

## Poređenje nekih funkcionalnih i antropometrijskih parametara kao faktora rizika za fragilnost među polovima kod starih osoba

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## