

CHARACTERISTICS AND EFFICIENCY OF SERVICE IN YOUNG TABLE TENNIS PLAYERS

KARAKTERISTIKE I EFIKASNOST SERVISA KOD MLADIH STONOTENISERKI

BRANKO ĐUKIĆ¹, VLADIMIR IVANEK²

¹Provincial Institute for Sports and Sports Medicine,
Novi Sad, Serbia

²University of Mostar-Faculty of Natural Sciences, Mathematics and Education, Study of Kinesiology, Bosnia and Herzegovina

¹ Pokrajinski zavod za sport i medicinu sporta,
Novi Sad, Srbija

²Sveučilište u Mostaru-Fakultet prirodoslovno-matematičkih i odgojnih znanosti, studij Kineziologije, Bosna i Hercegovina

Correspondence:

Branko Đukić
Provincial Institute for sport and sports medicine,
Novi Sad, Serbia
branko.djukic@pzsport.rs

Korespondencija:

Branko Đukić
Pokrajinski zavod za sport i medicinu sporta
Novi Sad, Srbija
branko.djukic@pzsport.rs

Abstract: The aim of this study was to determine the characteristics and efficiency of service in the best young table tennis players, as well as the existence of differences in service between young players of different ages. The research sample consisted of 18 matches (10 juniors, 8 cadets) at international tournaments in 2018 (ETTU Youth Top 10 in Portugal, European Youth Championship in Romania). The results of the analysis of the Hi-square independence test showed the existence of a statistically significant difference in the number of performed Forhand (FH) and Backhand (BH) short services in table tennis players. By 4.3%, more BH short services were recorded among juniors, while cadets significantly more used FH short services (3.5%) compared to older teammates. The research also proved the existence of a statistically significant difference in certain indicators of service efficiency. By 6.9%, Service without advantage is significantly higher among female cadets, and Service with acquired advantage is 5.9% higher among juniors. There is a difference in other indicators of service efficiency, but it is not statistically significant. Out of a total of 1450 services, only 1% of services were performed incorrectly.

Keywords: table tennis, kick-off, differences, cadets, juniors.

INTRODUCTION

Table tennis is one of the most technically and tactically complex sports. The precondition for gaining points is the successful application of as many different blows as possible. Each of them has its own way of performing, its own role in the point, and in relation to the quality and quantity of their application, the competitive achievement is determined, ie the style and concept of the player's game.

Sažetak: Cilj rada je bio da se utvrde karakteristike i efikasnost servisa kod najboljih mladih stonoteniserki, kao i postojanje razlika u servisu između mladih igračica različitog uzrasta. Uzorak istraživanja je činilo 18 mečeva (10 juniorki, 8 kadetkinje) na međunarodnim turnirima u 2018. godini (ETTU Youth Top 10 u Portugalu, Evropsko prvenstvo za mlade u Rumuniji). Rezultati analize Hi-kvadrat testa su pokazali postojanje statistički značajne razlike u broju izvedenih Forhend (FH) i Bekhend (BH) kratkih servisa kod stonoteniserki. Za 4,3% je zabeleženo više BH kratkih servisa kod juniorki, dok su kadetkinje značajno više koristile FH kratke servise (3,5%) u odnosu na starije saigračice. Istraživanjem je dokazano i postojanje statistički značajne razlike u po-jedinim indikatorima efikasnosti servisa. Za 6,9% Servis bez prednosti je veća od kadetkinja, a Servis sa stečenom prednosti je 5,9% više zabeležena kod juniorki. Razlika postoji i u ostalim indikatorima efikasnosti servisa, ali nije statistički značajna. Od ukupno 1450 servisa, samo 1% servisa je pogrešno izvedeno.

Ključne reči: stoni tenis, početni udarac, razlike, kadetkinje, juniorki.

UVOD

Stoni tenis spada u tehnički i taktički najsloženije sportove. Pretpostavka za dobijanje poena je uspešna primena što većeg broja različitih udaraca. Svaki od njih ima svoj način izvođenja, svoju ulogu u poenu, te u odnosu na kvalitet i kvantitet njihove primene determiniše se takmičarsko postignuće, odnosno stil i koncept igre igrača.

Determining the technical and tactical characteristics in competitive table tennis is important for improving all the performances necessary for a successful performance of the player, while respecting those elements of the game that are most used in the match and on whose efficiency the result largely depends.

Table tennis has a reputation for being the fastest ball game. The speed of a ball in table tennis depends on the type of stroke and the energy invested in the stroke itself. Thus, speeds range from 20-160km/h. Racket arm speed reaches 50-70km/h (Kondrič, Hudetz, & Furjan-Mandić, 2010).

Table tennis belongs to the group of polystructural acyclic sports and sports games, so it is clear that technical-tactical efficiency is the basis of table tennis success. In other words, the technical-tactical assumptions and requirements are extremely high and directly determine the final competitive success. The order of influence of certain technical and tactical variables on success in table tennis is as follows: Service efficiency, Efficiency in disabling the opponent and preparing your own attack, Efficiency of movement in the game, safety and efficiency in attacking game above the table and efficiency in active defense (Ivanek, 2015).

