UNIVERZITET U BEOGRADU
FAKULTET SPORTA I FIZIČKOG VASPITANJA
Beograd, 13. 07. 2023. god.

NASTAVNO-NAUČNOM VEĆU FAKULTETA

Predmet: Referat Komisije za ocenu doktorske disertacije Andrea Perazzetti.

Odlukom Nastavno-naučnog veća Univerziteta u Beogradu – Fakulteta sporta i fizičkog vaspitanja na 13. sednici održanoj 6. jula 2023. godine (akt 02-br. 1412/23-2 od 11. jula 2023. godine), a u skladu sa članom 40. Pravilnika o doktorskim akademskim studijama – *prečišćen tekst* (02-br. 532/22-4 od 9. novembra 2022. godine) i članom 41-43. Statuta Univerziteta u Beogradu – Fakulteta sporta i fizičkog vaspitanja – *prečišćen tekst* (02-br. 188/23-2 od 13. februara 2023. godine), na predlog Veća doktorskih akademskih studija (02-br. 1356/23-2 od 30. juna 2023. godine) donelo je odluku za formiranje Komisije za ocenu doktorske disertacije studenta **Andrea Perazzetti**, pod naslovom:

„A MULTIDIMENSIONAL APPROACH TO THE STUDY OF WATER POLO PERFORMANCE (VIŠEDIMENZIONALNI PRISTUP U IZUČAVANJU IGRANJA VATERPOLA)“

u sledećem sastavu:

- Dr Marko Ćosić, docent,
  Univerzitet u Beogradu - Fakultet sporta i fizičkog vaspitanja, predsednik komisije;
- Dr Željko Rajković, vanredni profesor,
  Univerzitet u Beogradu – Fakultet sporta i fizičkog vaspitanja, član;
- Dr Tomislav Okičić, redovni profesor,
  Univerzitet u Nišu - Fakultet sporta i fizičkog vaspitanja, član.

Doktorska disertacija je urađena pod mentorstvom:

- Dr Milivoj Dopsaj, redovni profesor,
  Univerzitet u Beogradu - Fakultet sporta i fizičkog vaspitanja;
- Dr Antonio Tessitore, vanredni profesor,
  University of Rome - Foro Italico, Italija.

Nakon pregledane finalne verzije doktorske disertacije, biografije kandidata i spiska objavljenih radova, Komisija podnosi Nastavno-naučnom veću Fakulteta sledeći

REFERAT

UVOD

Kandidat Andrea Perazzetti je finalnu verziju doktorske disertacije pod naslovom: „A MULTIDIMENSIONAL APPROACH TO THE STUDY OF WATER POLO PERFORMANCE (Višedimenzionalni pristup u izučavanju igranja vaterpola)“, predao arhivi

fakulteta dana 30.06.2023. godine. Doktorska disertacija obuhvata 97 strana, 30 tabela, 19 grafikona, 5 fotografija, kao i popis od 196 referenci koje su citirane u okviru rada. Doktorska disertacija je urađena u potpunosti u skladu sa Pravilnikom o doktorskim studijama Fakulteta sporta i fizičkog vaspitanja, kao i sa Uputstvom o formiranju repozitorijuma doktorskih disertacija koji je usvojio Senat Univerziteta u Beogradu. Disertacija je rezultat dosledno realizovanog projekta predviđenog u okviru elaborata teme doktorske disertacije, napisana je na engleskom jeziku i sadrži: Naslovnu stranu na engleskom i srpskom jeziku, Posvetu, Rezime na engleskom jeziku, Rezime na srpskom jeziku, Sadržaj, Popis grafikona, Popis tabela, Popis skraćenica, a zatim poglavlja: Uvod, Teorijski okvir i prethodna istraživanja, Problem, predmet, ciljevi i zadaci istraživanja, Hipoteze istraživanja, Metode merenja, Rezultati sa predstavljene četiri studije, Diskusija, Zaključci, Literatura i Prilozi.

BIOGRAFIJA

Rođen u Rimu (Italija) 7. aprila 1994. godine, Andrea Perazzeti je najstariji sin Rozete i Roberta. Andrea i njegova sestra Giorgia su odgajani u radničkoj porodici u kojoj je majka zaposlena u računovodstvu, a otac taksista. Andrea je rano počeo da se bavi plivanjem, a zatim je nastavio da se bavi 12 godina. Kasnije prelazi u vaterpolo gde se uspešno takmiči još 14 godina. Sve je uticalo na Andrea da nastavi studije u ovoj oblasti, odabravši Fakultet sportskih nauka. Bečeler (2017) i master (2020) završio je sa najvišim rezultatom na Univerzitetu u Rimu Foro Italico. Učestvovao je u Erazmus+ projektu (KA 107) na Univerzitetu u Beogradu, radeći u Laboratoriji za sport Katedre za medicinu sporta. Šest meseci je radio kao pripravnik u vaterpolo klubu Partizan. Godinu dana kasnije, 2020/21, upisao je doktorski program „Eksperimentalne metode istraživanja humane lokomocije“ na Fakultetu sporta i fizičkog vaspitanja - Univerzitet u Beogradu. Kao gostujući istraživač, tokom doktorske školske 2022/23. godine ponovo je učestvovao u programu Erazmus+ (KA103) na Univerzitetu u Rimu Foro Italico, obavljajući istraživačke aktivnosti u praćenju treninga i učinka u elitnom vaterpolu. Trenutno Andrea živi u Rimu i kao analitičar utakmica i pomoćni trener deo je prvog tima vaterpolo kluba S.S. Lacio Nuoto. Nastavlja da se bavi istraživanjima u vaterpolu u okviru ovog italijanskog kluba. Dalje, u akademskoj oblasti, drži časove prakse „timski sport“ kao pomoćni profesor na Univerzitetu u Rimu Foro Italico. Voli svoju porodicu, prijatelje iz detinjstva i fudbal. Govori italijanski (maternji), engleski (B2) i srpski (A2).

OBJAVLJENI RADOVI

Perazzetti, A., Dopsaj, M., Nedeljković, A., Mazić, S., & Tessitore, A. (2023). Survey on coaching philosophies and training methodologies of water polo head coaches from three different european national schools. Kinesiology, 55(1), 49-61. https://doi.org/10.26582/k.55.1.6b

Perazzetti, A., Dopsaj, M., Sansone, P., Mandorino, M., Tessitore, A. (2023). Effects of playing position and contextual factors on internal match loads, post-match recovery and well-being responses of elite male water polo players. Journal of Functional Morphology and Kinesiology, 8(1), 12. https://doi.org/10.3390/jfmk8010012

Perazzetti, A., Dopsaj, M., & Tessitore, A. (2023). Technical and tactical evaluation of ball possession in international youth water polo matches using the Team Sport Assessment Procedure (TSAP) instrument. Montenegrin Journal of Sports Science and Medicine, 12(2), Ahead-of. https://doi.org/10.26773/mjssm.230901

„Assessing Offensive Phase: The Use of Team Sport Assessment Procedure (TSAP) in Elite Water Polo“ (Submitted to International Journal of Performance Analysis in Sport) **Perazzetti A.**, Dopsaj M., Mandorino M., Tessitore A.

STRUKTURA DOKTORSKE DISERTACIJE

UVOD

Objašnjavajući temu (od 1. do 16. strane), autor kroz nekoliko poglavlja navodi činjenice vezane za vaterpolo a koje su od važnosti za disertaciju. U prvom poglavlju, navodi osnovne statističke činjenice vezane za vaterpolo sport generalno. Poredi zastupljenost vaterpola u odnosu na ostale vodene sportove, kao i geografsku raspodelu vaterpola po kontinentima. Najzastupljeniji je u Evropi u kojoj igra oko 56% ukupnog broja igrača (Fina, 2019). Takođe navodi i zemlje osvajače olimpijskih medalja na vaterpolo turnirima gde dominira reprezentacija Mađarske sa ukupno 16 medalja (9 zlatnih). U narednom poglavlju kroz istorijski razvoj objašnjava evoluciju igre od samih početaka do danas. Navodi da evolucija vaterpola pokazuje stalne promene sistema igre i trenažnih metodologija, da su delimično izvedene iz drugih timskih sportskih igara i prikazuje ih kroz šest istorijskih referentnih perioda. U trećem poglavlju Uvoda, obrađuju se pravila vaterpolo igre. Autor navodi da je uprkos stalnim promenama i znatnim poboljšanjima, nakon 2012. vaterpolo je ostao pun kontakata, hvatanja, zarona i povlačenja, koje sudije nisu uvek kažnjavale, uprkos pravilima koja predviđaju da se oni sude kao ozbiljni faulovi (Hraste et al., 2013). Autor takođe konstatuje da su prve promene pravila bile usmerene ka standardizaciji igre, dok su naknadne izmene učinjene u cilju poboljšanja dinamike i atraktivnosti sporta koji je omogućavao i podsticao napredak kako u mečevima tako i na treninzima. U narednom poglavlju definiše igračke pozicije u pet različitih kategorija. Takođe navodi i osnovne antropometrijske karakteristike igrača, kao i specifičnosti pojedinih pozicija. U petom poglavlju Uvoda, autor se bavi performansama igrača u vaterpolu. Navodi da je vaterpolo zahtevan vodeni timski sport, u kojem igrači moraju da pomeraju svoje telo unutar tečnosti (vode) i često u suprotnosti sa svojim protivnikom (Smith, 1998). U tom smislu, vaterpolo se smatra jednim od fizički i psihološki najzahtevnijih timskih sportova jer različite situacije u igri zahtevaju brze procese donošenja odluka, veštine predviđanja i rešavanja

problema. Ove karakteristike su rezultat evolucije pravila, suđenja i posledično poboljšanja same igre (Li & Graham, 2021). Navodi distribuciju metaboličkih sistema za vreme igre (Melchiorri et al., 2010[a]), gde na aerobne (≤ 2 mmol/L) otpada nešto preko 23%, na mešovitu zonu oko 23%, na uglavnom anaerobnu (≤ 6 mmol/L) nešto manje od 25% dok na anaerobnu zonu otpada (> 6 mmol/L) oko 28%. Takođe kroz pregledne tabele navodi i procente vremena održavanja različitih aktivnosti (plivanje ili duel i vertikalna pozicija) elitnih vaterpolista prema igračkim pozicijama i polu. Na kraju Uvoda, u šestom poglavlju navodi osnovne tehnike sa loptom koje se u vaterpolu primenjuju.

TEORIJSKI OKVIR I PRETHODNA ISTRAŽIVANJA

Drugo poglavlje (17 – 23) posvećeno je teorijskom okviru istraživanja i pregledu dosadašnjih istraživanja u vezi sa temom. U prvom delu drugog poglavlja, koji se tiče pregledane literature, autor u tabelama navodi koliko je radova bilo povezano za određeno polje istraživanja. Rezultati istraživanja naučne literature počevši od 2002. godine (Melchiorri et al., 2016) pokazuju da postoji ukupno 5 radova koji su tretirali motoričke veštine, od kojih su svi sa vaterpolistima osim jednog rada u kojem su pored vaterpolista analizirane i vaterpolistkinje. Analiza vaterpolo utakmica pojavljuje se u 14 radova, od kojih je 6 sa igračima i dodatna 4 rada kako sa igračicama tako i sa oba pola zajedno. Ukupno je 25 radova vezanih za polje medicine, od kojih je 9 sa igračicama, dok je 8 sa igračima, odnosno sa igračicama i igračicama zajedno. Većina istraživačkih radova se odnosi na testiranje i evaluaciju. Ukupno ih je 46, od kojih se 33 odnosi na igrače, 12 na igračice i jedan na oba pola. Konačno, ima ukupno 9 radova vezanih za trening, od kojih je 6 za vaterpoliste, 2 za vaterpolistkinje i jedan rad koji tretira oba pola istovremeno. Ukupno 99 radova, od kojih je 57 sa igračima, 27 sa igračicama i 15 radova sa oba pola.

Prema autorovoj pretrazi na Scopus, Pubmed i Scholar, u drugoj tabeli se prikazuju podaci koji pokrivaju period od 2016. do 2022. Autor navodi da postoji ukupno 10 radova koji su tretirali motoričke veštine, od kojih su po 4 za vaterpoliste, odnosno zajedno oba pola. Takođe, postoje 2 rada samo sa igračicama. Analiza vaterpolo utakmica pojavljuje se u 8 radova, od kojih su 4 sa igračima, 1 rad sa igračicama i 4 rada koji tretira oba pola. Ukupno je 15 radova koji se odnose na polje medicine, od kojih je 6 sa igračima, 4 sa igračicama, a sa igračima i igračicama zajedno ima 5 radova. Većina istraživačkih radova se odnosi na testiranje i evaluaciju. Ukupno 17, od kojih se 6 odnosi na igrače, 4 na igračice i 7 na oba pola. Konačno, ima ukupno 9 radova vezanih za trening, od kojih je 5 sa vaterpolistima i po 2 za vaterpolistkinje, kao i za oba pola zajedno. Ukupno ima 59 radova, od kojih je 25 sa igračima, 13 sa igračicama i 21 rad sa oba pola.

