolarna odvoda ekstremiteta i 3 unipolarna odvoda ekstremiteta) i 6 prekordijalnih odvoda, uređajem Schiller AT-2 plus odnosno Schiller AT-102, Schiller AG, made in Switzerland. Elektrokardiografsko snimanje je moralo zadovoljiti kriterije tehnički kvalitetnog ispisa prije analize nalaza, uz jasni prikaz svih električnih potencijala (P, QRS, T), odnosno uz pravilno obilježavanje trajanja svih intervala (PQ, QRS, QT). Uredan nalaz pretpostavlja sinus ritam uz trajanje intervala u granicama fizioloških varijacija s obzirom na dob, s normalnim izgledom električnih potencijala uz urednu lijevostranu električnu os srca. Puls mirovanja (broj otkucaja u minuti) je prosječna vrijednost pulsa mjerena u ležećem položaju (tijekom snimanja ECG-a) te u sjedećem položaju (tijekom mjerenja arterijskog tlaka). Uredan nalaz je u rasponu frekvencije od 60 do 100 otkucaja u minuti. Arterijski sistolički i dijastolički tlak (izmjera u mmHg) je vrijednost obavljenog mjerenja u sjedećem položaju sa nadlaktičnom manšetom, uzimajući u obzir prosječnu vrijednost mjerenja na obje strane. (Razlika u izmjerenim vrijednostima arterijskog tlaka normalno ne bi trebala biti veća od 20 mmHg za sistolički tlak odnosno veća od 10 mmHg za dijastolički tlak.) Mjerenja arterijskog tlaka su obavljena uz pomoć elektronskog nadlaktičnog tlakomjera Omron M10 IT te Omron M6 Confort, Omron Healthcare Co., Kyoto, Japan, sa standardnim veličinama manšeta za odrasle osobe 12x26 cm, za odrasle pretile osobe 12x40 cm, te za djecu i mršave odrasle osobe 12x18 cm. Vrijednosti izmjerenog arterijskog tlaka za odrasle osobe se procjenjuju prema važećim Smjernicama Europskog

Index (BMI), vital capacity (l) of the lungs, electrocardiogram (ECG), resting heart rate (beat/min.), arterial systolic and diastolic blood pressure (mmHg), haemoglobin (g/l), haematocrit (l/l), leukocytes (fl), platelets (fl), erythrocyte sedimentation rate (mm/h), athletes' age (years) and football club membership. Vital lung capacity was measured using a standard method of measuring of the forced exhalation after a maximal inhalation in 3 attempts (taking into account the highest vital capacity value achieved) on the Schiller Spirovit SP 1, Schiller AG, made in Switzerland. Lung finding was defined by physical examination (inspection - chest symmetric, symmetrical chest expansion, bilaterally respiratory well mobile, percussion - lower lung border: left level of 10th spinous process, right level of 8th spinous process. Respiratory float of lower lung limit is 1-2 cm in a deep inspiration). Comparative percussion: percutory normal pulmonary sound, relative dullness, absolute dullness, tympanism, hyperresonant lung sound and auscultatory examination of lung function - normal breathing sound or polyphonic bronchial whistles, intermittent, inspiratory rattles, crepitations, reduced respiration) and is considered unremarkable with breathing frequency of 16-18 breaths / min, with percutory sonority and ausculatory predominant vesicular breathing, except over the large bronchi and trachea where bronchovesicular breathing is present. ECG is performed by recording with a standard positioning of the electrodes with setting 6 peripheral drains (3 standard bipolar extremity drains and 3 unipolar extremity drains) and 6 precordial drains, with the help of devices Schiller AT-2 plus or Schiller MT-102, Schiller AG, made in Switzerland. ECG recording had to meet the criteria of technical quality print before analysis of the findings, with a clear presentation of all electrical potentials (P, QRS, T) and with proper labelling of the duration of all intervals (PQ, QRS, QT). Normal finding assumes sinus rhythm with intervals within physiological variation ranges according to the age, with normal appearance of electric potentials and with normal left electrical axis of the heart. Resting heartbeat (beats per minute) is the average value of the pulse measured while subject is lying down (during recording the ECG) and in a sitting position (during measurement of the blood pressure). Normal finding is the frequency ranging from 60 to 100 beats per minute. Arterial systolic and diastolic blood pressure (mmHg in the survey) is the value obtained by measurement performed in a sitting position with the upper-arm cuff, taking into account the average of the measurements on both sides. (The difference in the measured values of blood pressure normally should not be higher than 20 mmHg for systolic pressure, or higher than 10 mm Hg for diastolic blood pressure.) Measurements of arterial blood pressure were carried out using