The result in table tennis is determined by the quality and quantity of motor knowledge and those anthropological features that are most important for this sport. Knowing the hierarchy of significant factors in the success of the table tennis game is the first prerequisite that sports experts and players should know in order for sports training to be adequate (Đukić, Ivanek, Vujanović, Glamočić, 2018).

Experts and researchers from around the world believe and agree that table tennis is a sport of aerobic metabolism that requires significant endurance, with frequent intense anaerobic metabolism required in short exchange of strokes when playing points (Pradas et al., 2010; Zagatto et al., 2010; 2011; Zagatto and Gobatto, 2012).

Different criteria for the division of basic strokes can be found in the table tennis literature.

According to Hudetz (2000) in relation to the type of rotation that the blow produces, the basic blows are divided into: direct attacking blows (attack without rotation), spin blows (attack with rotation), block (stop) blows, cut defense, pimple, flip, balloon defense, service. Techniques derived from basic strokes are receiving service, returning attacking spin shots and short balls are very important elements of a modern table tennis game. All of these shots are performed in two basic ways: forehand and backhand.

In any sports situation, especially in table tennis, it is difficult, if not impossible, for a coach to notice and

Utvrđivanje tehničko-taktičkih karakteristika u takmičarskom stonom tenisu je značajno za unapređenje svih performansi neophodnih za uspešni nastup igrača pri tome uvažavajući one elemente igre koji se u meču najviše primenjuju i od čije efikasnosti u najvećoj meri zavisi rezultat.

Stoni tenis ima reputaciju najbrže igre s loptom. Brzina loptice u stonom tenisu zavisi od vrste udarca i energije uložene u sam udarac. Tako se brzine kreću od 20-160km/h. Brzina ruke s reketom dostižu od 50-70km/h (Kondrič, Hudetz, & Furjan-Mandić, 2010).

Stoni tenis spada u grupu polistrukturalnih acikličnih sportova i sportskih igara, pa je jasno kako tehničko-taktička efikasnost predstavlja osnovu stonoteniske uspešnosti. Drugim rečima, tehničko-taktičke pretpostavke i zahtevi su izuzetno visoki i direktno određuju konačnu takmičarsku uspešnost. Redosled uticaja pojedinih tehničko-taktičkih varijabli na uspeh u stonom tenisu je sledeći: efikasnost servisa, efikasnost u onemogućavanju protivničkog i pripremi vlastitog napada, efikasnost kretanja u igri, sigurnost i efikasnost u napadačkoj igri iznad stola i efikasnost u aktivnoj odbrani (Ivanek, 2015).

Rezultat u stonom tenisu determinišu kvalitet i kvantitet motoričkih znanja i onih antropoloških obeležja najznačajnijih za ovu sportsku granu. Poznavanje hijerarhije značajnih činilaca uspešnosti stonoteniske igre je prvi preduslov koji sportski stručnjaci i igrači treba da znaju da bi sportski trening bio adekvatan (Đukić, Ivanek, Vujanović, Glamočić, 2018).

Stručnjaci i istraživači iz čitavog sveta smatraju i saglasni su da je stoni tenis sport aerobnog metabolizma koji zahteva značajnu izdržljivost, sa čestim intenzivnim anaerobnim metabolizmom potrebnim u kratkim razmenama udaraca prilikom odigravanja poena (Pradas et al., 2010; Zagatto et al., 2010; 2011; Zagatto and Gobatto, 2012).

U stonoteniskoj literaturi se mogu pronaći različiti kriterijumi za podelu osnovnih udaraca.

Prema Hudetzu (2000) u odnosu na vrstu rotacije koju udarac proizvodi, osnovni udarci se dele na: direktne napadačke udarce (napad bez rotacije), spin udarce (napad s rotacijom), blok (štop) udarce, rezana odbrana, pimpl, flip, balon odbrana, servis. Tehnike izvedene iz osnovnih udaraca su: prijem servisa, vraćanje napadačkih spin udaraca i kratke lopte i oni su veoma važni elementi savremene stonoteniske igre. Svi ovi udarci se izvode sa dva osnovna načina: forhendom i bekhendom.

U svakoj sportskoj situaciji, naročito u stonom tenisu, treneru je teško, ako ne i nemoguće, uočiti i zapamtiti

remember all the key events that occur within a training or match, if he relies exclusively on his knowledge of the sport and his own observation skills. Nevertheless, analysis based on accurate observations and recollections is a key tool for improving the future game of table tennis. In table tennis, notation analysis is an objective way of recording a player's game, so that critical events in that performance can be quantified in a consistent and reliable way. Table tennis is one of the fastest ball games in the world, so it is difficult for a coach to spot and remember all the key elements that occur within a game or training (Sindik, Ochiana, & Kondrič, 2012).