U drugom delu drugog poglavlja, autor se bavi testovima - plivanjem i testiranjem na suvom. Rezultati naučnih istraživanja usmerili su istraživače da izaberu različite protokole za procenu plivačkih kapaciteta koji karakterišu određenu fazu vaterpolo utakmice. U stvari, za praćenje kondicije vaterpolista, test plivanja pokazuje da je to najčešći instrument koji se koristi u vaterpolo praksi. U pregledu testa plivanja za vaterpoliste, Chirico i sar. (2021) ukazali su da se fiziološka procena vaterpolista može podeliti na dve oblasti koje se tiču ocenjivanja plivanja: plivački testovi sprinta i izdržljivosti. Međutim, ovakav pristup bi mogao potceniti sposobnost igrača da plivaju sa loptom, što je ekološki uslov i zahteva posebne testove. Zaista, tokom vaterpolo utakmice igrači kontinuirano menjaju položaj iz vertikalnog u horizontalni i obrnuto (Lupo et al., 2009). Da bi se nosili sa horizontalnim fazama, igrači izvode tehnički vešte pokrete sa i bez lopte, za koje su potrebne različite plivačke sposobnosti, kao što su kraul, kraul sa glavom iznad vode, kraul dok vode loptu, kao i više varijanti specifičnog vaterpolo kraula (Dopsaj i sar., 2007). Štaviše, testovi na suvom igraju važnu ulogu u oblasti procedura testiranja u vaterpolu. De Villarreal i sar. (2015) su predložili da vaterpolo trening u predsezoni treba da uključi kombinovani program treninga koji sadrži trening snage na suvom i u vodi, kao i polimetrijski trening kako bi se optimizovala vaterpolo priprema za takmičenje. Prema Platanau i sar. (2005), u odnosu na njihov položaj i stepen takmičenja, sposobnosti igrača da pomeraju svoja tela vertikalno na vodi zavise od nivoa njihove konkurentnosti van vode. Konkretno, Keiner i sar. (2020) sugerišu da su parametri maksimalne jačine važni prediktori kapaciteta performansi vaterpolista koji se pored bacanja medicinke i visine skoka, testiraju i 1RM čučnjem i grudnim potiskom sa ravne klupe.

U sledećem delu drugog poglavlja, autor se bavi filozofijom treniranja, odnosno figurom vaterpolo trenera. Proširenje stručnih štabova donelo je novu kulturu upravljanja treninzima i takmičenjima, na koju utiču i lična „trenerska filozofija“ trenera, kao i tradicije različitih nacionalnih vaterpolo trenerskih škola. Zaista, metodologije treninga su u velikoj meri pod uticajem lične trenerske filozofije trenera, koja se sastoji od njegovih/njenih glavnih ciljeva i vrednosti, uverenja i principa koje žele da postignu u svojoj trenerskoj karijeri (Martens, 2012).

U četvrtom delu drugog poglavlja autor se bavi analizom performansi u vaterpolu. Autor navodi da za reprodukciju trenažnih aktivnosti kao što je takmičenje (Passos et al., 2017), treneri obično koriste analizu učinka kao specijalizovanu disciplinu kako bi pružili objektivne informacije koje im pomažu da razumeju karakteristike performansi (Lupo et al., 2014b). Analiza podudaranja u potpunosti odgovara na ove potrebe znanja o modelu performansi (Hughes et al., 2003) kroz svoje glavne oblasti proučavanja: analizu vremenskih karakteristika kretanja (TMA) i notacionu analizu (NA). TMA predstavlja analizu kretanja kroz proces klasifikacije aktivnosti koji razmatra različite intenzitete i vremenske obrasce kretanja

(Strudvick et al., 2016). Glavni elementi na kojima se zasniva ova analiza su intenzitet, trajanje, udaljenost i učestalost akcija (Villiams et al., 2005). Sistemi notacijske analize imaju za cilj metodičku analizu događaja u ponašanju koji se dešavaju tokom utakmice, kroz proučavanje taktičkih ponašanja (sa i bez lopte) i tehničkih gestova u odnosu na različite situacije igre na utakmici (Ademović et al., 2020). Autor navodi da je u poslednje dve decenije došlo do porasta studija usmerenih na taktičko učenje u timskim sportovima. Na osnovu pretpostavke da učenici konstruišu i uče taktičko znanje u vezi sa motoričkim veštinama (Grehaigne & Godbout, 1998) za procenu napretka u smislu taktičkih veština i ofanzivne efikasnosti (kako se stiče posed lopte i kako se sa loptom tokom igre raspolaže) predložen je TSAP. S tim u vezi, Grehaigne, Godbout & Bouthier (1997) razvili su Proceduru procene timskih sportova (TSAP), korisno sredstvo za procenu različitih scenarija u okviru stvarnih konteksta igre (Richard, Godbout, Tousignant, & Grehaigne, 1999). Štaviše, u vezi sa analizom utakmica, pruženo je nekoliko studija o vaterpolu o tehničkim i taktičkim aspektima (Lupo et al., 2011), efikasnosti igranja (Lupo et al., 2012), evoluciji pravila (Lozovina et al. 2019; Argudo et al., 2021), nivoima takmičenja (Lupo et al., 2010) i uticaja na ishod utakmica (Ordonez et al., 2021). Takođe, postoji nekoliko istraživanja koja procenjuju nivo taktičke svesti igrača i znanja o igri pomoću TSAP instrumenta. Osnovna ideja ove vrste procene je posmatranje ponašanja igrača tokom igre i sumiranje podataka prikupljenih ili u obliku ukupnog broja pojavljivanja ili u obliku dva indeksa učinka: indeksa efikasnosti i indeksa obima igre (Grehaigne et al., 1997). Do danas su objavljene studije u vezi sa procedurom procene timskog sporta u fudbalu (Blomkvist et al., 2005; Ortega-Toro et al., 2019), košarci (Otero-Saborido et al., 2015), hokeju na ledu (Nadeau et al., 2008) i odbojku (Richard et al., 2002; Sgro et al., 2018), dok njene primene u vaterpolu još uvek nema. Na osnovu rezultata Perazzetti-a i Tessitore-a (2021), čini se da upotreba TSAP instrumenta daje objektivnu indikaciju ofanzivnog učinka timova u vaterpolu. Nalazi ove studije, koja je analizirala FINA Svetsko prvenstvo u vaterpolu za juniore, sugerišu da bi TSAP mogao da pomogne u vođenju trenažnog procesa tokom turnira ili cele sezone.

U petom delu drugog poglavlja autor se bavi monitoringom u vaterpolu. S obzirom na povećane zahteve vaterpola, planiranje strategije monitoringa napora igrača je ključno kako bi se osiguralo da su sportisti izloženi adekvatnim trenažnim opterećenjima kako bi se smanjio rizik od prekomernog opterećenja i maksimizirao njihov učinak (Thornton et al., 2019). U tom smislu, pokazalo se da je praćenje oporavka igrača u najmanju ruku jednako važno kao ono za vreme treninga i utakmica (Hininen et al., 2006), kako bi se izbeglo da aktivnost visokog intenziteta bez adekvatnih perioda oporavka uzrokuje štetne uticaj na igračke sposobnosti. Učinak u timskim sportovima je izraz složenih i dinamičnih višedimenzionalnih i interaktivnih procesa, zbog čega je važno proceniti efekte različitih opterećenja i strategija oporavka kako bi pomogli

trenerima da prilagode individualne programe igrača (Thorpe et al., 2017). Da bi se postigao ovaj cilj, u timskim sportovima stručni štab prikuplja širok spektar podataka za praćenje koji se odnose na spoljna i unutrašnja opterećenja igrača, kao i fiziološke i psihološke procene umora (Kelli et al., 2007). Unutrašnje opterećenje predstavlja relativnu fiziološku reakciju igrača na opterećenje na treningu ili meču, i povezano je i sa pozitivnim (tj. kondicija i pripremljenost) i negativnim (tj. umor, nefunkcionalno preopterećenje i povrede/bolest) treningom - povezani ishodi (McLaren et al., 2017). Spoljašnje opterećenje se definiše kao rad koji je obavio sportista, mereno nezavisno od njegovih unutrašnjih karakteristika. Pošto i spoljašnja i unutrašnja opterećenja imaju zasluge za razumevanje opterećenja sportiste, kombinacija oba može biti važna za praćenje treninga (Halson, 2014), čak i ako je sposobnost povezivanja spoljašnjih i unutrašnjih opterećenja u timskim sportovima teška zbog varijabilnost fizičkih performansi tokom utakmica i sport-specifičnih treninga i (Thorpe, 2017). Foster i sar. (1998, 2001) su predložili jednostavan i efikasan sistem za kvantifikaciju unutrašnjeg opterećenja u treningu (TL), zasnovan na oceni percipiranog napora (RPE). To su i potvrdili tokom godina praćenje opterećenja nekoliko različitih modaliteta treninga (tehnički, taktički, izdržljivost, brzina i snage). Intenzitet, trajanje i učestalost treninga mogu izazvati veliki pritisak na biološke sisteme sportista, te se iz tog razloga treneri pozivaju da usvoje efikasne strategije oporavka (Tessitore et al., 2007). Da bi se postigla optimalna ravnoteža između opterećenja treningom i oporavka, potrebno je održavati visoke fizičke performanse i minimizirati rizik od povreda (Tessitore et al., 2008). U tom smislu, oporavak se smatra višestrukim (npr. fiziološkim, psihološkim) procesom oporavka u odnosu na vreme (Kelmann et al., 2018), naglašavajući važnost pažljivo praćenog procesa oporavka (Kentta & Hassmen, 1998). Iz tog razloga, poslednjih godina status oporavka igrača u timskim sportovima nakon meča se povećava (Thorpe et al., 2017). Praćenje oporavka posle meča igrača zahteva alate za praćenje koji su osetljivi na umor izazvan od meča. Metod koji se koristi za merenje procesa oporavka, je kvalitet ukupnog oporavka (TKR) koji korišćenjem TKR skale, strukturisane oko skale razvijene za ocene percipiranih napora (RPE), omogućava da se proceni proces oporavka (Kentta & Hasmen, 1998). Među ostalim alatima, Hooper-indeks i/ili njegovi podskupovi (tj. kvalitet sna i količine stresa, umora i bolova u mišićima) (Hooper & Mackinnon, 1995) su nedavno prikazani kao potencijalno dobar alat za praćenje umora igrača (Thorpe et al., 2015; Fessi et al., 2016; Rabbani & Buchheit, 2016; Clemente et al., 2017). Ovaj metod se zasniva na važnosti da dnevnici treninga i merenja dobrobiti sportista mogu pomoći u programiranju odgovarajućih opterećenja tokom intenzivnog treninga i tejperinga (Hooper & Mackinnon, 1995). U skladu sa Hooper i Mackinnon (1995), subjektivne ocene koje koriste skale od 1–7 od „veoma nisko ili dobro“ (tačka 1) do „veoma veoma visoko ili loše“ (tačka 7) su predložene kao jedna od najboljih strategija za rano otkrivanje sin-

droma pretreniranosti (Angeli et al., 2004). Pokazalo se da procena unutrašnjeg trenažnog opterećenja (ITL) korišćenjem ocene sesije percipiranog napora (RPE sesije) pruža vredne informacije u treningu i na utakmicama (Lupo et al., 2014b). Ova studija je potvrdila metod session-RPE kao jednostavan i pouzdan alat za procenu ITL-a u vaterpolu, omogućavajući trenerima da efikasno prate svoje programe.

PROBLEM, PREDMET, CILJEVI I ZADACI ISTRAŽIVANJA

U trećem poglavlju autor definiše problem, predmet, kao i ciljeve i zadatke studije (24. str.). Autor navodi da prema njegovim saznanjima ne postoje studije koje su istraživale karakteristike trenerske filozofije i metodologije vaterpolo trenera iz različitih zemalja. Iz tog razloga, najčešće metodologije treninga koje se koriste među trenerima i razlike između različitih nacionalnih škola vaterpola su još uvek nepoznate. U oblasti analize utakmica, do danas nijedna studija nije koristila TSAP instrument za analizu mečeva cele sezone sa igračima prvog tima VP.

U pogledu monitoringa treninga, nije naučno dokazano da li uživanje, poremećaj sna, umor, stres i bol u mišićima mogu uticati na percepciju napora i percipirani oporavak kod vaterpolista (kako kod mladih tako i kod starijih vaterpolista). Konačno, do danas nijedna studija nije upoređivala različite stilove i modalitete plivačkog vaterpola sa i bez lopte između različitih starosnih kategorija. Na osnovu prethodno istaknutih nalaza, može se spekulisati da su istraživanja o vaterpolu i dalje pod uticajem sledećih ograničenja:

- Ne postoje studije koje istražuju filozofiju trenera i metodologije obuke trenera koji pripadaju različitim nacionalnim školama vaterpola;
- Još uvek je malo istraživanja koja procenjuju napredak timova i igrača u smislu taktičkih veština i ofanzivne efikasnosti;
- Malo je studija o praćenju treninga i utakmica tokom zgusnutih perioda aktivnosti i tokom cele sezone.
- Nedostaju studije u vezi sa upotrebom specifičnih vaterpolo testova za procenu sposobnosti plivanja i agilnosti.

Nakon predstavljanja problematike predložene studije, autor je definisao svrhu istraživanja, kao i ciljeve. **Predmet** ove doktorske disertacije je primena ekološkog i multidimenzionalnog pristupa u istraživanju trenerske filozofije i praćenju fizičkih i tehničko-taktičkih performansi, oporavka i dobrobiti elitnih vaterpolista.

Ciljevi ove doktorske disertacije se odnose na elitni vaterpolo nivo i definisani su prema sledećim pitanjima:

• Istražiti trenersku filozofiju i metodologiju vaterpolo glavnih trenera koji pripadaju različitim nacionalnim školama.

• Da obezbedi specifičnu metodologiju za tehničke i taktičke analize elitnih vaterpolista pomoću specifičnog alata za notaciju (TSAP).

• Da prati opterećenje igrača, oporavak i stanje dobrobiti tokom cele elitne vaterpolo sezone.