udruženja za hipertenziju i kardiologiju i Preporukama Hrvatskoga referalnog centra za hipertenziju centra izvrsnosti Europskog društva za hipertenziju, a za djecu i adolescente prema odgovarajućim literaturnim izvorima (Mancia et al., 2013; Vrdoljak et al., 2014; The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents, 2004).

Statistička analiza

Podaci su analizirani programom IBM SPSS 20.0. Sve razlike i povezanosti komentirane su na razini značajnosti od p<0,05. Razlike u antropološkim i zdravstvenim pokazateljima analizirane su primjenom t-testa (u slučaju normalno distribuiranih varijabli omjernog tipa), odnosno neparametrijskim postupcima (Mann Whitney U test i Hi-kvadrat test), ukoliko neki od navedenih uvjeta nije zadovoljen. U analizi povezanosti korišteni su Pearsonov ili Spearmanov koeficijent korelacije, a pointbiserijalni koeficijent korelacije je izračunat između omjernih i binarnih varijabli. Konačno, za određivanje profila nogometaša pojedine dobne grupe korištena je K-means metoda klasteriranja.

Rezultati i rasprava

Razlike između dobnih skupina nogometaša za MFZ varijable prikazani su (tablica 1). Stariji (u dobi> 30) nogometaši su statistički značajno teži i imaju veći ITM te viši puls mirovanja, sistolički i dijastolički krvni tlak. Veća brzina sedimentiranja eritrocita može ukazivati na veću učestalost kroničnih upalnih i inflamacijskih bolesti te češće uzimanje lijekova u starijim dobnim skupinama sportaša (posebno u veteranskoj skupini). Brzina sedimentacije eritrocita ubrzava s povećanjem dobi, nakon 40-te godine života, a još više i kasnije (Osei-Bimpong i sur., 2007; Assasi i sur., 2015). Stariji su nogometaši niži i imaju manji vitalni kapacitet pluća, u usporedbi s mlađim dobnim skupinama. Dobiveni podaci su u skladu sa dostupnim literaturnim podacima (Reichert i sur., 2009; Hanson i Jones, 2015; Börjesson, 2016; Osei-Bimpong i sur., 2007; Assasi i sur., 2015). Povoljniji MFZ pokazatelji su povezani s obimom, intenzitetom i kontinuitetom fizičke aktivnosti, koja je uglavnom izraženija u mlađim odraslim kategorijama sportaša. Objašnjenje ovih rezultata može se također naći u velikoj razlici u prosječnoj dobi nogometaša u ove dvije dobne skupine. Stariji igrači su uglavnom veterani (prosječna dob 43.84±9.17), dok seniori imaju prosječnu dob 21,48±3,51. Uz navedene razloge, nepovoljni morfološki pokazatelji potencijalno umanjuju i fiziološke kapacitete, nepovoljno djelujući i na zdravstvene pokazatelje. Suprotno navedenome, povećanje fizioloških kapaciteta organizma kroz adekvat-

electronic upper-arm sphygmomanometer Omron M10 IT and Omron M6 Comfort, Omron Healthcare Co., Kyoto, Japan, with the standard sizes of the cuffs for adults 12x26 cm, for obese adults 12x40 cm, and for children and thin adults 12x18 cm. The values of the measured blood pressure for adults is estimated according to the current guidelines of the European Society for Hypertension and Cardiology 1, and for children and adolescents according to the relevant literature sources (Mancia et al., 2013; Vrdoljak et al., 2014; The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents, 2004).

Statistical analysis

Data were analyzed IBM SPSS 20.0. All the differences and correlations are commented on the significance level of p <0.05. Differences in MPH indicators were analyzed using the t-test (in the case of normally distributed variables omjernog type) or non-parametric methods (Mann Whitney U test and Chi-square test), if any of these conditions is not met. In the analysis of the correlations, Pearson or Spearman's correlation coefficients are used, while pointbiserial correlation coefficient is calculated between ratio and binary variables of MPH indicators. Finally, to determine the profiles of players in each age group in MPH indicators, K-means method of clustering is used.