Each part of the points is characterized by certain blows, ie technical and tactical knowledge. The start of the point is reserved for service and service reception. No point can start without an initial kick, ie. service. He is the only kick in table tennis that does not depend directly on the opponent. Service is the initial shot in which the player directs the ball to his own, and then to the opponent's field of the table. In modern game, a large number of services are applied, which differ from each other in rotation, length, the part of the table where the ball is directed, as well as from other criteria. Receipt of service, ie return of service is carried out with the help of various strokes that are applied as a technical-tactical means of playing the match.

The importance of the service is evidenced by the interest of many authors in various research services (Đokić, 2003; Wang, 2019; Kocić, 2016, Ivanek, 2015).

Research Wang (2019) tried to determine the differences in service and service reception at the 2012 and 2016 Olympics and found that at the last Olympics significantly less efficient service and service reception, as well as fewer backhand receptions.

Service is the starting point in table tennis, as well as in many other sports (tennis, volleyball). That is why it is so important. Players who serve well, after a well-executed serve, can easily win a point or come to such a position to take the initiative. A table tennis player can have a strong kick, he can have a great spin, but all this cannot be expressed due to the fact that the opponent's serve returns poorly or that he serves poorly (Talović, Kazazović, Žifko, Hadžiahmetović, 2011).

In their research, Wu, X., Zhen, Z., (1996) found that in most cases, after services performed without rotation, points end after the first ball, while after variants of cut and side serves, the second and third balls are played, that is, scoring.

A good serve in table tennis is more than just bringing the ball into play. If you have quality service, you will be able to constantly prepare for the attack and control the

sve ključne događaje koji se javljaju unutar treninga ili meča, ako se oslanja isključivo na svoje znanje o sportu i vlastitu veštinu posmatranja. Ipak, analiza na temelju tačnih zapažanja i prisećanja je ključni alat za poboljšanje buduće igre stonotenisera. U stonom tenisu notacijska analiza je objektivan način snimanja igre igrača, tako da se kritični događaji u toj performansi mogu kvantifikovati na dosledan i pouzdan način. Stoni tenis je jedna od najbržih igara s loptom na svetu, pa je za trenera teško uočiti i zapamtiti sve ključne elemente koji se javljaju unutar igre ili treninga (Sindik, Ochiana, & Kondrič, 2012).

Svaki deo poena karakterišu određeni udarci, odnosno tehničko-taktička znanja. Početak poena je rezervisan za servis i prijem servisa. Nijedan poen ne može da počne bez početnog udarca, tj. servisa. On je jedini udarac u stonom tenisu koji ne zavisi direktno od protivnika. Servis je početni udarac u kojem igrač upućuje lopticu u svoje, pa u protivnikovo polje stola. U savremenoj igri se primenjuje veliki broj servisa koji se međusobno razlikuju po rotaciji, dužini, delu stola gde se loptica upućuje, kao i od drugih kriterijuma. Prijem servisa, odnosno vraćanje servisa se sprovodi uz pomoć različitih udaraca koji se primenjuju kao tehničko-taktičko sredstvo odigravanja meča.

O značajnosti servisa govori interesovanje mnogih autora za različitim istraživanjima servisa (Đokić, 2003; Wang, 2019; Kocić, 2016, Ivanek, 2015).

Wanga (2019) je pokušao da utvrdi razlike u servisu i prijemu servisa na OI 2012. i 2016. godine i ustanovio je da su na poslednjim OI značajno manje efikasni servis i prijem servisa, kao i manji broj prijema bekhendom.

Servis je početni udarac u stonom tenisu, kao i u mnogim drugim sportovima (tenis, odbojka). Upravo zato ima veliki značaj. Igrači koji dobro serviraju, nakon dobro izvedenog servisa, mogu lako osvojiti poen ili doći u takvu poziciju da preuzmu inicijativu. Igrač stonog tenisa može imati snažan udarac, može imati odličan spin, ali sve to ne može doći do izražaja iz razloga što se loše vraća protivnikov servis ili što sam loše servira (Talović, Kazazović, Žifko, Hadžiahmetović, 2011).

Wu, X., Zhen, Z., (1996) su u svom istraživanju utvrdili da u većini slučajeva nakon servisa izvedenih bez rotacije poen završavaju već nakon prve odigrane lopte, dok posle varijanti rezanih i postraničnih servisa dolazi do odigravanja druge i treće lopte, odnosno poentiranja.

Dobar servis u stonom tenisu je više od pukog uvođenja loptice u igru. Ako imate kvalitetan servis, moći ćete konstantno pripremati napad i kontrolisati tok igre,

course of the game, throwing the opponent off balance. Often, if you have good service, you can win with less effort and weaker shots (Seemiller, Holowchak, 2000).

The efficiency of the service enables the attacker to realize technical-tactical activities and most often gain initiative in the game, and by receiving the service the opponent is prevented or at least hindered by the next offensive action or takes the initiative to organize the attack (Ivanek et al., 2018).