Na osnovu definisanog problema, predmeta i ciljeva studije, kroz ovo istraživanje su realizovani sledeći **zadaci**:

• Definisanje grupa i veličine uzorka i njihovih karakteristika;

• Prikupljanje podataka;

• Definisanje trenerske filozofije vaterpolo trenera iz različitih nacionalnih škola;

• Definisanje TSAP parametara i indeksa vaterpolo timova i igrača;

• Definisanje skala za praćenje elitnih vaterpolista;

• Analiziranje podataka korišćenjem softvera za statističku analizu SPSS;

• Opisivanje analiziranih varijabli i tumačenje rezultata;

• Obezbediti korisne i lako dostupne instrumente za vaterpolo vežbače.

HIPOTEZE

Na osnovu analizirane literature, kao i definisanog problema, predmeta, cilja i zadataka disertacije, u četvrtom poglavlju definisane su generalna (HG) i pomoćne hipoteze (25. str.):

HG – Višedimenzionalni pristup zasnovan na razumevanju nacionalne trenerske filozofije, integrisan procenom individualnih i kolektivnih taktičkih veština, kao i praćenjem opterećenja igrača i statusa oporavka, može pozitivno uticati na analizu i tumačenje vaterpolo nastupa.

H1 – Privrženost nacionalnim školama vaterpola će pokazati razlike u trenerskoj filozofiji i profesionalnom obrazovanju među trenerima koji pripadaju različitim nacionalnim školama vaterpola.

H2 – Organizacija treninga i upravljanje takmičenjem su pod uticajem njihove nacionalne škole vaterpola.

H3 – U vaterpolo utakmicama mladih, taktička analiza pomoću TSAP instrumenta će pokazati značajne razlike u kolektivnom ponašanju vaterpolo timova i donošenju odluka prema zonama terena i uravnoteženu/neuravnoteženu konačnu rezultatsku razliku utakmice.

H4 – U vaterpolo utakmicama elitnog nivoa, taktička analiza pomoću TSAP instrumenta će pokazati značajne razlike u zavisnosti od lokacije utakmice, uravnotežene/neuravnotežene konačne skor razlike utakmice, dela sezone, individualnog vremena igre i pozicija igrača.

H5 – Značajne razlike u opterećenju treninga, oporavku i odzivima Huperovog indeksa biće pronađene prema igračkim pozicijama, minutama igre u takmičenju, lokaciji meča (kod kuće ili u gostima), uravnoteženoj/neuravnoteženoj razlici u konačnom rezultatu i fazi sezone.

METODE MERENJA

Peto poglavlje (25. str.) je posvećeno metodama. Ova doktorska disertacija obuhvata transverzalne i longitudinalne studije uz podnošenje upitnika i alata za analizu mečeva. Prikupljanje podataka odvijalo se u tri koraka, praveći četiri različite studije i testirajući pet različitih hipoteza. Prvi korak je bio da se istraže nacionalne vaterpolo trenerske škole, drugi korak da se postigne TSAP instrument, treći korak da se prati opterećenje igrača na utakmicama, oporavak i status blagostanja. Analitičke i osnovne deskriptivne, univarijantne i multivarijantne statističke metode korišćene su kao glavni alati za kognitivno rezonovanje i kvalitativno definisanje istraživanih pojava. Ovo istraživanje se može okarakterisati kao fundamentalno i primenjeno jer pruža nov i višedimenzionalni pristup u okviru opštih znanja koja već postoje u vaterpolo performansama. Aktuelne studije su praktično primenljive i za vaterpolo trenere.

Protokoli istraživanja su priznati u Helsinškoj deklaraciji, a odobrili su ih Etički komitet Fakulteta sporta i fizičkog vaspitanja Univerziteta u Beogradu (broj 484–2) i Etički komitet Univerziteta u Rimu Foro Italico (broj 27/202 i broj 99/2021).

REZULTATI

U okviru poglavlja Rezultati (26-69), predstavljena su četiri sprovedena istraživanja u kojima je kandidat prvi autor. Istraživanja su predstavljena kroz uvod, metode (uzorak, prikupljanje podataka, statistička analiza), rezultati, diskusija i zaključak.

Prvo istraživanje, koje je i objavljeno (Perazzetti, A., Dopsaj, M., Nedeljković, A., Mazić, S., & Tessitore, A. (2023). Survey on coaching philosophies and training methodologies of water polo head coaches from three different European national schools. Kinesiology, 55(1), 49-61. https://doi.org/10.26582/k.55.1.6) imalo je za cilj da anketiranjem 40 trenera iz tri važne nacionalne vaterpolo škole (Italija, Grčka i Srbija) identifikuje i uporedi filozofije treniranja. Anketa koja je i priložena u disertaciji se zasnivala na pet sekcija (tehničko osoblje sastav, spisak tima, nedeljna periodizacija, testiranje i praćenje, taktike i strategije). Izračunata je deskriptivna statistika svih parametara, uključujući srednje vrednosti, standardne devijacije i frekvencije za sve učesnike i objedinjene podatke. Pošto su nominalni podaci prikupljeni u ovoj anketi, sproveden je Kruskal-Wallis' test da bi se ispitale razlike u odgovorima prema nacionalnim školama vaterpola trenera. Deskriptivni podaci tri grupe su dati u izveštaju koji je jasno pokazao razliku između svakog para grupa. Statističke analize su sprovedene korišćenjem

statističkog paketa SPSS (verzija 26.00; Institute, Inc., Cari, NC), a kriterijum značajnosti je postavljen na alfa nivou od 0,05. Zaključak je bio da istraživanje može ponuditi objektivnu indikaciju razlika i sličnosti u metodologijama treninga i upravljanju takmičenjem koje proizilaze iz trenerske filozofije intervjuisanih glavnih trenera, kao i iz različitih nacionalnih škola vaterpola. Zaista, kako se sportska disciplina razvija u nekoj zemlji može se videti u složenoj interakciji društvene važnosti, sportskih dostignuća, medijskog izveštavanja, finansijskih sredstava i tako dalje, pored istorijske veze zemlje sa tim specifičnim sportom. U ovom drugom pogledu, na primer, vaterpolo se proširio u Srbiji počevši od jedne Centralne škole u Beogradu i u glavnim gradovima bivše Jugoslavije (Bratuša, 2021); u Grčkoj se razvila iz glavnih klubova u oblasti Velikog Pireja, dok bi se u Italiji moglo spekulisati da se italijanska škola razvijala paralelno sa različitim i originalnim karakteristikama između različitih italijanskih regiona (uglavnom Ligurije, Lacija, Kampanije i Sicilija).

U drugom istraživanju koje je predstavljeno, a koje je takođe objavljeno (Perazzetti, A., Dopsaj, M., & Tessitore, A. (2023). Technical and tactical evaluation of ball possession in international youth water polo matches using the Team Sport Assessment Procedure (TSAP) instrument. Montenegrin Journal of Sports Science and Medicine, 12(2), Ahead-of. https://doi.org/10.26773/mjssm.230901) kandidat navodi da je svrha studije bila da pruži analizu ofanzivnih akcija, pomoću Procedure za procenu timskog sporta (TSAP) prve četiri mlade reprezentacije tokom 20. FINA juniorskog svetskog prvenstva u vaterpolu. Za analizu je odabrano dvadeset devet elitnih vaterpolo utakmica u kojima su učestvovale mlade (U20) reprezentacije Grčke (n=7), Srbije (n=7), Italije (n=7) i Hrvatske (n=8). TSAP je uključivao: i) dva indikatora sticanja lopte u posedu; ii) četiri indikatora bacanja lopte. Koristeći ove indikatore, izračunati su sledeći indeksi tehničkih performansi: Obim igre (VP), Indeks efikasnosti (EI) i Skor performansi (PS). Teren je bio podeljen na dvanaest zona. Jednosmerni ANOVA test nije pokazao značajne razlike između timova za sve parametre ($p>0,05$), osim što su se za ofanzivne lopte (OB) i uspešne udarce (SS) desile u određenim zonama terena: za OB značajne razlike su nađene u zoni 1 ($p=.019$), u zoni 2 ($p=.014$) i u zoni 5 ($p=.007$); za SS značajne razlike nađene su u zoni 1 ($p=.026$) i u zoni 2 ($p=.008$). Glavni razlog razlika između timova mogao bi se objasniti prisustvom levorukog igrača u igri, kao i taktičkim ponašanjem trenera i igrača. TSAP instrument bi mogao da ponudi produktivnu povratnu informaciju trenerima da uoče različite zahteve igranja i da procene kako igrači razumeju igru.

U **trećem istraživanju** koje je predstavljeno (Perazzetti A., Dopsaj M., Mandorino M., Tessitore A. Assessing Offensive Phase: The Use of Team Sport Assessment Procedure (TSAP) in Elite Water Polo. Submitted to Internal Journal of Performance Analysis in Sport) cilj je bio da se pomoću TSAP instrumenta pruži tehnička i taktička analiza ofanzivnih akcija koje je tokom

svih mečeva cele sezone izvodio elitni vaterpolo tim koji učestvuje u italijanskom šampionatu prve lige za muškarce. Glavne hipoteze studije bile su da se značajne razlike u rezultatima TSAP performansi mogu naći između dve faze sezone (regularna faza i plej-aut), između uravnoteženih i neuravnoteženih mečeva i između domaćih i gostujućih utakmica tokom cele vaterpolo takmičarske sezone (2021/22) i da TSAP parametri, indeks i rezultati mogu biti različiti između igrača u zavisnosti od njihove igračke pozicije. Uzorak ovog istraživanja je bio 15 muških igrača italijanske elitne vaterpolo tima S.S. Lacio Nuoto. Igrači su posmatrani tokom svih 19 zvaničnih utakmica italijanskog prvenstva prve lige za muškarce 2021/22 (Serija A1) i klasifikovani u 4 grupe prema njihovoj glavnoj poziciji u igri. Posmatrane utakmice su preuzete iz baze podataka „ADrive.com“, platforme sa besplatnim javnim pristupom. Sve utakmice su klasifikovane prema konačnoj rezultatskoj razlici, definisanoj kao razlika postignutih golova između dva tima na utakmici (uravnoteženo: ≤3 gola naspram neuravnoteženo: >3 gola) i lokaciji utakmice (kod kuće ili u gostima) (Perazzetti et. al., 2023a). Analiza je obezbeđena pomoću TSAP instrumenta (Grehaigne et al., 1997) sa svim igračima primljenim (RB) i osvojenim loptama (CB) koje se računaju kao varijable za sticanje poseda lopte; dok su neutralne lopte svih igrača (NB), izgubljene lopte (LB), ofanzivne lopte (OB) i uspešni udarci (SS) računali kao varijable za odlaganje lopte (tabela 15). Kao indikatori učinka, obim igre (VP= RB+CB), indeks efikasnosti [EI= (OB+SS)/(10+LB)] i rezultat učinka [PS= (VP/2)+(EI*10)] izračunate su iz TSAP varijabli (Perazzetti et al., 2023b). Za konkretnu svrhu prikupljanja podataka kreirana je odgovarajuća vaterpolo kontrolna tabla korišćenjem LongoMatch Pro softvera (LongoMatch bi Fluendo, Vindovs verzija 1.9), što je omogućilo prikupljanje TSAP parametara tokom svih ofanzivnih akcija analiziranog tima i njegovih igrača. Statističke analize su vršene korišćenjem Excel verzije 2016 i SPSS verzije 26.0 (IBM, Chicago, IL, USA). Za svaku promenljivu, deskriptivni podaci su izraženi kao srednje vrednosti ± standardne devijacije (srednja vrednost ± SD). Dve višestruke linearne regresije su generisane sa VP i PS kao zavisnim varijablama, dok su u obe analize pozicija za igru, faza sezone, lokacija meča i konačna razlika u rezultatu bili konstantni prediktori. Zatim je primenjena analiza ANCOVA sa vremenom igranja kao kovarijantom da bi se procenile razlike VP i PS u odnosu na igračke pozicije. Analiza ANCOVA pokazala se otpornom na kršenje pretpostavke uslovne normalnosti ili homogenosti u prethodnim studijama (Olejnik & Algina, 1984). Iz tog razloga, pretpostavka normalnosti nije proverena. Konačno, klaster analiza je primenjena da identifikuje 3 grupe igrača prema VP i PS indeksima. Nivo značajnosti je postavljen na $p<0,05$. Ova studija je pružila tehničku i taktičku analizu ofanzivnih akcija istraženih u odnosu na uticaj različitih kontekstualnih faktora (sezona faza, lokacija utakmice i konačna rezultatska razlika), može se smatrati originalnim i korisnim doprinosom boljem razumevanju performansi vaterpolo utakmice. Generalno, rezultat ovog istraživanja

omogućava diskriminaciju nivoa performansi među svim igračima u okruženju utakmice u odnosu na njihove ofanzivne sposobnosti i veštine sa loptom, bilo da se radi o identifikaciji talenata, odabiru igrača ili u svrhu procene učinka. Studija je ograničena na jedan elitni muški seniorski tim, stoga bi buduća istraživanja pomoću TSAP instrumenta mogla uključiti veći broj vaterpolo tima i igrača i uključiti i analizu zone terena, koji nisu razmatrani u ovoj studiji. Štaviše, TSAP instrument razmatra samo ofanzivno ponašanje tima, dok se odbrambene aktivnosti ne uzimaju u obzir. Iz tog razloga, moglo bi biti zanimljivo uporediti TSAP igrača sa nekim indeksima odbrane. Naime, prema opštem mišljenju većine trenera vaterpolo elitnih trenera, defanzivna faza bi mogla biti značajnija od ofanzivne, i u odnosu na selekciju i angažovanje mladih talenata (Perazzetti et al., 2023c). Prema sadašnjoj TSAP analizi vaterpolista, treneri bi mogli da planiraju treninge uzimajući u obzir specifične tehničke i taktičke aspekte za elitne muške vaterpolo timove. Konkretno, upotreba TSAP-a takođe za redovno praćenje treninga (tj. tokom malih igara) može biti važan zadatak za nove korisne načine praćenja igrača.