Results and Discussion

Differences between age groups of football players for the MPH variables are presented (Table 1). Older (aged >30) football players are statistically significantly heavier and have higher BMI, higher pulse rate, systolic and diastolic blood pressure. The speed of sedimentation of red blood cells may indicate a higher incidence of chronic inflammation and inflammatory diseases, and often medication in older age groups of athletes (especially in the veteran group). Erythrocyte sedimentation rate accelerates with increasing age, after 40-years of age, and more and later (Osei-Bimpong et al., 2007; Assas et al., 2015). Older players also have lower height and lower vital capacity of the lungs, as compared with younger age group. The obtained data are consistent with the available recent findings (Reichert et al., 2009; Hanson and Jones, 2015; Börjesson, 2016; Osei-Bimpong et al., 2007; Assas et al., 2015). More favorable MSH indicators are related to the scope, intensity and continuity of physical activity, which is usually more pronounced in the young adult categories of athletes. The explanation of these results can be also found in a large gap between average age of the football players in these two age groups is very large. Older players are mostly veterans (mean age 43.84±9.17), while seniors have mean age

nu tjelesnu aktivnost ima povoljni učinak na parametre zdravstvenog stanja. (Arena i Cahalin, 2014; Cléroux i sur., 1999). Prema tome, stariji igrači imaju manje poželjne MFZ osobine. Samo jedan sudionik imao je patološki nalaz pregleda pluća (u osobe starije od 30 godina), tako da je razlika između dvije dobne skupine nije bila statistički značajna. Praktična iskustva sportskog liječnika PMRS pokazuju da recipročan odnos nepovoljnih morfoloških i fizikalnih (zdravstvenih) pokazatelja vrijede i za fizikalni pregled srca, te za osnovni ortopedski odnosno neurološki pregled. Naime, patološke promjene pri fizikalnom pregledu utvrđuju se uglavnom već u mlađim dobnim skupinama (predškolska, školska i pubertetska dob). Stoga se, infekcije, alergije, kao i srčani šumovi, češće dijagnosticiraju u mlađim dobnim skupinama, prije adolescentne dobi. S aspekta ove pozitivne selekcije, može se reći da razlika u fizikalnim pokazateljima između istraživane dvije dobne skupine nogometaša uglavnom ne postoje (izuzev očekivanih dobnih varijacija).

Po EKG-u, bilo je 297 sudionika u dobi 17-30 i 401 sudionik u dobi iznad 30 godina s urednim nalazom, a 64 sudionika u dobi 17-30 i 50 sudionika u dobi iznad 30 godina s patološkim nalazom. Ova razlika bila je statistički značajna (Hi^2=7,33; p<0,01; df=1), u smjeru češće urednih nalaza EKG za starije sudionike. Glavni uzroci nagle srčane smrti u mlađih odraslih sportaša nasljedni oblici srčanih bolesti, a u starijim dobnim skupinama (iznad 35-e godine života) bolesti koronarnih arterija. Iz navedenog slijedi da EKG (važan modalitet probira u mlađim dobnim skupinama sportaša), ima ograničenu vrijednost za skupinu starijih sportaša, kojima se preporuča individualno indicirano ergometrijsko testiranje (Schmied i Borjesson, 2014; Asif i sur., 2013; George i sur., 2012; Shephard, 2011; Giada i sur., 2011; Löllgen i sur., 2010). Kardiovaskularno remodeliranje kao posljedica intenzivnog kontinuiranog sportskog treninga se češće pojavljuje u visoko aktivnih sportaša natjecatelja, uglavnom u mlađim odraslim dobnim skupinama, te nerijetko rezultira s promjenama u nalazu EKG (fiziološka adaptacija), koje mogu nalikovati patološkim promjenama (Corrado i sur., 2009; Baggish, 2015). Praktična iskustva sportskog liječnika u PMRS ukazuju na dojam da u starijih zdravih osoba EKG ispis postaje „zreliji" u smislu urednog nalaza, dok u mlađih odraslih osoba katkad postoji određeni nesrazmjer veličine tijela i unutrašnjih organa, uz tanji prsni koš, pa ispis EKG-a postaje „patološkiji". S druge strane, sustavnim radom na prevenciji i obvezom pregleda sportaša uočen je relativno značajan broj specifičnih poremećaja ritmova koji ulaze u patološku kategoriju EKG-a, posebno u skupini mlađih odraslih sportaša. Na-

21.48±3.51. In addition to these reasons, unfavorable morphologic indicators could potentially reduce the physiological capacity, adversely acting on health indicators. Contrary to the above, an increase in the physiological capacity of the organism through appropriate physical activity has a favorable effect on the parameters of health. (Arena and Cahalin, 2014; Cléroux et al., 1999).