METHODS

The sample of entities consists of 18 international matches of table tennis players of cadet and junior age, which are in the top 60 on the ETTU ranking list. The research included 10 matches, 39 sets, 737 points, ie services in the competition of juniors (16-18 years) and 8 matches, 40 sets, 713 points, ie services in the competition of cadets (11-15 years).

Observed and analyzed matches were played in 2018 at international tournaments organized by ETTU (Youth Top 10 in Portugal, European Youth Championship in Romania).

izbacujući protivnika iz ravnoteže. Često, ako imate dobre servise, možete pobeđivati sa manje napora i slabijim udarcima (Seemiller, Holowchak, 2000).

Efikasnost servisa omogućuje napadaču realizaciju tehničko-taktičkih aktivnosti i najčešće sticanje inicijative u igri, a prijemom servisa se protivniku onemogućava ili barem otežava naredna napadačka akcija ili preuzima inicijativa organizovanja napada (Ivanek i sar., 2018).

METOD RADA

Uzorak entiteta čine 18 međunarodnih mečeva stonoteniserki kadetskog i juniorskog uzrasta, koji se nalaze u prvih 60 na rang listi ETTU. Istraživanjem je obuhvaćeno 10 mečeva, 39 setova, 737 poena, odnosno servisa u konkurenciji juniorki (16-18 godina) i 8 mečeva, 40 setova, 713 poena, odnosno servisa u konkurenciji kadetkinja (11-15 godina).

Posmatrani i analizirani mečevi su odigrani 2018. godine na međunarodnim turnirima u organizaciji ETTU (Youth Top 10 u Portugalu, Evropsko prvenstvo za mlade u Rumuniji).

Table 1. Overview of the research sample / Tabela 1. Pregled uzorka istraživanja

VARIABLES / VARIJABLE	AGE CATEGORIES / UZRASNE KATEGORIJE		
	juniors girls / juniorke	cadets girls / kadetkinje	total / ukupno
matches / mečevi	10	8	18
sets / setovi	39	40	79
points / poeni	737	713	1450
service / servis	737	713	1450

The significance of the differences between the characteristics and success of the service was tested by applying the Chi square test and the method of crustabulation between the table tennis players of the junior and cadet age categories.

RESULTS AND DISCUSSION

Testing the differences in the frequencies of characteristics and service efficiency in juniors and cadets (Table 2) shows that there are statistically significant differences in the two variables. In the analysis of services classified by length (short, semi-long and long service) and in relation to the stroke with which it is performed (FH/BH service), no significant differences were obtained. In relation to the effect of the difference, with the indicator Type of service VRSSER, the effect of the observed differences is small (9%), below 10%. The variable EFISER had a medium-high effect with a 12% share of this indicator in defining the difference in service efficiency among cadets and juniors.

Značajnost razlika između karakteristika i uspešnosti servisa testirana je primenom Hi kvadrat testa i metodom krostabulacije između stonoteniserki juniorske i kadetske uzrasne kategorije.

REZULTATI I DISKUSIJA

Testiranje razlika u frekvencijama karakteristika i efikasnosti servisa kod juniorki i kadetkinja (Tabela 2.) pokazuje da postoje statistički značajne razlike u dve varijable. Kod analize servisa razvrstanih po dužini (kratki, poludugi i dugački servis) i u odnosu na udarac kojim se izvodi (FH/BH servis) nisu dobijene značajne razlike. U odnosu na efekat razlike, kod indikatora Vrsta servisa VRSSER je efekat uočenih razlika mali (9%). Kod varijable EFISER zabeležen je srednje visoki efekat sa 12% učešća ovog indikatora u definisanju razlike u efikasnosti servisa kod kadetkinja i juniorki.

Table 2. Test results of differences in frequencies, characteristics and efficiency of services for juniors and cadets girls

Variables / Varijable	Code / Šifra	χ^2	p	Cramer's V
Type of service* / Vrsta servisa*	VRSSER	11.198	0.048	0.09
Division of service by length / Podela servisa prema dužini	DUZSER	0.53	0.768	0.02
Type of service (FH service/BH service) / Tip servisa (FH servis/BH servis)	TIPSER	1.30	0.229	- 0.03(fi)
Service efficiency** / Efikasnost servisa**	EFISER	20.94	0.000	0.12

Legend: χ^2 – The value of the chi square of the test, the p-level of statistical significance of the chi square of the test, the V-value of the Cramer's V, the fi-value of the phi coefficient; * significant at $p \leq 0.05$; ** significant at $p \leq 0.01$

The entire sample included in this research is 1450 services that were applied in 79 sets of table tennis players in the cadet and junior age categories. Observing (Table 3) we notice that 54.3% recorded FH short service SEFHKR, then 14.7% BH short service SEBHKR, 13.9% FH semi-long service SEFHPO. The least represented service is the BH long service SEBHDU, which was performed 44 times out of 1450 services of both age categories of table tennis players.