Četvrto istraživanje koje je predstvljeno (Perazzetti, A., Dopsaj, M., Sansone, P., Mandorino, M., & Tessitore, A. (2023). Effects of Playing Position and Contextual Factors on Internal Match Loads, Post-Match Recovery and Well-Being Responses of Elite Male Water Polo Players. Journal of Functional Morphology and Kinesiology, 8(1), 12. https://doi.org/10.3390/jfmk8010012) je takođe objavljeno. Studija je imala za cilj da istraži efekte igračke pozicije i kontekstualnih faktora (ishod utakmice, konačna razlika u rezultatu, lokacija meča, trajanje putovanja, broj postignutih i primljenih golova) na unutrašnje opterećenje utakmice, percipirani oporavak igrača i dobrobit igrača. Session-RPE (s-RPE), percipirana skala oporavka (PRS) i Hooper indeks (HI) 17 muških elitnih vaterpolista praćeni su tokom svih mečeva prvenstva (regularne sezone i plej-auta) italijanske Serije A1 2021/22. Tri odvojena, mešovita linearna modela za ponovljena merenja pokazala su značajne glavne efekte: izvučeni u poređenju sa dobijenim mečevima doveli su do viših vrednosti s-RPE (srednja vrednost ± SE = 277 ± 17,6 naspram 237,3 ± 20,6), dok je duže trajanje putovanja (procena = -0,148) i postignuti golovi (procena = −3,598) doveli su do nižih vrednosti s-RPE; izbalansirani u poređenju sa neuravnoteženim mečevima doveli su do viših vrednosti PRS (srednja vrednost ± SE = 6,8 ± 0,3 naspram 5,1 ± 0,4), dok su vreme igre (procena = −0,041) i postignuti golovi (procena = −0,180) doveli do nižih vrednosti PRS; viši rezultati HI su registrovani za regularnu sezonu u poređenju sa plej-autom (srednja vrednost ± SE = 15,6 ± 0,9 naspram 13,5 ± 0,8). Ova studija označava važnost ekoloških i neinovativnih alata za praćenje za procenu unutrašnjeg opterećenja utakmice, oporavka i dobrobiti elitnih vaterpolista. Takođe, autor navodi da iako studija ima ograničenja, da je pružila novu strategiju za praćenja vaterpolista jer je, po saznanjima autora, ovo bio prvi rad

koji istražuje efekte različitih kontekstualnih faktora na vrednosti s-RPE, PRS i HI tokom cele takmičarsku sezonu u elitnom vaterpolu. U stvari, nalazi ove studije pokazuju važnost praćenja s-RPE, oporavka posle meča i dobrobiti vaterpolista na nedeljnom nivou. Konkretno, praćenje percipiranog psiho-fiziološkog statusa igrača tokom „kritičnih“ dana prelaska između poslednje utakmice i prvog treninga bi moglo pomažu trenerima da organizuju precizne i prilagođene treninge u skladu sa kontekstualnim faktorima i ukupnim statusom koji percipiraju njihovi igrači. Međutim, nalazi studije takođe pokazuju da percipirano unutrašnje opterećenje, oporavak i blagostanje ne bi trebalo da se koriste naizmenično. Iz tog razloga, kao praktična strategija, trenerima se savetuje da prate sve parametre jer bi specifični kontekstualni faktori mogli da odrede različite odgovore. U stvari, na utakmici, intenzitet „spora“ (opozicije) između dva tima, može posredovati RPE (a zatim i s-RPE). Na primer, kao što je pokazano u studiji, gubitak meča sa većom razlikom u konačnom rezultatu (neuravnotežen) odredio je niži s-RPE u poređenju sa mečevima koji su bili uravnoteženiji (npr. nerešeni mečevi).

DISKUSIJA

U sedmom poglavlju Diskusija (70-72) autor analizira dobijene rezultate kroz diskusiju. Glavni ciljevi ove doktorske disertacije su realizovani u četiri odvojene studije koje su istraživale pet hipoteza. U vezi sa generalnom hipotezom, može se izvesti sledeća diskusija:

HG – Višedimenzionalni pristup zasnovan na razumevanju nacionalne trenerske filozofije, integrisan procenom individualnih i kolektivnih taktičkih veština, kao i praćenjem opterećenja igrača i statusa oporavka, može pozitivno uticati na analizu stručnog štaba i tumačenje vaterpolo nastupa. Istraživanje ove doktorske disertacije je potvrdilo sve formulisane hipoteze i obezbedilo neinvazivne, praktične, ekološke i pristupačne strategije za unapređenje trenerske filozofije i pristupa treningu za trenere i kondicione trenere. U vezi sa svakom pomoćnom hipotezom, mogu se povući sledeće diskusije:

H1 – (Studija br. 1) Privrženost nacionalnim školama vaterpola će pokazati razlike u trenerskoj filozofiji i profesionalnom obrazovanju među trenerima koji pripadaju različitim nacionalnim školama vaterpola.

Sopstvena trenerska filozofija se razvija tokom karijere trenera pod uticajem trenerovog profesionalnog iskustva, utičući na njegov/njen rad. Istražujući ovu hipotezu, glavna značajna razlika pronađena između tri nacionalne škole (Grčka, Srbija i Italija) je broj mladih igrača u spisku prvog tima koji dolaze iz omladinskog pogona istog kluba. Razliku između tri nacionalne vaterpolo škole pronašla je i profesija glavnog trenera. Naime, većina srpskih (93%) i grčkih (67%) glavnih trenera navela je zanimanje vaterpolo trenera kao svoj glavni posao, dok u Italiji ovaj procenat pada na niži prag (30%).

H2 – (Studija 1) Organizacija treninga trenera i upravljanje takmičenjem su pod uticajem njihove sopstvene nacionalne škole vaterpola.

Prema ulozi analitičara utakmice studija nije pokazala značajne razlike između nacionalnih škola, kao ni za figuru kondicionog trenera. U stvari, samo 37,5% od ukupnog broja ispitanika izjavilo je da u svom osoblju ima lik analitičara utakmice, dok 52,5% ima figuru kondicionog trenera. U pogledu sastava tehničkog osoblja, glavna razlika između nacionalnih škola pokazala je veću šarenolikost profesionalnih figura srpske vaterpolo škole gde većina štabova uključuje i figuru trenera golmana (srpska škola, n= 10, grčka škola, n = 5, italijanska škola, n= 3), pokazujući viši profesionalni pristup za upravljanje treningom ove važne igračke pozicije. Što se tiče organizacije treninga, većina srpskih timova obično planira tri treninga nedeljno u teretani, dok je većina italijanskih i grčkih timova pokazala da planira samo dva treninga.

Govoreći o upravljanju takmičenjem, u smislu timskih strateških šema, značajne razlike su nađene u situaciji u kojoj se igra sa igračem više, pa čak i u defanzivnoj fazi. S tim u vezi, izgleda da je grčka škola ona sa manje šema igre od druge dve škole, verovatno zbog kreativnosti koja obično karakteriše grčke igrače, što se može videti u stilu igre koji pokazuju mlade reprezentacije Grčke tokom poslednjih međunarodnih takmičenja mladih.

H3 – (Studija 2) U vaterpolo utakmicama mladih, taktička analiza pomoću TSAP instrumenta će pokazati značajne razlike u kolektivnom ponašanju vaterpolo timova i donošenju odluka prema zonama terena i izbalansiran/neuravnotežen konačni rezultat razlike utakmice. U ovoj oblasti istraživanja, razlike pronađene između četiri reprezentacije u odnosu na različite zone terena mogu se objasniti taktičkim znanjem i strateškim odlukama trenera, kao i tehničkim i taktičkim veštinama igrača. Takođe, reprezentacija bi mogla da usvoji statičniju ili dinamičniju igru koja karakteriše njen sopstveni stil igre. Stoga su ova uputstva trenera mogla uticati na distribuciju broja ofanzivnih dodavanja u odnosu na zone terena koje utiču na donošenje odluka i tehničke veštine igrača. Konkretno, razlike u OB i SS pronađene između četiri reprezentacije mogu se objasniti prisustvom ili ne levorukog igrača u igri.

H4 – (Studija 3) U elitnim vaterpolo utakmicama, taktička analiza pomoću TSAP instrumenta će pokazati značajne razlike u zavisnosti od lokacije meča, uravnotežene/neuravnotežene konačne razlike u rezultatu utakmice, faze sezone, individualnog vremena igre igrača i igračke pozicije. Rezultati potvrđuju trend za TSAP parametre, dajući bolje vrednosti TSAP parametara u mečevima odigranim kod kuće nego u gostima, čak i s obzirom na neuravnoteženu konačnu rezultatsku razliku i jače timove protivnika. Zaista, osim prisustva publike sa lokalnim navijačima i izostanka putovanja, veći uticaj na vrednosti TSAP-a na domaćim utakmicama može se objasniti činjenicom da domaći tim igra na istom bazenu gde je

svakodnevno trenirao svoj sistem. Uzimajući u obzir celu sezonu, rezultati su pokazali veće srednje vrednosti u utakmicama sa uravnoteženim konačnim rezultatom nego u neuravnoteženim za PS i SS, respektivno. Ovi rezultati se takođe mogu objasniti u svetlu većeg procenta golova postignutih sa igračem više tokom uravnoteženih mečeva nego u neuravnoteženim (40% prema 29%, respektivno). U stvari, Lupo et al. (2012a) su pokazali da je tokom ovakvih mečeva veća pojava grešaka isključenja protivnika za izvođenje akcija sa igračem više koje bi mogle da prijave veću učestalost postignutih golova, dok se Medić i sar. (2014) pokazali da je poentiranje u situacijama brojčane prednosti igrača (postignutih golova) jedan od glavnih tehničkih i taktičkih parametara koje treba uzeti u obzir u uravnoteženim utakmicama. Nalazi Medić i sar. (2014) su u skladu sa dobijenim rezultatima koji su pokazali veće vrednosti (osim za LB, čija niža vrednost i dalje ima pozitivan efekat) za sve TSAP parametre tokom plej-aut faze (tabela 21), koja se vremenski igra na kraju regularne sezone. Efekat kovarijatnog vremena igranja uticao je na razliku između pozicija za igru.

H5 – (Studija 4) Značajne razlike u opterećenju na treningu, oporavku i odgovorima Huperovog indeksa biće pronađene prema igračkim pozicijama, minutama igre u takmičenju, lokaciji meča (kod kuće ili u gostima), uravnoteženoj/neuravnoteženoj razlici u konačnom rezultatu i fazi sezone. Iako nije značajno, studija pokazuje veće vrednosti s-RPE koje doživljavaju P igrači u poređenju sa CD i CF. Takve razlike se mogu objasniti različitim tehničkim i taktičkim zadacima koje obavlja svaka vaterpolo uloga. Što se tiče uticaja vremena za igru na s-RPE igrača, podaci su pokazali značajan uticaj na vreme igre. Iako su i vreme igranja (u minutima) i vrednost RPE doprinele proizvoljnoj jediničnoj količini s-RPE (tj. minuti k RPE), efekat vremena igranja može se objasniti razlikama između uloga. Nivo percipiranog oporavka igrača je takođe bio pod uticajem njihove količine vremena provedenog u vodi tokom meča, pri čemu duže vreme igre odgovara nižim percipiranim rezultatima oporavka (što je veći obim igre, to je niži kvalitet oporavka). Štaviše, analiza dobrobiti igrača je takođe bila u skladu sa prethodnim izjavama za s-RPE i uočeni oporavak. U stvari, otkrivena je opšta tendencija (p= 0,083) da se posmatraju veće percipirane vrednosti uživanja u odnosu na niži ukupni rezultat HI (što znači viši status blagostanja igrača). Ovu činjenicu mogu potvrditi i viši HI rezultati uočeni tokom regularne sezone, kada je posmatrani tim izgubio dvanaest mečeva i jedan remizirao (u trinaest mečeva), uz veći broj neuravnoteženih mečeva konačne razlike u rezultatu.

ZAKLJUČCI

U osmom poglavlju (72 – 74) autor izvodi zaključke na osnovu 4 sprovedena istraživanja. U vezi sa generalnom hipotezom, izvodi sledeći zaključak: **HG** – Višedimenzionalni pristup zasnovan na razumevanju nacionalne trenerske filozofije, integrisan

procenom individualnih i kolektivnih taktičkih veština, kao i praćenjem opterećenja igrača i statusa oporavka, može pozitivno uticati na analizu stručnog štaba i tumačenje vaterpolo nastupa. Može se zaključiti da je u potpunosti prihvaćen jer je ustanovljeno da nacionalne škole vaterpola utiču na trenersku filozofiju i metodologiju treninga glavnih vaterpolo trenera (Studija br. 1). TSAP pruža specifičan alat za procenu taktičkog ponašanja igrača koji pokazuju različite vrednosti prema zonama terena (Studija br. 2), pozicijama za igru i nekoliko kontekstualnih faktora (Studija br. 3). Praćenje opterećenja igrača pruža ekološki alat za nadgledanje aktivnosti igrača tokom zvaničnih vaterpolo utakmica (Studija br. 4).

U vezi pomoćnih hipoteza, izvodi sledeći zaključke: **H1** – Privrženost nacionalnim školama vaterpola će pokazati razlike u trenerskoj filozofiji i profesionalnom obrazovanju među trenerima koji pripadaju različitim nacionalnim školama vaterpola. Može se zaključiti da je to u potpunosti prihvaćeno jer je ustanovljeno da su glavni treneri iz tri različite nacionalne škole pokazivali različite pristupe prema rukovođenju timskom spiskom, stručnoj spremi i tumačenju posla (Studija br. 1).