Accordingly, older players have less desirable MPH characteristics. Only one participant a negative finding of the lung examination (who was older than 30 years), thus the difference between two age groups was not statistically significant. Practical experiences of sports physician in POHS show that reciprocal relationship of adverse morphological and physical (health) indicators could be applied to the physical examination of the heart, as well as for the main orthopedic and neurological examination. Mainly, pathological changes are found already during the physical examination determined in ounger age groups (pre-school, school and teenage age). Therefore, infections, allergies, and heart murmurs, are more often diagnosed in younger age groups, before the adolescence. From the point of positive selection, it can be said that the difference in physical indicators between two age groups of studied football players generally do not exist (except for the expected age variations). Therefore, the difference in physical parameters between the two groups players generally do not exist (except for the expected age variations).

According to ECG, there were 297 participants in the age 17-30 and 401 participants in the age group over 30 years of age with positive finding, and 64 participants in the age 17-30 and 50 participants in the age group over 30 years. This difference is statistically significant (Chi square= 7.33; p<0.01; df=1), in direction of relatively more positive ECG findings for older participants. The main causes of sudden cardiac death in young adult athletes are hereditary forms of heart disease, while in the older age group (over 35 years) it is coronary artery disease. It follows that the ECG (an important modality of screening in younger age groups of athletes), is of limited value for the group of older athletes, for whom is advised individually indicated exercise test (Schmied and Börjesson, 2014; Asif et al., 2013; George et al., 2012; Shephard, 2011; Giada et al., 2011; Löllgen et al., 2010). Cardiovascular remodeling, as a result of intensive continuous sports training, may be more prevalent in highly active athletes competitors, mainly in the young adult age groups, and often results in the changes in ECG findings (physiological adaptation), which may resemble pathological changes (Corrado et al., 2009; Baggish, 2015). Practical experience of sports physicians in POHS indicate the impression that the elderly healthy subjects ECG print be-

ime, promjene u EKG-u, očekivane u sportaša starijih od 30 godina, drugačije su od najčešćih značajnih promjena u mlađih odraslih sportaša (17-30 godina). U starijoj skupini dominiraju ishemijske promjene, a od aritmija fibrilacija atrija. U mlađoj dobnoj skupini dominiraju urođene promjene, primjerice preekscitacija te ekstrasistolije.

comes "mature" in terms of proper ECG findings, while in young adults sometimes there is a certain discrepancy in size of the body and internal organs, with a thin chest, and printing ECG becomes "more pathologic". On the other hand, systematic work on prevention and liability of examinations of the athletes, revealed a relatively sig-

***Tablica 1.** Razlike između dobnih skupina nogometaša za varijable istraživanja /*
***Table 1.** Differences between age groups of football players for the variables in research*

Variables/ Varijable	age group (year)/ dobna grupa (god.)	N	Mean/ Arit. sredina	Std. Deviation/ Std. raspršenje	Std. Error Mean/ Greška Arit. sred.	Median test (p)
height (cm)/visina	17-30	362	179.65	6.60	0.35	**0.00**
	>30	451	178.12	6.35	0.30	
weight (kg)/ tjel. masa	17-30	362	75.31	10.19	0.54	**0.00**
	>30	451	85.97	11.75	0.55	
vital cap./vitalni kap.	17-30	190	5.53	0.78	0.06	**0.00**
	>30	192	5.25	0.92	0.07	
pulse rate/puls mirovanja	17-30	362	59.04	10.75	0.57	**0.00**
	>30	451	63.61	11.08	0.52	
systolic pressure/ sist. tlak	17-30	362	119.22	11.85	0.62	**0.00**
	>30	451	127.98	13.05	0.61	
diastolic pressure / diast. tlak	17-30	362	71.40	8.37	0.44	**0.00**
	>30	451	81.44	8.84	0.42	
hemoglobin	17-30	362	146.78	8.21	0.43	0.24
	>30	451	147.69	8.08	0.38	
hematocrit/ hematokrit	17-30	362	0.44	0.02	0.00	0.11
	>30	451	0.45	0.02	0.00	
leukocyte/ leukocit	17-30	362	6.76	8.30	0.44	0.92
	>30	451	7.58	11.31	0.53	
thrombocyte/ trombocit	17-30	362	218.30	46.50	2.44	0.12
	>30	451	225.62	56.09	2.64	
sedimentation/ sedimentacija	17-30	362	4.05	2.53	0.13	**0.00**
	>30	451	6.02	4.04	0.19	
BMI/ ITM	17-30	361	23.30	2.64	0.14	**0.00**
	>30	451	27.08	3.28	0.15	