Table 3. Display of frequencies of different types of services for juniors and cadets girls

Varijable / Varijable	Statistics / Statistici	Category / Kategorija		
		juniors girls / Juniorke	cadets girls / Kadetkinje	Total / Ukupno
Forhend short SEFHKR / Forhend kratki SEFHKR	Frequency / Frekvencija % for category / % za kategoriju	388 52.6%	400 56.1%	788 54.3%
Forhend half-long SEFHPO / Forhend poludugi SEFHPO	Frequency / Frekvencija % for category / % za kategoriju	98 13.3%	104 14.6%	202 13.9%
Forhend long SEFHDU / Forhend dugacki SEFHDU	Frequency / Frekvencija % for category / % za kategoriju	83 11.3%	65 9.1%	148 10.2%
Bekhend short SEBHKR / Bekhend kratki SEBHKR	Frequency / Frekvencija % for category / % za kategoriju	124 16.8%	89 12.5%	213 14.7%
Bekhend half-long SEBHPO / Bekhend poludugi SEBHPO	Frequency / Frekvencija % for category / % za kategoriju	28 3.8%	27 3.8%	55 3.8%
Bekhend long SEBHDU / Bekhend dugacki SEBHDU	Frequency / Frekvencija % for category / % za kategoriju	16 2.2%	28 3.9%	44 3.0%
Total / Ukupno	Frequency / Frekvencija % for category / % za kategoriju	737 100.0%	713 100.0%	1450 100.0%

$\chi^2 = 11.198$ $p = 0.048$ $V = 0.088$

Legend: χ^2 – Chi square test value, p - level of statistical significance chi square test, V-Cramer's V

Tabela 2. Rezultati testiranja razlika u frekvencijama karakteristika i efikasnosti servisa za juniorke i kadetkinje

Legenda: χ^2 – Vrednost hi kvadrat testa, p–nivo statističke značajnosti hi kvadrat testa, V-vrednost Kramerovog pokazatelja (Cramer's V), fi- vrednost fi koeficijenta (phi coefficient); * značajno na $p \leq 0,05$; **značajno na $p \leq 0,01$

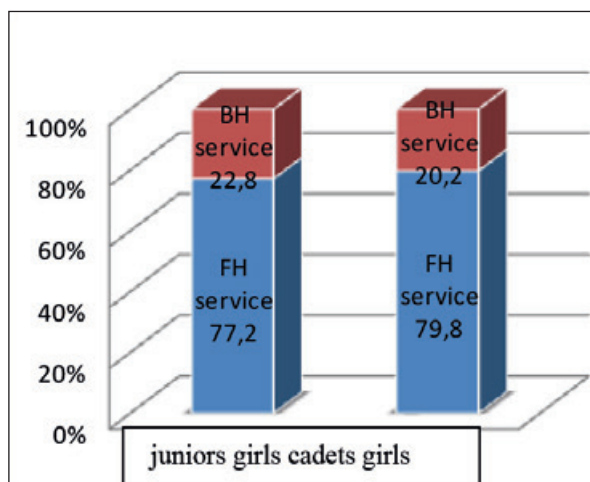
Celokupan uzorak obuhvaćen ovim istraživanjem je 1450 servisa koji su primenjivani u 79 setova stonoteniserki kadetske i juniorske uzrasne kategorije. Posmatrajući (Tabelu 3) uočavamo da je 54,3% zabeležen FH kratki servis SEFHKR, zatim 14,7% BH kratki servis SEBHKR, 13,9% FH poludugi servis SEFHPO. Najmanje zastupljen servis je BH dugački servis SEBHDU, koji je 44 puta izveden od 1450 servisa obe uzrasne kategorije stonoteniserki.

Tabela 3. Prikaz frekvencija različitih vrsta servisa za juniorke i kadetkinje

The results of the analysis of the Chi-square independence test showed that there is a statistically significant difference in the number of performed FH and BH short services in table tennis players. By 4.3%, more BH short services were recorded among juniors, while cadets significantly more used FH short services (3.5%) compared to older teammates.

FH long service (SEFHDU) is used more by juniors by 2.2% than cadets, which may indicate that they are technically and tactically better prepared for the attacking actions of opponents. The choice of service, as well as other technical and tactical elements in the match are certainly a consequence of the tactical ideas of the players.

BH semi-long services (SEBHPO) in both categories are also represented in relation to other types of services, while 1.3% of cadets use FH semi-long services more. Bearing in mind that semi-long service is often the intention of applying short service, ie it is a consequence of inaccuracy, we can say that cadets did not perfect short services the best. However, the semi-long service is also a competitive tool, ie the desire of the server, because the recipients of the service do not receive the service in the best way due to poor assessment of the length of the service, which gives the server an advantage to continue the points with attacking actions. Out of 1450 performed services, 78.5% perform table tennis services with forehand, 21.5% with backhand. Graph 1 shows that 2.6% of juniors in matches rely more on BH services.