H2 – Organizacija treninga trenera i upravljanje takmičenjem su pod uticajem njihove nacionalne škole vaterpola. Može se zaključiti da je to u potpunosti prihvaćeno jer je ustanovljeno da su glavni treneri iz tri različite nacionalne škole pokazali različitu organizaciju stafa, različite ideje i broj šema kako u ofanzivnoj tako i u defanzivnoj fazi igre (Studija br. 1).

H3 – U omladinskim vaterpolo utakmicama, taktička analiza pomoću TSAP instrumenta će pokazati značajne razlike u kolektivnom ponašanju vaterpolo timova i donošenju odluka prema zonama terena i uravnoteženu/neuravnoteženu konačnu rezultatsku razliku utakmice. Može se zaključiti da je to u potpunosti prihvaćeno jer je utvrđeno da parametri TSAP-a i indeksi mogu biti različiti prema zoni terena i njihovo povećanje ili smanjenje zavisi od konačne skor razlike utakmice (Studija br. 2).

H4 – U elitnim vaterpolo utakmicama, taktička analiza pomoću TSAP instrumenta će pokazati značajne razlike u zavisnosti od lokacije meča, uravnotežene/neuravnotežene konačne razlike u rezultatu utakmice, sezone, individualnog vremena igre i pozicija igrača. Može se zaključiti da je u potpunosti prihvaćen jer je ustanovljeno da TSAP instrument pruža različite korisne indekse prema svim kontekstualnim faktorima koji se razmatraju u hipotezi (Studija br. 3).

H5 – Značajne razlike u opterećenju treninga, oporavku i odzivima Huperovog indeksa biće pronađene prema pozicijama igrača, minutama igre u takmičenju, lokaciji meča (kod kuće ili u gostima), uravnoteženoj/neuravnoteženoj razlici u konačnom rezultatu i fazi sezone. Može se zaključiti da je to u potpunosti prihvaćeno jer je ustanovljeno da praćenje igrača obezbeđuje

različite RPE, s-RPE, Recoveri i Hooper indeks prema igračkim pozicijama i svim kontekstualnim faktorima koji se razmatraju u hipotezi (Studija br. 4).

Disertacija je imala za cilj da odgovori na pomenuti nedostatak literature o trenerskom znanju, analizi utakmica i procedurama praćenja na elitnom vaterpolo nivou. Prema mišljenju autora, studija 1 bi mogla da ponudi objektivnu indikaciju o razlikama i sličnostima u metodologijama treninga i vođenju takmičenja koje proizilaze iz trenerske filozofije intervjuisanih glavnih trenera, kao i razlika između tri nacionalne škole vaterpola. U stvari, način na koji se sportska disciplina razvija u zemlji može se posmatrati kao složena interakcija društvenog značaja, sportskih dostignuća, medijskog izveštavanja, finansijskih resursa i tako dalje, pored istorijske veze zemlje sa tim specifičnim sportom. Da bi se ovaj deo studije dodatno unapredio, moglo bi biti zanimljivo proširiti uzorak uključivanjem više glavnih trenera iz vaterpolo klubova širom sveta, uključujući i glavne trenere U18 timova. Po mišljenju autora, ista pitanja koja se postavljaju široj publici trenera iz različitih zemalja i iz različitih nacionalnih vaterpolo škola, proširila bi naučne podatke dostupne istraživačima i pogodovala prenosivosti znanja trenerima ove discipline. U studijama 2 i 3, upotreba TSAP instrumenta mogla bi ponuditi produktivnu povratnu informaciju trenerima o različitim zahtevima igre i da proceni kako igrači razumeju igru kolektivno ili pojedinačno. Naime, ovakav instrument bi mogao biti koristan za: prilagođavanje strateškog profila igre i uspostavljanje specifičnosti treninga fokusiranih na glavne taktičke i tehničke potrebe tima; da evidentira glavne ofanzivne aktivnosti koje se javljaju od igrača prema zonama terena i vrsti utakmica; da proveri koji je igrač sa najvećom vrednošću indeksa (ključni igrači), procenjujući kako se njihovi parametri menjaju na različitim utakmicama tokom takmičarske elitne sezone. Kao što je pokazano u studijama, moglo bi se spekulisati da se aspekti igre mladih elitnih muških vaterpolo utakmica moraju analizirati u odnosu na konkretne margine pobede, a ne samo sa obzirom na pobednički i porazni ishod, uzimajući u obzir zonu polja, dok u elitnom seniorskom timu takođe treba uzeti u obzir kontekstualne faktore „domaći“ i „gosti“ za analizu poseda lopte. U studiji 4, pokazano je kako elitni vaterpolisti mogu da ispolje različite nivoe umora, blagostanja, uživanja i statusa oporavka kao odgovor na zvanične utakmice, pružajući trenerima korisne i lako dostupne instrumente za praćenje. Kombinacija studije 3 i studije 4 mogla bi da pruži specifičan profil vaterpolista, koristan za praćenje tokom cele sezone, kako tehničko-taktičkih tako i psiho-fizioloških aspekata, koji bi mogli biti u korelaciji u zavisnosti od različitih kontekstualnih faktora. Ova doktorska disertacija pruža nalaze o metodologijama koje su neinvazivne, izvodljive, ekološke i nisu posebno skupe, kako bi se poboljšale postojeće trenažne metode koje koriste vaterpolo i kondicioni treneri, kao i drugi učesnici u vaterpolu.

LITERATURA

U poglavlju Literatura (75 - 87) navedene su bibliografske jedinice (196) na osnovu kojih je formulisana teorijska osnova i metodološka struktura istraživanja i na osnovu kojih su diskutovani rezultati dobijeni u istraživanjima. Bibliografske jedinice su korektno navedene u tekstu i u spisku literature. Preko 98% ih iz inostranih izvora sa Anglo-Saksonskog govornog područja, dok su ostale jedinice iz domaće bibliografije.

PRILOZI

Poglavlje Prilozi (88 - 97) sadrži: (1) Saglasnost Etičkog komiteta; (2, 3 i 4) Naslovne strane objavljenih radova kandidata kao prvog autora (1, 2. i 4. studija); (5) Biografiju kandidata; (6) Bibliografiju kandidata; (7) Izjava o autorstvu; (8) Izjava o istovetnosti štampane i elektronske verzije doktorskog rada; (9) Izjava o korišćenju.

MIŠLJENJE I PREDLOG KOMISIJE

Doktorska disertacija Andrea Perazzetti-ja napisana je na engleskom jeziku. Urađena doktorska disertacija ima za cilj definisanje dela tehnologije trenažnog procesa u vaterpolu, kao i da se ispitaju performanse vaterpola uspostavljanjem ekološkog i višedimenzionalnog pristupa praćenju fizičkog i tehničko-taktičkog vrednovanja vaterpolista. Tema je formulisana na osnovu pažljive analize obimne bibliografske građe. Problem istraživanja je detaljno objašnjen, a cilj i hipoteze su jasno formulisane.

Istraživanje je veoma značajno sa teorijske tačke gledišta, kao za tehnologiju treninga u sportskim igrama, tako, specifično i za vaterpolo sport. Posebno treba naglasiti, da je realizovano tako da će njegovi rezultati imati i neposrednu primenu u praksi. Osmišljeno je da pruži nalaze o metodologijama koje su neinvazivne, izvodljive, ekološke i ne posebno skupe, kako bi se poboljšale postojeće trenažne metode koje koriste vaterpolo i kondicioni treneri, ali i sami vaterpolo igrači, bez obzira na takmičarski nivo. Takođe, na osnovu rezultata dobijenih u disertaciji omogućiće se upotpunjavanje literature o esencijalno važnom segmentu u smislu kontrole efekata trenažnog rada - analizi specifične tj. takmičarske performanse igrača primenom metode analize utakmica, što će direktno obezbediti informacije potrebne za povećanje fundusa specifičnog znanja potrebnom trenerima, kao i o procedurama praćenja i testiranja elitnih vaterpolista.

Predlažemo da Nastavno-naučno veće Fakulteta prihvati pozitivni Referat Komisije i Veću naučnih oblasti društveno-humanističkih nauka uputi odluku kojom se odobrava odbrana doktorske disertacije Andrea Perazzetti pod naslovom „A MULTIDIMENSIONAL APPROACH TO THE STUDY OF WATER POLO PERFORMANCE (VIŠEDIMENZIONALNI PRISTUP U IZUČAVANJU IGRANJA VATERPOLA)“ u kojoj su mentori bili redovni profesor dr Milivoj Dopsaj, Univerzitet u Beogradu - Fakultet sporta i fizičkog vaspitanja, Srbija i vanredni profesor dr Antonio Tessitore, University of Rome - Foro Italico, Italija.

U Beogradu, 13.07.2023. godine

Članovi Komisije:

_____

Dr Marko Ćosić, docent,
Univerzitet u Beogradu - Fakultet sporta i fizičkog vaspitanja, predsednik komisije.

_____

Dr Željko Rajković, vanredni profesor,
Univerzitet u Beogradu - Fakultet sporta i fizičkog vaspitanja, član.

_____

Dr Tomislav Okičić, redovni profesor,
Univerzitet u Nišu - Fakultet sporta i fizičkog vaspitanja, član.

UNIVERSITY OF BELGRADE
FACULTY OF SPORT AND PHYSICAL EDUCATION
Belgrade, July 13, 2023.

TO THE TEACHING-SCIENTIFIC COUNCIL OF THE FACULTY

Subject: Report of the Committee for the evaluation of the doctoral dissertation of Andrea Perazzetti

By the decision of the Teaching-Scientific Council of the University of Belgrade - Faculty of Sport and Physical Education at the 13th session held on July 6, 2023 (Act 02-No. 1412/23-2 of July 11, 2023), and in accordance with Article 40 of the Rulebook on Doctoral Academic Studies - *revised text* (02-No. 532/22-4 dated November 9, 2022) and Article 41-43. Statute of the University of Belgrade - Faculty of Sport and Physical Education - *revised text* (02-No. 188/23-2 of February 13, 2023), on the proposal of the Doctoral Council of academic studies (02-No. 1356/23-2 of 30 June 2023) made a Decision to form the Committee for the Evaluation of the Doctoral Dissertation of the student Andrea Perazzetti, entitled:

"A MULTIDIMENSIONAL APPROACH TO THE STUDY OF WATER POLO PERFORMANCE (VIŠEDIMENZIONALNI PRISTUP U IZUČAVANJU IGRANJA VATERPOLA)"

in the following composition:

- Marko Ćosić, PhD, Assistant Professor,
  University of Belgrade - Faculty of Sport and Physical Education, chairman of the Committee;
- Željko Rajković, PhD, Associate Professor,
  University of Belgrade - Faculty of Sport and Physical Education, Committee member;
- Tomislav Okičić, PhD, Full Professor,
  University of Niš - Faculty of Sport and Physical Education, Committee member.

The doctoral dissertation was completed under the supervision of:

- Dr. Milivoj Dopsaj, full professor,
  University of Belgrade - Faculty of Sport and Physical Education,
- Dr. Antonio Tessitore, associate professor,
  University of Rome - Foro Italico, Italy.

After reviewing the final version of the doctoral dissertation, the candidate's biography and the list of published works, the Committee submits the following to the Teaching-Scientific Council

REPORT

INTRODUCTION

Candidate Andrea Perazzetti submitted the final version of his doctoral dissertation entitled: "A MULTIDIMENSIONAL APPROACH TO THE STUDY OF WATER POLO PERFORMANCE (Višedimenzionalni pristup u izučavanju igranja vaterpola)" to the Faculty

archives on June 30, 2023. The doctoral dissertation includes 97 pages, 30 tables, 19 graphs, 5 photographs, as well as a list of 196 references cited within the work. The doctoral dissertation was completed in full compliance with the Regulations on Doctoral Studies of the Faculty of Sports and Physical Education, as well as with the Instructions on the Formation of the Repository of Doctoral Dissertations adopted by the Senate of the University of Belgrade. The dissertation is the result of a consistently implemented project foreseen within the elaboration of the topic of the doctoral dissertation, it is written in English language and contains: Front page in English and Serbian language, Acknowledgments, Abstract in English language, Abstract in Serbian language, Contents, List of graphs, List of tables, List of abbreviations, and then chapters: Introduction, Theoretical framework and previous research, Problem, purpose, research goals and objectives, Hypotheses, Measurement methods, Results from the presented four studies, Discussion, Conclusions, References and Appendices.

BIOGRAPHY

Born in Rome (Italy) on April 7, 1994, Andrea Perazzetti is the eldest son of Rosetta and Roberto. Andrea and his sister Giorgia were raised in a working-class family where their mother worked in accounting and their father was a taxi driver. Andrea started swimming at an early age and then continued to swim for 12 years. Later, he switched to water polo, where he competed successfully for another 14 years. Everything influenced Andre to continue his studies in this field, choosing the Faculty of Sports Sciences. Bachelor (2017) and Master (2020) he finished with the highest result at the University of Rome Foro Italico. He participated in the Erasmus+ project (KA 107) at the University of Belgrade, working in the Sports Laboratory of the Department of Sports Medicine. For six months, he worked as a trainee at the water polo club Partizan. A year later, in 2020/21, he enrolled in the doctoral program “Experimental research methods of human locomotion” at the Faculty of Sports and Physical Education - University of Belgrade. As a visiting researcher, during the doctoral school year 2022-23 he took again part in the Erasmus+ (KA103) program at the University of Rome Foro Italico, performing research activities in the monitoring of training and performance in elite water polo. Currently, Andrea lives in Rome and as a match analyst and assistant coach is part of the first team of the water polo club S.S. Lazio Nuoto. He continues to do research in water polo within this Italian club. Furthermore, in the academic field, he gives practice classes in “team sports” as an assistant professor at the University of Rome Foro Italico. He loves his family, childhood friends and football. He speaks Italian (native), English (B2) and Serbian (A2).