***Bold:** statistically significant differences at p<0,01 / **Podebljano:** statistički značajne razlike uz p<0,01*

***BMI/ ITM:** Body Mass Index / Indeks tjelesne mase*

Profili nogometaša za dva dobivena klastera i za obje dobne skupine su vrlo slični. Samo malo poželjnije osobine (s kineziološkog i medicinskog aspekta) imaju nogometaši grupirane u drugim klasterima u obje dobne grupe (tablica 2). Najjednostavnije tumačenje ovih rezultata može se naći u činjenici da je većina nogometaša generalno ocijenjena kao zdrava, u ovim rutinskim medicinskim pregledima.

Od 78 korelacija, 24 su bile statistički značajne u dobnoj skupini od 17-30, te 34 u dobnoj skupini > 30 (tablica 3), dok je smjer povezanosti bio u skladu s oče-

nificant number of specific disorders of the rhythms, that are included in the category of pathological ECG, especially among younger adults athletes. The changes in the ECG that are expected in athletes older than 30 years, are different from the most common significant changes in young adult athletes (17-30 years). In the older group dominated ischemic changes and arrhythmias of atrial fibrillation. In the younger age group dominated innate changes, such as excitation and extrasystolia.

The profiles of football players in both age groups, indicate that two clusters obtained are very similar. Just

Table 2. *Profiles of football players, according to the variables in the study, stratified by age group /*
Tablica 2. *Profili nogometaša prema varijablama u istraživanju, stratificirani prema dobnoj skupini*

>30		Clusters for age group	17-30	
1st	2nd	Klasteri za dobnu grupu	1st	2nd
177.0	180.0	height/ visina	180.4	179.0
85.54	86.47	weight/ masa	76.51	76.48
5.14	5.33	vital capacity/ vitalni kapacitet	5.60	5.40
66	63	pulse rate/ puls	57	60
129	127	systolic press./ sistolički tlak	121	120
82	80	diastolic press./ diastolički tlak	73	70
146	147	hemoglobin	147	146
0.44	0.44	hematocrit/ hematokrit	0.44	0.44
8.5	7.0	leukocyte/ leukocit	6.1	6.5
263	184	thrombocyte/ trombocit	190	264
7	5	sedimentation/ sedimentacija	4	4
22.02	24.47	BMI/ ITM	27.09	27.01
84	**108**	Number of Cases/ broj slučajeva	**122**	**68**

BMI/ ITM: *Body Mass Index / Indeks tjelesne mase*

kivanjima. Razložno tumačenje ovakvog trenda može se dati u terminima razvoja koji još nije završen za dio predstavnika mlađe dobne skupine.