Graph 1. Display of service type frequencies (FH / BH service) for juniors and cadets

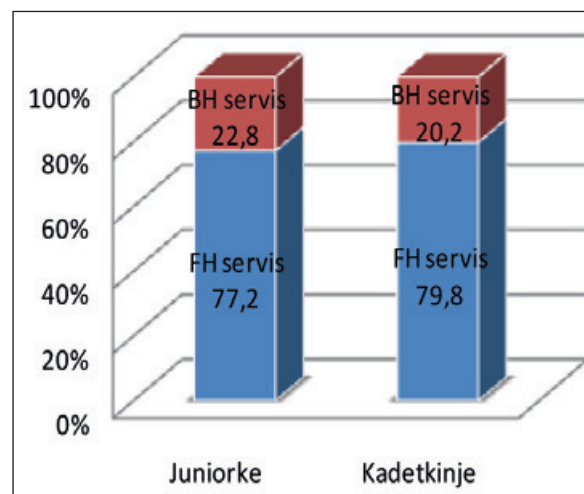
The results of our research differ from the research of Wu, X., Zhen, Z., (1996) and Đokić (2003), where in matches FH service is represented by 94.7%, and BH service by 5.3%, and show a significantly higher percentage participation of backhand service in matches. Look-

Rezultati analize Hi-kvadrat testa nezavisnosti su pokazali da postoji statistički značajna razlika u broju izvedenih FH i BH kratkih servisa kod stonoteniserki. Za 4,3% je zabeleženo više BH kratkih servisa kod juniorki, dok su kadetkinje značajno više koristile FH kratke servise (3,5%) u odnosu na starije saigračice.

FH dugački servis (SEFHDU) više primenjuju juniorke za 2,2% od kadetkinja, što može da nam ukaže da su one tehnički i taktički bolje spremne za napadačke akcije protivnika. Izbor servisa, kao i ostalih tehničko taktičkih elemenata u meču sugurno su posledica taktičkih zamisli igrača.

BH poludugi servisi (SEBHPO) kod obe kategorije su isto zastupljeni u odnosu na ostale vrste servisa, dok su 1,3% kadetkinje više primenjivale FH poluduge servise. Imajući u vidu da je poludugi servis često namera primene kratkog servisa, odnosno posledica je nepreciznosti, možemo reći da kadetkinje nisu najbolje usavršile kratke servise. Međutim, poludugi servis je i takmičarsko sredstvo, odnosno želja servera, jer primaoci servisa zbog loše procene dužine servisa ne prime servis na najbolji način što predstavlja serveru prednost za nastavak poena napadačkim akcijama.

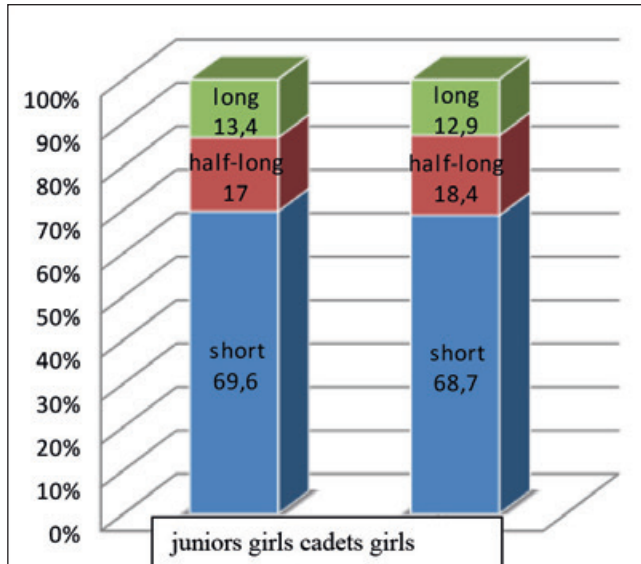
Od 1450 izvedenih servisa 78,5% servisa stonoteniserke izvode forhendom, 21,5% bekhendom. U grafikonu 1 se vidi da se za 2,6% juniorke u mečevima više oslanjaju na BH servise.



Grafikon 1. Prikaz frekvencija tipa servisa (FH/BH servis) kod juniorki i kadetkinja

Rezultati našeg istraživanja se razlikuju od istraživanja Wu, X., Zhen, Z., (1996) i Đokića (2003), gde je u mečevima FH servis zastupljen 94,7%, a BH servis 5,3%, i pokazuju značajno veći procenat učešća bekhend servisa u mečevima.