PUBLISHED PAPERS

Perazzetti, A., Dopsaj, M., Nedeljković, A., Mazić, S., & Tessitore, A. (2023). Survey on coaching philosophies and training methodologies of water polo head coaches from three different european national schools. Kinesiology, 55(1), 49-61. https://doi.org/10.26582/k.55.1.6b

Perazzetti, A., Dopsaj, M., Sansone, P., Mandorino, M., Tessitore, A. (2023). Effects of playing position and contextual factors on internal match loads, post-match recovery and well-being responses of elite male water polo players. Journal of Functional Morphology and Kinesiology, 8(1), 12. https://doi.org/10.3390/jfmk8010012

Perazzetti, A., Dopsaj, M., & Tessitore, A. (2023). Technical and tactical evaluation of ball possession in international youth water polo matches using the Team Sport Assessment Procedure (TSAP) instrument. Montenegrin Journal of Sports Science and Medicine, 12(2), Ahead-of. https://doi.org/10.26773/mjssm.230901

"Assessing Offensive Phase: The Use of Team Sport Assessment Procedure (TSAP) in Elite Water Polo" (Submitted to International Journal of Performance Analysis in Sport**) Perazzetti A.**, Dopsaj M., Mandorino M., Tessitore A.

STRUCTURE OF THE DOCTORAL DISSERTATION

INTRODUCTION

Explaining the topic (from pages 1 to 16), the author through several chapters, states facts related to water polo that are important for the dissertation. In the first chapter, he lists the basic statistical facts related to the sport of water polo in general. Compare the representation of water polo in relation to other water sports, as well as the geographical distribution of water polo by continent. It is most prevalent in Europe, where about 56% of the total number of players play (Fina, 2019). It also lists the countries that have won Olympic medals in water polo tournaments, where the Hungarian national team dominates with a total of 16 medals (9 gold). In the following chapter, the evolution of the game from the very beginnings to today is explained through historical development. He states that the evolution of water polo shows constant changes in game systems and training methodologies, that they are partly derived from other team sports, and shows them through six historical reference periods. In the third chapter of the Introduction, the rules of the water polo game are covered. The author states that despite constant changes and significant improvements, after 2012 water polo remained full of contacts, catches, dives and pulls, which were not always punished by the referees, despite the rules that stipulate that they are judged as serious fouls (Hraste et al., 2013).

The author also notes that the first rule changes were aimed at standardizing the game, while subsequent changes were made in order to improve the dynamics and attractiveness of the sport, which enabled and encouraged progress both in matches and in training. In the following chapter, he defines player positions in five different categories. It also lists the basic

anthropometric characteristics of players, as well as the specifics of individual positions. In the fifth chapter of the Introduction, the author deals with the performance of water polo players. He states that water polo is a demanding aquatic team sport, in which players must move their bodies within the fluid (water) and often in opposition to their opponent (Smith, 1998). In this sense, water polo is considered one of the most physically and psychologically demanding team sports because different game situations require quick decision-making processes, predictive skills and problem-solving skills. These features are the result of the evolution of the rules, officiating and consequently the improvement of the game itself (Li & Graham, 2021). He states the distribution of metabolic systems during the game (Melchiorri et al., 2010a), where aerobic (≤ 2 mmol/L) for slightly over 23%, mixed zone for about 23%, mostly anaerobic (≤ 6 mmol/L) slightly less than 25%, while the anaerobic zone (> 6 mmol/L) accounts for about 28%. It also lists the percentages of time spent in various activities (swimming or duel and vertical position) of elite water polo players according to playing positions and gender through overview tables. At the end of the Introduction, in the sixth chapter, he lists the basic techniques with the ball that are used in water polo.

THEORETICAL FRAMEWORK AND PREVIOUS RESEARCH

The second chapter (17 - 23) is dedicated to the theoretical framework of the research and an overview of previous research related to the topic. In the first part of the second chapter, which concerns the reviewed literature, the author lists in tables how many papers were related for a certain field of research. The results of the scientific literature research starting in 2002 (Melchiorri et al., 2016) show that there are a total of 5 papers that treated motor skills, all of which were with water polo players except for one paper in which, in addition to water polo players, female water polo players were also analyzed. The analysis of water polo matches appears in 14 papers, 6 of which are with male players and an additional 4 papers with both female players and both genders together. There is a total of 25 works related to the field of medicine, of which 9 are with female players, while 8 are with male players, i.e., male and female players together. Most research papers are about testing and evaluation. There are 46 of them in total, of which 33 refer to male players, 12 to female players and one to both genders. Finally, there are a total of 9 papers related to training, of which 6 are for male water polo players, 2 for female water polo players and one paper that treats both genders simultaneously. A total of 99 works, of which 57 are with male players, 27 with female players and 15 with both genders.

According to the author's search on Scopus, Pubmed and Scholar, the second table shows data covering the period from 2016 to 2022. The author states that there are a total of 10

papers that dealt with motor skills, of which 4 are for water polo players, i.e., both genders together. Also, there are 2 works with female players only. The analysis of water polo matches appears in 8 papers, 4 of which are with male players, 1 paper with female players and 4 papers that treat both genders. There is a total of 15 works related to the field of medicine, of which 6 are with male players, 4 with female players, and there are 5 works with male and female players together. Most research papers are about testing and evaluation. A total of 17, of which 6 refer to male players, 4 to female players and 7 to both genders. Finally, there are a total of 9 works related to training, of which 5 are with male water polo players and 2 each for female water polo players, as well as for both genders together. There is a total of 59 works, of which 25 are with male players, 13 with female players and 21 with both genders.

In the second part of the second chapter, the author deals with tests - swimming and dry testing. The results of scientific research directed researchers to choose different protocols for evaluating swimming capacities that characterize a certain phase of a water polo match. In fact, to monitor the fitness of water polo players, the swim test shows that it is the most common instrument used in water polo practice. In a review of the swimming test for water polo players, Chirico et al. (2021) indicated that physiological assessment of water polo players can be divided into two areas related to swimming assessment: sprint and endurance swimming tests. However, this approach could underestimate the ability of players to swim with the ball, which is an environmental condition and requires special tests. Indeed, during a water polo match, players continuously change their position from vertical to horizontal and vice versa (Lupo et al., 2009). To cope with the horizontal phases, players perform technically skilled movements with and without the ball, which require different swimming abilities, such as crawling, crawling with the head above water, crawling while carrying the ball, as well as several variations of the specific water polo crawl (Dopsaj et al., 2007). Furthermore, dry tests play an important role in the field of water polo testing procedures. De Villarreal et al. (2015) suggested that pre-season water polo training should include a combined training program containing both dry and aquatic strength training as well as polymetric training to optimize water polo competition preparation. According to Platan et al. (2005), in relation to their position and level of competition, players' abilities to move their bodies vertically in the water depend on their level of competitiveness outside the water. Specifically, Keiner et al. (2020) suggest that maximal strength parameters are important predictors of water polo player's performance capacity, which, in addition to the medicine ball throw and jump height, are also tested with 1RM squat and bench press.

In the next part of the second chapter, the author deals with the philosophy of coaching, that is, the figure of the water polo coach. The expansion of the professional staffs brought a

new culture of training and competition management, which is influenced by the personal "coaching philosophy" of the coach, as well as the traditions of the various national water polo coaching schools. Indeed, training methodologies are largely influenced by the coach's personal coaching philosophy, which consists of his/her main goals and the values, beliefs and principles they wish to achieve in their coaching career (Martens, 2012).

In the fourth part of the second chapter, the author deals with the analysis of performance in water polo. The author states that to reproduce training activities such as a competitive game (Passos et al., 2017), coaches usually use performance analysis as a specialized discipline to provide objective information that helps them understand performance characteristics (Lupo et al., 2014b). Matching analysis fully addresses these performance model knowledge needs (Hughes et al., 2003) through its main fields of study: temporal motion analysis (TMA) and notational analysis (NA). TMA represents movement analysis through an activity classification process that considers different intensities and temporal patterns of movement (Strudvick et al., 2016). The main elements on which this analysis is based are intensity, duration, distance and frequency of actions (Williams et al., 2005). Notational analysis systems aim at the methodical analysis of behavioral events that occur during the match, through the study of tactical behaviors (with and without the ball) and technical gestures in relation to different game situations in the match (Ademović et al., 2020). The author states that in the last two decades there has been an increase in studies focused on tactical learning in team sports. Based on the assumption that students construct and learn tactical knowledge related to motor skills (Grehaigne and Godbout, 1998) to assess progress in terms of tactical skills and offensive efficiency (how to acquire possession of the ball and how to handle the ball during the game) the TSAP was proposed. In this regard, Grehaigne, Godbout, and Bouthier (1997) developed the Team Sports Assessment Procedure (TSAP), a useful tool for evaluating different scenarios within real game contexts (Richard, Godbout, Tousignant, & Grehaigne, 1999). Furthermore, related to match analysis, several water polo studies have been provided on technical and tactical aspects (Lupo et al., 2011), playing efficiency (Lupo et al., 2012), rule evolution (Lozovina et al. 2019; Argudo et al. al., 2021), levels of competition (Lupo et al., 2010) and influence on the outcome of matches (Ordonez et al., 2021). Also, there are several studies that assess the level of players' tactical awareness and knowledge of the game using the TSAP instrument. The basic idea of this type of evaluation is to observe the behavior of the players during the game and summarize the data collected either in the form of the total number of appearances or in the form of two performance indices: the efficiency index and the index of game volume (Grehaigne et al., 1997). To date, studies have been published regarding the assessment procedure of team sports in soccer (Blomqvist et al., 2005; Ortega-Toro et al., 2019),

basketball (Otero-Saborido et al., 2015), ice hockey (Nadeau et al. al., 2008) and volleyball (Richard et al., 2002; Sgro et al., 2018), while its application in water polo is still missing. Based on the results of Perazzetti and Tessitore (2021), the use of the TSAP instrument appears to provide an objective indication of the offensive performance of water polo teams. The findings of this study, which analyzed the FINA World Junior Water Polo Championships, suggest that TSAP could help guide the training process during a tournament or an entire season.

In the fifth part of the second chapter, the author deals with monitoring in water polo. Given the increased demands of water polo, planning a player effort monitoring strategy is critical to ensure that athletes are exposed to adequate training loads to minimize the risk of overload and maximize their performance (Thornton et al., 2019). In this sense, it has been shown that monitoring the recovery of players is at least as important as that during training and matches (Hininen et al., 2006), in order to avoid that high-intensity activity without adequate recovery periods causes adverse effects on playing abilities. . Performance in team sports is an expression of complex and dynamic multidimensional and interactive processes, which is why it is important to evaluate the effects of different workloads and recovery strategies to help coaches tailor individual player programs (Thorpe et al., 2017). To achieve this goal, in team sports coaching staffs collect a wide range of monitoring data related to external and internal player loads, as well as physiological and psychological assessments of fatigue (Kelly et al., 2007). Internal load represents a player's relative physiological response to training or match load, and is associated with both positive (i.e. fitness and preparedness) and negative (i.e. fatigue, dysfunctional overload and injury/illness) training-related outcomes (McLaren et al., 2017). External load is defined as the work done by the athlete, measured independently of his internal characteristics. Because both external and internal loads have merit in understanding athlete workload, a combination of both may be important for training monitoring (Halson, 2014), even if the ability to link external and internal loads in team sports is difficult due to the variability of physical performance during matches and sport-specific training and (Thorpe, 2017). Foster et al. (1998, 2001) proposed a simple and effective system for quantifying internal training load (TL), based on the rating of perceived exertion (RPE). This has been confirmed over the years by monitoring the workload of several different training modalities (technical, tactical, endurance, speed and strength). The intensity, duration and frequency of training can cause great pressure on the biological systems of athletes, and for this reason coaches are urged to adopt effective recovery strategies (Tessitore et al., 2007). In order to achieve an optimal balance between training load and recovery, it is necessary to maintain high physical performance and minimize the risk of injury (Tessitore et al., 2008). In this sense, recovery is

considered a multiple (e.g. physiological, psychological) process of recovery over time (Kelmann et al., 2018), emphasizing the importance of a carefully monitored recovery process (Kentta and Hassmen, 1998). For this reason, in recent years the post-match recovery status of team sports players has been increasing (Thorpe et al., 2017). Monitoring players' post-match recovery requires monitoring tools that are sensitive to match-induced fatigue. The method used to measure the recovery process is the quality of total recovery (TKR) which, by using the TKR scale, structured around the scale developed for ratings of perceived exertion (RPE), allows to evaluate the recovery process (Kentta and Hasmen, 1998). Among other tools, the Hooper-index and/or its subsets (i.e., sleep quality and amounts of stress, fatigue and muscle soreness) (Hooper and Mackinnon, 1995) have recently been shown to be a potentially good tool for monitoring player fatigue (Thorpe et al., 2015; Fessi et al., 2016; Rabbani & Buchheit, 2016; Clemente et al., 2017). This method is based on the importance that training diaries and measurements of athletes' well-being can help program appropriate loads during intensive training and tapering (Hooper and Mackinnon, 1995). Consistent with Hooper and Mackinnon (1995), subjective ratings using scales of 1–7 from “very low or good” (item 1) to “very very high or poor” (item 7) have been suggested as one of the best strategies for early detection of overtraining syndrome (Angeli et al., 2004). Assessment of internal training load (ITL) using session rating of perceived exertion (RPE session) has been shown to provide valuable information in training and matches (Lupo et al., 2014b). This study validated the session-RPE method as a simple and reliable tool for assessing ITL in water polo, allowing coaches to effectively monitor their programs.