Razlike i korelacije u MFZ, u različitim dobnim skupinama nogometaša, prikupljeni rutinskim zdravstvenim pregledima, mogu pomoći i za kineziološke i za zdravstvene svrhe. Utvrđivanje različitih profila igrača, pomaže težnji postizanja više razine sportske izvrsnosti (primarno u pogledu optimalne fizičke spremnosti), kao i za planiranje specifičnog kineziološkog tretmana, prilagođenog određenim profilima. Ovdje su neki primjeri s nalazima nekoliko autora. Studija o dugoročnim i kratkoročnim učincima teške dinamičke vježbe na neuralnu kontrolu otkucaja srca, može objasniti koegzistenciju bradikardije uslijed treninga te znakova pojačane simpatičke aktivnosti kod treniranih vrhunskih sportaša (Furlan i sur., 1993). E/A kvocijent (omjer vršne brzine tijekom rane i kasne dijastole) ukazuje da redovita tjelesna aktivnost u starijoj dobi može štititi od dobno ovisnog smanjenja dijastoličke funkcije (Pavlik i sur., 2001). U studiji utjecaja aerobnog treninga, rezultati su otkrili da su uz poboljšanje aerobne izdržljivosti, nogometaši poboljšali svoju izvedbu povećavanjem pretrčanih udaljenosti, pojačanjem intenziteta rada, te povećanjem broja sprinteva i posjeda lopte tijekom utakmice (Helgerud et al., 2001). Plan i program KT tijekom ljetnog pripremnog razdoblja promjene motoričkih sposobnosti kod nogometaša FC Rad (Beograd), rezultirao je većim ili manjim promjenama koje su se dogodile tijekom tog pripremnog razdoblja (Janjić i sur, 2010). Slično navedenome, uvidi iz ove studije mogu doprinijeti određivanju smjernica za posebnu

a bit more desirable characteristics (from kinesiological and medical aspect) have football player grouped in second clusters in both age groups (Table 2). The simplest interpretation of these results can be found in the fact that most players are generally estimated as healthy, in these routine medical examinations.

Out of 78 correlations, 24 were statistically significant in the age group 17-30, and 34 for the age group >30 (Table 3), while the direction of associations was in line with the expectations. The reasonable interpretation of this trend can be given in terms of growth that is still not completed for some representatives of the younger age group in research.

The differences and correlations in the MPH, in different age group of football players, collected from routine medical examinations, might help both for kinesiological and health purposes. Establishing different profiles of players, helps to the achieving a higher level of sports excellence (primarily optimal physical fitness), as well as for designing specific kinesiological treatment (special TP), adjusted to certain profiles. Here are some of the examples from findings of several authors. The study on the long term and short-term effects of heavy dynamic exercise on neural control of heart rate may explain the coexistence of training bradycardia, with signs of enhanced sympathetic activity in trained champion athletes (Furlan et al., 1993). E/A quotient (ratio of peak velocity during early and late diastole) suggested that regular physical activity at an older age might protect against age dependent impairment of diastolic function (Pavlik et al., 2001). In the study of the effects of ae-

Table 3. *Intercorrelations between the variables in research, for certain age groups of football players /*
Tablica 3. *Intercorrelations između varijabli u istraživanju, za određene dobne skupine nogometaša*

17-30 god.	height	weight	vital	pulse	systolic	diastolic	hemoglo	hematocr	leukocit	trombo	sedime	BMI	ECG
height/ visina	1	.543**	.450**	-.063	.123*	.051	-.040	-.054	-.044	-.134*	-.027	-.007**	.070
weight/ masa		1	.372**	.015	.222**	.148**	.066	.063	-.050	.012	.078	.834**	-.072
vital capacity/ vitalni kapacitet			1	-.032	.141	-.027	.042	.011	-.118	-.160*	-.118	.118	.023
pulse rate/ puls				1	.105*	.109*	.145**	.153**	-.046	.052	-.018	.059**	-.323**
systolic press./ sist. tlak					1	.501**	.023	.007	.008	-.036	.050	.190**	.077
diastolic press./dias.tlak						1	.161**	.118*	.069	-.061	-.003	.147**	.044
hemoglobin							1	.930**	.008	.050	-.296**	.106*	-.071
hematocrit/ hematokrit								1	.024	.058	-.299**	.109*	-.063
leukocyte/ leukocit									1	.145**	.024	-.032	-.039
thrombocyte/ trombocit										1	.190**	.102	-.070
sedimentation/ sedimentacija											1	.116*	-.024
BMI/ ITM												1	-.129*
ECG/ EKG													1
>30 god.	height	weight	vital	pulse	systolic	diastolic	hemoglo	hematocr	leukocit	trombo	sedime	BMI	ECG
height/ visina	1	.444**	.352**	-.104*	-.058	-.038	-.013	.030	-.003	-.182**	-.021	-.088	.115*
weight/ masa		1	.083	.124**	.219**	.271**	.176**	.209**	-.063	-.013	.038	.850**	-.018
vital capacity/ vitalni kapacitet			1	-.036	-.138	-.108	.086	.115	.045	-.044	.039	.105	-.037
pulse rate/ puls				1	.214**	.238**	.183**	.208**	.159**	.108*	.105*	.203**	-.300**
systolic pressure					1	.726**	.085	.092	-.024	.043	.065	.282**	-.084
diastolic pressure						1	.159**	.151**	-.017	.055	.106*	.329**	-.077
hemoglobin							1	.896**	.037	-.057	-.292**	.209**	-.148**
hematocrit/ hematokrit								1	.083	-.039	-.281**	.218**	-.140**
leukocyte/ leukocit									1	.035	-.007	-.076	-.051
thrombocyte/ trombocit										1	.250**	-.094*	-.042
sedimentation/ sedimentacija											1	.005	.028
BMI/ ITM												1	-.089
ECG/ EKG													1