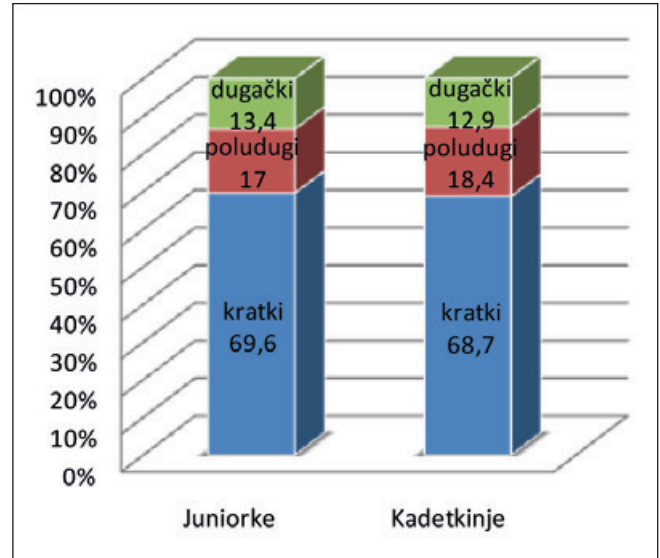
ing at Chart 2, we notice a slightly higher percentage of short services (0.5%) and 0.9% of long services among juniors, while 1.4% of semi-long FH and BH services were recorded among cadets, but no statistically significant difference. A total of 13.4% of long services differ from the research (Đokić, 2003) in which 19.90% of long services were served.



Graph 2. Display of frequencies of the type of service in relation to the length of juniors and cadets

Service efficiency is described by the following indicators: SERGRE - indicates a service error, ie an error in performing the service; SERBEZ - no advantage gained by service, good reception of service, poorly performed service; SERPRE-acquired service advantage, poor service reception, excellent service; SERDIR- directly scored a point with a service, an error in receiving the service. Inspecting (Table 4), we can conclude that there is a statistically significant difference in individual indicators of service efficiency. The variable SERBEZ is significantly higher by 6.9% in cadets, SERPRE is 5.9% higher in juniors. There is a difference in other indicators of service efficiency, but it is not statistically significant. Out of 1450 services performed by table tennis players, only 1% of services were performed incorrectly.

Posmatrajući grafikon 2 uočavamo neznatno veći procenat kratkih servisa (0,5%) i 0,9% dugačkih servisa kod juniorki, dok je 1,4% poludugih FH i BH servisa zabeležen kod kadetkinja, ali razlika nije statistički značajna. Ukupno 13,4% dugačkih servisa se razlikuje od istraživanja (Đokić, 2003) u kom je 19,90% servirano dugačkih servisa.



Grafikon 2. Prikaz frekvencija vrste servisa u odnosu na dužinu kod juniorki i kadetkinja

Efikasnost servisa opisan je sledećim indikatorima: SERGRE-označava servis grešku, odnosno grešku u izvođenju servisa; SERBEZ–nije stečena prednost servisom, dobar prijem servisa, loše izveden servis; SERPRE-stečena prednost servisom, loš prijem servisa, odlično izveden servis; SERDIR- direktno osvojen poen servisom, greška u prijemu servisa.

Uvidom u (Tabelu 4.) možemo konstatovati postojanje statistički značajne razlike u pojedinim indikatorima efikasnosti servisa. Varijabla SERBEZ je za 6,9% značajno veća kod kadetkinja, SERPRE je 5,9% više zabeležena kod juniorki. Razlika postoji i u ostalim indikatorima efikasnosti servisa, ali nije statistički značajna. Od 1450 servisa izvedenih kod stonoteniserki, samo 1% servisa je pogrešno izvedeno.

Table 4. Test results of differences in service efficiency frequencies in table tennis players of cadet and junior age

Variables / Varijable	Statistics / Statistiki	Category / Kategorija		
		Juniors girls / Juniorke	Cadets girls / Kadetkinje	Total / Ukupno
Service error SERGRE / Servis greška SERGRE	Frequency / Frekvencija % for category / % za kategoriju	10 1.4%	5 0.7%	15 1.0%
Service without advantages SERBEZ / Servis bez prednosti SERBEZ	Frequency / Frekvencija % for category / % za kategoriju	535 72.6%	567 79.5%	1102 76.0%
Service-acquired advantage SERPRE / Stečena prednost servisom SERPRE	Frequency / Frekvencija % for category / % za kategoriju	77 10.4%	32 4.5%	109 7.5%
Direct service point SERDIR / Direktan poen servisom SERDIR	Frequency / Frekvencija % for category / % za kategoriju	115 15.6%	109 15.3%	224 15.4%
Total / Ukupno	Frequency / Frekvencija % for category / % za kategoriju	737 100.0%	713 100.0%	1450 100.0%

$\chi^2 = 20.94$ $p = 0.000$ $V = 0.120$

Tabela 4. Rezultati testiranja razlika u frekvencijama efikasnosti servisa kod stonoteniserki kadetskog i juniorskog uzrasta

Legend: χ^2 – Chi square value of the test, p - level of statistical significance chi square of the test, V -Cramer's V

The recorded number of more efficient services among juniors tells us that older players have a greater need for better service due to the increased demands of the game in the older category, and therefore the training is more focused on this segment of the game. Juniors, compared to cadets, have more training experience, which certainly contributes to a better and more versatile service. For cadets, the service is not sufficiently perfected, as well as its diversity, which leads to better reception of the service and does not present difficulties in the game of the recipient. In general, service efficiency is extremely important in the table tennis game. Namely, with efficient service, first of all, we are able to directly win a point, or on the other hand, with efficient service, we can enable a better position in the continuation of the game to win points in the match.