PROBLEM, PURPOSE, AIMS AND TASKS OF THE STUDY

In the third chapter, the author defines the problem, the purpose, as well as the goals and tasks of the study (p. 24). The author states that, according to his knowledge, there are no studies that investigated the characteristics of the coaching philosophy and methodology of water polo coaches from different countries. For this reason, the most common training methodologies used among coaches and the differences between different national water polo schools are still unknown. In the field of match analysis, to date no study has used the TSAP instrument to analyze full season matches with VP first team players.

Regarding training monitoring, it has not been scientifically proven whether enjoyment, sleep disturbance, fatigue, stress and muscle pain can affect the perception of effort and perceived recovery in water polo players (both in young and in older water polo players). Finally, to date no study has compared different styles and modalities of swimming water polo with and without the ball between different age categories. Based on the previously highlighted

findings, it can be speculated that water polo research is still affected by the following limitations:

- There are no studies that investigate the philosophy of coaches and training methodologies of coaches belonging to different national water polo schools;
- There is still little research evaluating the progress of teams and players in terms of tactical skills and offensive efficiency;
- There are few studies on monitoring training and matches during concentrated periods of activity and throughout the season.
- There is a lack of studies regarding the use of specific water polo tests to assess swimming ability and agility.

After presenting the issues of the proposed study, the author defined the purpose of the research, as well as the aims. The **purpose** of this doctoral dissertation is to apply an ecological and multidimensional approach in researching coaching philosophy and monitoring physical and technical-tactical performance, recovery and well-being of elite water polo players.

The **aims** of this doctoral dissertation refer to the elite water polo level and are defined according to the following questions:

• Investigate the coaching philosophy and methodology of water polo head coaches belonging to different national schools.

• To provide a specific methodology for technical and tactical analyzes of elite water polo players using a specific notation tool (TSAP).

• To monitor player workload, recovery and well-being throughout the elite water polo season.

Based on the defined problem, purpose and aims of the study, the following **tasks** were realized through this research:

• Defining groups and sample sizes and their characteristics;

• Data collection;

• Defining the coaching philosophy of water polo coaches from different national schools;

• Defining TSAP parameters and indexes of water polo teams and players;

• Defining scales for monitoring elite water polo players;

• Analyzing data using software for statistical analysis SPSS;

• Describing the analyzed variables and interpreting the results;

• Provide useful and easily accessible instruments for water polo practitioners.

HYPOTHESES

Based on the analyzed literature, as well as the defined problem, purpose, goal and tasks of the dissertation, in the fourth chapter the following general (HG) and supporting hypotheses are defined (p. 25):

HG - A multidimensional approach based on the understanding of the coach's national coaching philosophy, integrated with the assessment of individual and collective tactical skills, as well as monitoring the player's workload and recovery status, can positively influence the analysis and interpretation of water polo performances.

H1 - Commitment to national water polo schools will show differences in coaching philosophy and professional education among coaches belonging to different national water polo schools.

H2 – Coach training organization and competition management are influenced by their national water polo school.

H3 - In youth water polo matches, tactical analysis using the TSAP instrument will show significant differences in the collective behavior of water polo teams and decision-making according to court zones and the balanced/unbalanced final score difference of the match.

H4 - In elite water polo matches, tactical analysis using the TSAP instrument will show significant differences depending on match location, balanced/unbalanced final match score difference, part of the season, individual playing time and player positions.

H5 – Significant differences in training load, recovery and Hooper's index responses will be found by playing positions, minutes played in the competition, match location (home or away), balanced/unbalanced difference in final score and stage of the season.

MEASUREMENT METHODS

The fifth chapter (page 25) is devoted to methods. This doctoral dissertation includes cross-sectional and longitudinal studies with the submission of questionnaires and match analysis tools. Data collection took place in three steps, creating four different studies and testing five different hypotheses. The first step was to survey the national water polo coaching schools, the second step to achieve the TSAP instrument, the third step to monitor the players' match load, recovery and well-being status. Analytical and basic descriptive, univariable and multivariable statistical methods were used as the main tools for cognitive reasoning and qualitative definition of the investigated phenomena. This research can be characterized as fundamental and applied because it provides a new and multidimensional approach within the general knowledge that already exists in water polo performance. Current studies are practically applicable for water polo coaches.

The research protocols are recognized in the Declaration of Helsinki, and were approved by the Ethics Committee of the Faculty of Sport and Physical Education of the University of Belgrade (number 484-2) and the Ethics Committee of the University of Rome Foro Italico (number 27/202 and number 99/2021).

RESULTS

Within the Results chapter (26-69), four conducted researches in which the candidate is the first author are presented. The research is presented through an introduction, methods (sample, data collection, statistical analysis), results, discussion and conclusion.

The first research, which was published (Perazzetti, A., Dopsaj, M., Nedeljković, A., Mazić, S., & Tessitore, A. (2023). Survey on coaching philosophies and training methodologies of water polo head coaches from three different European national schools. Kinesiology, 55(1), 49-61. https://doi.org/10.26582/k.55.1.6) aimed to survey 40 coaches from three important national water polo schools (Italy, Greece and Serbia) identify and compare coaching philosophies. The survey that was attached to the dissertation was based on five sections (technical staff composition, team list, weekly periodization, testing and monitoring, tactics and strategies). Descriptive statistics of all parameters were calculated, including means, standard deviations, and frequencies for all participants and pooled data. Because nominal data were collected in this survey, a Kruskal-Wallis' test was conducted to examine differences in responses by national school of water polo coaches. Descriptive data of the three groups were provided in a report that clearly showed the difference between each pair of groups. Statistical analyzes were performed using the SPSS statistical package (version 26.00; Institute, Inc., Cari, NC), and the significance criterion was set at an alpha level of 0.05. The conclusion was that the research can offer an objective indication of differences and similarities in training methodologies and competition management arising from the coaching philosophy of the interviewed head coaches, as well as from different national water polo schools. Indeed, how a sporting discipline develops in a country can be seen in the complex interplay of social importance, sporting achievements, media coverage, financial resources and so on, in addition to the country's historical connection to that specific sport. In this second respect, for example, water polo spread in Serbia starting from one Central School in Belgrade and in the capitals of the former Yugoslavia (Bratuša, 2021); in Greece it developed from the main clubs in the Greater Piraeus area, while in Italy it could be speculated that the Italian school developed in parallel with different and original characteristics between different Italian regions (mainly Liguria, Lazio, Campania and Sicily).

In **the second presented research**, which was also published (Perazzetti, A., Dopsaj, M., & Tessitore, A. (2023). Technical and tactical evaluation of ball possession in international youth water polo matches using the Team Sport Assessment Procedure (TSAP) instrument. Montenegrin Journal of Sports Science and Medicine, 12(2), Ahead-of. https://doi.org/10.26773/mjssm.230901) candidate states that the purpose of the study was to provide analysis offensive actions, using the Team Sport Assessment Procedure (TSAP) of the first four youth national teams during the 20th FINA World Junior Water Polo Championships. Twenty-nine elite youth (U20) water polo matches in which the national teams of Greece (n=7), Serbia (n=7), Italy (n=7) and Croatia (n=8) participated were selected for analysis. The TSAP included: i) two indicators of possession; ii) four ball drop indicators. Using these indicators, the following technical performance indices were calculated: Game Volume (VP), Efficiency Index (EI) and Performance Score (PS). The field was divided into twelve zones. One-way ANOVA test showed no significant differences between teams for all parameters ($p>0.05$), except that for offensive balls (OB) and successful shots (SS) occurred in certain zones of the field: for OB, significant differences were found in zone 1 ($p=.019$), in zone 2 ($p=.014$) and in zone 5 ($p=.007$); for SS, significant differences were found in zone 1 ($p=.026$) and in zone 2 ($p=.008$). The main reason for the differences between the teams could be explained by the presence of a left-handed player in the game, as well as the tactical behavior of the coaches and players. The TSAP instrument could offer productive feedback to coaches to perceive the different demands of playing and to assess how players understand the game.

In **the third research** presented (Perazzetti A., Dopsaj M., Mandorino M., Tessitore A. Assessing Offensive Phase: The Use of Team Sport Assessment Procedure (TSAP) in Elite Water Polo. Submitted to Internal Journal of Performance Analysis in Sport) aimed to use the TSAP instrument to provide a technical and tactical analysis of the offensive actions performed during all matches of the entire season by an elite water polo team participating in the Italian First Division Men's Championship. The main hypotheses of the study were that significant differences in TSAP performance scores could be found between the two phases of the season (regular phase and play-out), between balanced and unbalanced matches and between home and away matches during the whole water polo competitive season (2021/22) and that TSAP parameters, index and results may be different between players depending on their playing position. The sample of this research was 15 male players of the Italian elite water polo team S.S. Lazio Nuoto. The players were observed during all 19 official matches of the 2021/22 Italian Premier League Men's Championship (Serie A1) and classified into 4 groups according to their main position in the game. Watched matches are taken from the database 'ADrive.com', a platform with free public access. All matches are classified according to the final score

difference, defined as the goal difference between the two teams in the match (balanced: ≤3 goals vs. unbalanced: >3 goals) and the location of the match (home or away) (Perazzetti et. al., 2023a). Analysis was provided using the TSAP instrument (Grehaigne et al., 1997) with all players received (RB) and possessions (CB) counted as possession variables; while all players' neutral balls (NB), loose balls (LB), offensive balls (OB) and successful shots (SS) counted as ball disposal variables (Table 15). As performance indicators, game volume (VP= RB+CB), efficiency index [EI= (OB+SS)/(10+LB)] and performance score [PS= (VP/2)+(EI*10)] calculated are from TSAP variables (Perazzetti et al., 2023b). For the specific purpose of data collection, a suitable water polo control panel was created using LongoMatch Pro software (LongoMatch by Fluendo, Windows version 1.9), which enabled the collection of TSAP parameters during all offensive actions of the analyzed team and its players. Statistical analyzes were performed using Excel version 2016 and SPSS version 26.0 (IBM, Chicago, IL, USA). For each variable, descriptive data are expressed as means ± standard deviations (mean ± SD). Two multiple linear regressions were generated with VP and PS as dependent variables, while in both analyzes playing position, season stage, match location and final score difference were constant predictors. An ANCOVA analysis was then applied with playing time as a covariate to assess the differences of VP and PS in relation to playing positions. ANCOVA analysis has been shown to be robust to violations of the assumption of conditional normality or homogeneity in previous studies (Olejnik and Algina, 1984). For this reason, the assumption of normality was not checked. Finally, cluster analysis was applied to identify 3 groups of players according to VP and PS indices. The significance level was set at $p<0.05$. This study provided a technical and tactical analysis of offensive actions investigated in relation to the influence of different contextual factors (season stage, match location and final score difference), it can be considered an original and useful contribution to a better understanding of water polo match performance. Overall, the result of this research allows discrimination of performance levels among all players in a match environment in relation to their offensive abilities and ball skills, whether for talent identification, player selection or performance evaluation purposes. The study was limited to one elite men's senior team, therefore future research using the TSAP instrument could include a larger number of water polo teams and players and include field zone analysis, which were not considered in this study. Moreover, the TSAP instrument considers only the offensive behavior of the team, while the defensive activities are not taken into account. For this reason, it might be interesting to compare a player's TSAP with some defensive indexes. Namely, according to the general opinion of the majority of elite water polo coaches, the defensive phase could be more important than the offensive phase, and in relation to the selection and engagement of young talents (Perazzetti et al., 2023c). According to the current TSAP analysis

of water polo players, coaches could plan training sessions taking into account specific technical and tactical aspects for elite men's water polo teams. In particular, the use of TSAP also for regular training monitoring (i.e. during small games) may be an important task for new useful ways of monitoring players.

The fourth research presented (Perazzetti, A., Dopsaj, M., Sansone, P., Mandorino, M., & Tessitore, A. (2023). Effects of Playing Position and Contextual Factors on Internal Match Loads, Post-Match Recovery and Well-Being Responses of Elite Male Water Polo Players. Journal of Functional Morphology and Kinesiology, 8(1), 12. https://doi.org/10.3390/jfmk8010012) was also published. The study aimed to investigate the effects of playing position and contextual factors (match outcome, final score difference, match location, travel duration, number of goals scored and conceded) on internal match strain, perceived player recovery and player well-being. Session-RPE (s-RPE), perceived recovery scale (PRS) and Hooper index (HI) of 17 male elite water polo players were monitored during all championship matches (regular season and play-offs) of the Italian Serie A1 2021/22. Three separate repeated-measures mixed linear models showed significant main effects: drawn compared to won matches led to higher s-RPE values (mean ± SE = 277 ± 17.6 vs. 237.3 ± 20.6), while longer travel duration (estimate = -0.148) and goals scored (estimate = −3.598) led to lower s-RPE values; balanced compared to unbalanced matches led to higher PRS values (mean ± SE = 6.8 ± 0.3 vs. 5.1 ± 0.4), while playing time (estimate = −0.041) and goals scored (estimate = −0.180) led to lower PRS values; higher HI scores were registered for the regular season compared to the play-offs (mean ± SE = 15.6 ± 0.9 vs. 13.5 ± 0.8). This study highlights the importance of ecological and non-innovative monitoring tools to assess the internal match load, recovery and well-being of elite water polo players. Also, the author states that although the study has limitations, it provided a new strategy for monitoring water polo players because, to the authors' knowledge, this was the first paper to investigate the effects of different contextual factors on s-RPE, PRS, and HI values throughout an elite competitive season. water polo. In fact, the findings of this study demonstrate the importance of monitoring s-RPE, post-match recovery and well-being in water polo players on a weekly basis. In particular, monitoring the perceived psycho-physiological status of players during the "critical" transition days between the last game and the first practice could help the coaching staff to organize precise and adapted training according to the contextual factors and the overall status perceived by their players. However, the study findings also indicate that perceived internal burden, recovery, and well-being should not be used interchangeably. For this reason, as a practical strategy, coaches are advised to monitor all parameters as specific contextual factors may determine different responses. In fact, in a match, the intensity of the “contest” (opposition)

between two teams, can be mediated by RPE (and subsequently s-RPE). For example, as shown in the study, losing a match with a larger difference in the final score (unbalanced) determined a lower s-RPE compared to matches that were more balanced (e.g., tied matches).