** correlation statistically significant at p<0,01 / * correlation statistically significant at p<0,05
** korelacija statistički značajna uz p<0,01/ * korelacija statistički značajna uz p<0,05
BMI/ ITM: Body Mass Index / Indeks tjelesne mase; ECG/ EKG: electrocardiogram / elektrokardiogram

pozornost liječnika u izvanbolničkoj medicini i u sportu, kada promatra igrače u danim dobnim skupinama.

Zaključci

Pronađeno je nekoliko statistički značajnih razlika u MFZ karateristikama između dvije dobne skupine, uglavnom u smjeru poželjnijih obilježja u mlađoj dobnoj skupini, koje su objašnjene u smislu velikog udjela veterana u starijoj dobnoj skupini. Međutim, načelno se može reći da rutinski medicinski pregledi u mlađim dobnim skupinama sportaša dovode do njihove pozitivne selekcije, u smislu poželjnih zdravstvenih pokazatelja. Stoga se sve razlike dobivene u ovoj studiji mogu objasniti uo-

robic training, the results revealed that enhanced aerobic endurance in football players improved their performance by increasing the distance covered, enhancing work intensity, and increasing the number of sprints and ball possession during a match (Helgerud et al., 2001). ET plan and program during the summer preparation period on motor abilities changes in football players of FC Rad (Belgrade) resulted with the major or minor changes that occur during this preparation period (Janjić et al, 2010).

Similarly, the insights from this study can contribute to determine the guidelines for special attention of physicians in outpatient medicine and sport, when observing players in given age groups.

bičajenim fiziološkim promjenama, karakterističnim za dobne skupine sportaša (npr. recipročan odnos nepovoljnih morfoloških i fizikalnih (zdravstvenih) pokazatelja). Uvidi iz ove studije djelomično doprinose razumijevanju i praktičnoj primjeni rutinskih pregleda u ambulantama medicine rada i sporta, za poboljšanje mjera primarne i sekundarne prevencije poremećaja u zdravstvenom statusu sportaša.

Popis kratica korištenih u tekstu:

MFZ - morfološki, fiziološki i zdravstveni pokazatelji

AN - antropometrijske karakteristike

FI - fiziološke karakteristike

VO2max - maksimalni aerobni kapacitet ili maksimalni primitak kisika

KT - kondicijski trening

VI - vezni igrači (VI)

M±SD - aritmetička sredina / standardna devijacija (raspršenje)

PMRS - Poliklinika za medicinu rada i sporta Zagrebačkog športskog saveza s medicinsko-biokemijskim laboratorijem u Zagrebu

Conclusions

Several differences in MPH are found between two age groups, mainly in direction more desirable features in younger age group, which are explained in terms of large share of veterans in older age group. However, in principle, it can be said that a routine medical examination in early age of the athletes, bring to their positive selection, in terms of desirable health indicators. Therefore, all differences obtained in this study can be explained by the physiological changes characteristic of the age group of athletes (eg. a reciprocal relationship adverse morphological and physical (health) indicators). Findings from this study partially contribute to the understanding and practical application of medical examinations in outpatient medicine and sport, improving the measures of primary and secondary prevention of of the disorders in the health status of the athletes.

Abbreviations used in text:

MPH - morphological, physiological and health indicators

AN - anthropometric characteristics

PI - physiological characteristics

VO2max - maximal aerobic capacity or maximum oxygen uptake

ET - exercise training

MP - midfielders (VI)

M ± SD - mean / standard deviation (scattering)

POHS - Polyclinic for Occupational Health and Sport of Zagreb Sports Association with clinical laboratory in Zagreb

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