CONCLUSION

The analysis of service, as an initial kick in a point, the only shot that is not performed after the opponent's kick, is of great importance in competitive table tennis. Changing the rules of service (prohibition of hiding the contact of the racket and the ball with the free hand), increasing the volume of the ball, switching to the use of a plastic ball have somewhat reduced the impact of service in the game. However, in addition to that, it is of great importance in the structure of points and represents the main technical and tactical weapon for many players.

In accordance with the initial assumptions, technical-tactical success affects the competitive success of

Legenda: χ^2 – Vrednost hi kvadrat testa, p – nivo statističke značajnosti hi kvadrat testa, V -Kramerov pokazatelj (Cramer's V)

Zabeležen veći broj efikasnijih servisa kod juniorke nam govori da starije igralice imaju veću potrebu za kvalitetnijim izvođenjem servisa zbog povećanih zahteva igre u starijoj kategoriji, samim tim je i trening više usmeren na ovaj segment igre. Juniorke, u odnosu na kadetkinje imaju više trenažnog iskustva koji sigurno doprinosi boljem i svestranijem izvođenju servisa. Kod kadetkinja servis nije dovoljno usavršen, kao i njegova raznovrsnost što dovodi do boljeg prijema servisa i ne predstavlja poteškoće u igri primaoca. Generalno, efikasnost servisa izuzetno je važna u stonoteniskoj igri. Naime, efikasnim servisom pre svega, u mogućnosti smo direktno osvojiti poen, ili u drugu ruku, efikasnim servisom omogućiti bolju poziciju u nastavku igre za osvajanje poena u meču.

ZAKLJUČAK

Analiza servisa kao početnog udarca u poenu, jedinog udarca koji se ne izvodi posle protivnikovog udarca, veliku važnost ima u takmičarskom stonom tenisu. Promena pravila servisa (zabrana skrivanja kontakta reketa i loptice slobodnom rukom), povećanje obima loptice, prelazak na upotrebu plastične loptice su donekle uticali na smanjenje uticaja servisa u igri. Međutim i pored toga, on ima veliku značaj u strukturi poena i predstavlja glavno tehničko-taktičko oružje mnogim igračima.

U skladu sa inicijalnim pretpostavkama tehničko-taktička uspešnost utiče na takmičarsku uspešnost

players. Table tennis belongs to the group of polystructural acyclic sports and its performance is a sports game, so it was clear that technical-tactical efficiency is the basis of table tennis success. In other words, the technical-tactical assumptions and requirements are particularly high and directly determine the final competitive success. The order of the influence of certain technical and tactical variables on the success in table tennis ranks the efficiency of the service among the most important indicators of success in the game.

The research proved that the service for juniors is more efficient, and 5.9% more services were recorded, which gave them an advantage in points compared to cadets. By 4.3%, more BH short services were recorded among juniors, while cadets significantly more used FH short services (3.5%) compared to older teammates.

The research tried to point out the importance of the service and its analysis, as well as the importance of noting its frequency in order to help sports experts and athletes in their work. Recording the frequencies of characteristics and efficiency of technical-competitive abilities should be an unavoidable segment of the training process in table tennis.

Announcemet

We announce that the authors have equally contributed to this paper.

Conflict of interests

There is no conflict of interests among the authors themselves.

igrača. Stoni tenis spada u grupu polistrukturalnih acikličkih sportova i izvedbom je sportska igra, pa je bilo jasno kako tehničko-taktička efikasnost predstavlja osnovu stolnoteniske uspešnosti. Drugim rečima, tehničko-taktičke pretpostavke i zahtevi su posebno visoki i direktno određuju konačnu takmičarsku uspešnost. Redosled uticaja pojedinih tehničko-taktičkih varijabli na uspeh u stonom tenisu, efikasnost servisa svrstava među najznačajnije indikatore uspeha u igri.

Istraživanjem je dokazano da je servis kod juniorki efikasniji, i zabeleženo je za 5,9% više servisa kojim je ostvarena prednost u poenu u odnosu na kadetkinje. Za 4,3% je zabeleženo više BH kratkih servisa kod juniorki, dok su kadetkinje značajno više koristile FH kratke servise (3,5%) u odnosu na starije saigračice.

Istraživanjem se pokušalo ukazati na značaj servisa i njegove analize, kao i na značaj notiranja njegove frekvencije u funkciji pomoći sportskim stručnjacima i sportistima u radu. Beleženje frekvencija karakteristika i efikasnosti tehničko-taktičkih sposobnosti treba da bude nezaobilazan segment trenažnog procesa u stonom tenisu.

Izjava

Izjavljujemo da su autori podjednako doprineli radu.

Konflikt interesa

Između autora ne postoji interesni konflikt.

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