DISCUSSION

In the seventh chapter, Discussion (70-72), the author analyzes the results obtained through the discussion. The main objectives of this doctoral dissertation were realized in four separate studies that investigated five hypotheses. Regarding the general hypothesis, the following discussion can be made:

HG - A multidimensional approach based on the understanding of the coaches' national coaching philosophy, integrated by the assessment of the individual and collective tactical skills, as well as the monitoring of players' workload and recovery status, can positively affect the coaching staff's analysis and interpretation of water polo performance. Overall, the research of this PhD dissertation has confirmed all the formulated hypotheses and provided a non-invasive, practical, ecological, and reasonably priced strategies to enhance coaching philosophies and training approaches for coaches and water polo strength and conditioning coaches. In relation to each supporting hypothesis, the following discussions can be drawn:

H1 – (Study #1) The adherence to a national water polo schools will show differences in coaching philosophies and professional backgrounds among coaches belonging to different national water polo schools. The own coaching philosophy evolves along the coach's career influenced by the coach's professional experiences, having an impact on his/her and work. Investigating on this hypothesis, the main significant difference found between the three national schools (Greece, Serbia and Italy) has been the number of youth players in the first team roster coming from the youth department of the same club. Indeed, six Serbian head coaches indicated having more than 15 players from the youth teams in their current first team rosters, which was a relevant number respect to the other two national schools. Difference between the three national water polo schools has also been found by the profession of head coach. In fact, the majority of Serbian (93%) and Greek (67%) head coaches indicated the profession of water polo head coach as their main job, while in Italy this percentage drops to a lower threshold (30%).

H2 – (Study #1) Coaches' training organization and competition management are influenced by their own national water polo school. According to the role of the match analyst study showed no significant differences between national schools, as well as for the figure of the fitness coach. In fact, only the 37.5% of total respondents declared to have in their staff the figure of match analyst, while 52.5% to have that of fitness coach. In terms of technical staff

composition, the main difference between national schools showed a higher plurality of professional figures by the Serbian water polo school where most of staffs have included also the figure of goalkeeper coach (Serbian school, n= 10, Greek school, n= 5, Italian school, n= 3), showing a higher professional approach for the training management of this important playing position. About the training organization, most Serbian teams are usual to plan three weekly training sessions in the gym, while most of the Italian and Greek teams showed to plan only two sessions. Talking about competition management, in terms of team strategic schemes, significant differences were found in the power-play situation and even defensive phase. In this regard, the Greek school seems to be the one with fewer schemes of play than the other two schools, probably due to the creativity that usually characterizes Greek players, as could be seen in the style of play showed by the Greek youth national teams during the last youth international competitions.

H3 – (Study #2) In youth water polo matches, the tactical analysis by means of the TSAP instrument will show significant differences in water polo teams' collective behaviors and decision making according to the zones of the fields and balanced/unbalanced final score difference of the match. In this area of investigation, the differences found between the four national teams in relation to the different zones of the field could be explained by the tactical knowledge and strategic decision of the coaches, and players' technical and tactical skills. Also, a national team could adopt a more static or dynamic game that characterize its own playing style. Therefore, these coaches' directions might have impacted on the distribution of the number of offensive passes in relation to the zones of the field influencing players' decision making and technical skills. In particular, the differences in OB and SS found between the four national teams could be explained by the presence or not of a left-hand player in the game.

H4 – (Study #3) In elite water polo matches, the tactical analysis by means of the TSAP instrument will show significant differences according to the match location, balanced/unbalanced final score difference of the match, season phase, individual playing time and players' playing positions. The results confirm trend for TSAP parameters, providing better values of TSAP parameters in matches played at home than away, even considering an unbalanced final score difference and stronger opponent teams. Indeed, apart the presence of an audience with local supporters and the missing of traveling, the higher influence on TSAP values in home matches can be explained by the fact that the home team plays in the same swimming-pool where has daily trained its system. Considering the entire season, results showed higher mean values in balanced final score difference matches than in unbalanced ones for PS and SS, respectively. These results could also be explained in light of the higher percentage of goals scored in power play situation during balanced matches than in unbalanced

ones (40% vs 29%, respectively). In fact, Lupo et al. (2012a) demonstrated that during this kind of matches there is a higher occurrence of opponent's exclusion fouls to perform power-play actions that could report higher frequency of goals scored, while Medić et al. (2014) showed that scoring in situations of players' numerical superiority (power-play goals scored) is one of the main technical and tactical parameters to consider in balanced matches. The findings of Medić et al. (2014) are in line with results which showed higher values (except for LB, whose lower value still has a positive effect) for all TSAP parameters during the play-out phase (table 21), which is temporally played at the end of the season regular phase. The effect of the covariate playing time influenced the difference between playing positions.

H5 – (Study #4) Significant differences in training loads, recovery and Hooper index responses will be found according to players' playing positions, minutes of play in competition, match location (home or away), balanced/unbalanced final score difference and season phase. Although not significant, study shows higher s-RPE values experienced by P players compared to CD and CF. Such differences can be explained by the different technical and tactical tasks performed by each water polo role. Regarding the effect of playing time on players' s-RPE, data showed a significant effect for playing time. Although both playing time (in minutes) and RPE value contributed to the arbitrary unit amount of the s-RPE (i.e., minutes x RPE), the effect of playing time can be explained the between-role differences. The players' level of perceived recovery has also been influenced by their amount of time spent in the water during the match, with a higher playing time corresponding to lower perceived recovery scores (the higher the volume of play, the lower the quality of recovery). Moreover, the analysis of players' well-being was also in line with the previous statements for s-RPE and perceived recovery. In fact, it was found a general tendency ($p= 0.083$) to observe higher perceived enjoyment values in relation to a lower HI total score (which means a higher players' well-being status). This fact can be confirmed by the higher HI scores observed during the regular season, when the observed team lost twelve matches and drew one (in thirteen matches), with the higher number of unbalanced final score difference matches.

CONCLUSIONS

In the eighth chapter (72 - 74), the author draws conclusions based on 4 conducted studies. In relation to the general hypothesis, he draws the following conclusion: HG - A multidimensional approach based on the understanding of the coach's national coaching philosophy, integrated by the assessment of individual and collective tactical skills, as well as monitoring the players' workload and recovery status, can positively influence the analysis of the coaching staff and the interpretation of water polo performances. It can be concluded that it

is fully accepted because national water polo schools have been found to influence the coaching philosophy and training methodology of head water polo coaches (Study No. 1). The TSAP provides a specific tool for assessing the tactical behavior of players who show different values according to the zones of the court (Study No. 2), playing positions and several contextual factors (Study No. 3). Monitoring of players workload provides an ecological tool for monitoring player activity during official water polo matches (Study No. 4).

Regarding the supporting hypotheses, it draws the following conclusions: **H1** - Commitment to national water polo schools will show differences in coaching philosophy and professional education among coaches belonging to different national water polo schools. It can be concluded that this was fully accepted as it was found that head coaches from three different national schools showed different approaches to roster management, training and job interpretation (Study No. 1).

H2 – Coach training organization and competition management are influenced by their national water polo school. It can be concluded that this is fully accepted because it was found that head coaches from three different national schools showed different organization of technical staff, different ideas and number of schemes in both offensive and defensive phases of the game (Study No. 1).

H3 - In youth water polo matches, tactical analysis using the TSAP instrument will show significant differences in the collective behavior of water polo teams and decision-making according to court zones and the balanced/unbalanced final score difference of the match. It can be concluded that it is fully accepted because it was determined that TSAP parameters and indices can be different according to the field zone and their increase or decrease depends on the final score difference of the match (Study No. 2).

H4 - In elite water polo matches, tactical analysis using the TSAP instrument will show significant differences depending on match location, balanced/unbalanced final match result difference, season, individual playing time and player positions. It can be concluded that it is fully accepted because the TSAP instrument was found to provide different useful indices according to all the contextual factors considered in the hypothesis (Study No. 3).

H5 – Significant differences in training load, recovery and Hooper's index responses will be found according to player positions, minutes played in the competition, match location (home or away), balanced/unbalanced difference in final score and stage of the season. It can be concluded that this is fully accepted as player tracking was found to provide different RPE, s-RPE, Recovery and Hooper index according to playing positions and all contextual factors considered in the hypothesis (Study No. 4).

The dissertation aimed to respond to the aforementioned lack of literature on coaching knowledge, match analysis and monitoring procedures at the elite water polo level. According to the author, study 1 could offer an objective indication of the differences and similarities in the training and competition management methodologies arising from the coaching philosophy of the interviewed head coaches, as well as the differences between the three national water polo schools. In fact, the way a sports discipline develops in a country can be seen as a complex interaction of social importance, sporting achievements, media coverage, financial resources and so on, in addition to the country's historical connection to that specific sport. To further improve this part of the study, it might be interesting to expand the sample by including more head coaches from water polo clubs around the world, including head coaches of U18 teams. The same questions that are asked to a wider audience of coaches from different countries and from different national water polo schools, would expand the scientific data available to researchers and favor the transferability of knowledge to coaches of this discipline. In studies 2 and 3, the use of the TSAP instrument could offer productive feedback to coaches about the different demands of the game and assess how players understand the game collectively or individually. Namely, such an instrument could be useful for: adjusting the strategic profile of the game and establishing specific training programs focused on the main tactical and technical needs of the team; to record the main offensive activities that occur from the players according to the zones of the field and the type of matches; to check which one is the player with the highest index value (key player), evaluating how their parameters change in different matches during the competitive elite season. As shown in the studies, it could be speculated that aspects of the game of youth elite men's water polo matches must be analyzed in relation to specific margins of victory, and not only in terms of winning and losing outcomes, taking into account the field zone, while in the elite senior the team should also take into account the contextual factors of “home” and “away” for the analysis of possession. In Study 4, it was demonstrated how elite water polo players may exhibit different levels of fatigue, well-being, enjoyment, and recovery status in response to official matches, providing coaches with useful and easily accessible monitoring instruments. The combination of study 3 and study 4 could provide a specific profile of water polo players, useful for monitoring throughout the season, both technical-tactical and psycho-physiological aspects, which could be correlated depending on different contextual factors. This doctoral dissertation provides findings on methodologies that are non-invasive, feasible, environmentally friendly and not particularly expensive to improve the training methodology of coaches, strength and conditioning coaches and water polo practitioners.

REFERENCES

In the References chapter (75 - 87) bibliographic units (196) are listed on the basis of which the theoretical basis and methodological structure of the research was formulated and on the basis of which the results obtained in the research were discussed. Bibliographic units are correctly listed in the text and in the bibliography. Over 98% of them are from foreign sources from the Anglo-Saxon speaking area, while the rest are units from the domestic bibliography.

APPENDICES

Chapter Appendices (88 - 97) contains: (1) Consent of the Ethics Committee; (2, 3 and 4) Title pages of published works of the candidate as the first author (1, 2 and 4 studies); (5) Candidate's biography; (6) Candidate's bibliography; (7) Statement of authorship; (8) Statement on the identity of the printed and electronic version of the doctoral thesis; (9) Statement of Use.

OPINION AND PROPOSAL OF THE COMMITTEE

Andrea Perazzetti's doctoral dissertation was written in English language. The completed doctoral dissertation aims to define part of the technology of the training process in water polo, as well as to examine water polo performance by establishing an ecological and multidimensional approach to monitoring the physical and technical-tactical evaluation of water polo players. The topic is formulated on the basis of a careful analysis of extensive bibliographic material. The research problem is explained in detail, and the aims and hypotheses are clearly formulated.

The research is very significant from a theoretical point of view, both for the technology of training in sports games and, specifically, for the sport of water polo. In particular, it should be emphasized that it was implemented in such a way that its results will have immediate application in practice. It is designed to provide findings on methodologies that are non-invasive, feasible, environmentally friendly and not particularly expensive, in order to improve existing training methods used by water polo and fitness coaches, but also by water polo players themselves, regardless of competitive level. Also, based on the results obtained in the dissertation, it will be possible to complete the literature on an essential segment in terms of controlling the effects of training work - specific analysis, i.e. competitive performance of players using the match analysis method, which will directly provide the information needed to increase the fund of specific knowledge needed by coaches, as well as monitoring and testing procedures of elite water polo players.

We suggest that the Teaching-Scientific Council of the Faculty accept the positive Report of the Committee and send a decision to the Council of Scientific Fields of Social sciences and Humanities approving the defense of Andrea Perazzetti's doctoral dissertation under the title “A MULTIDIMENSIONAL APPROACH TO THE STUDY OF WATER POLO PERFORMANCE (VIŠEDIMENZIONALNI PRISTUP U IZUČAVANJU IGRANJA VATERPOLA)“ in which the mentors were full professor Dr. Milivoj Dopsaj, University of Belgrade - Faculty of Sports and Physical Education, Serbia and associate professor Dr. Antonio Tessitore, University of Rome - Foro Italico, Italy.

In Belgrade, July 13, 2023.

Committee members:

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Marko Ćosić, PhD, Assistant Professor,
University of Belgrade, Faculty of Sport and Physical Education, chairman of the Committee;

_____

Željko Rajković, PhD, Associate Professor,
University of Belgrade, Faculty of Sport and Physical Education, Committee member;

_____

Tomislav Okičić, PhD, Full Professor,
University of Niš, Faculty of Sport and Physical Education, Committee member.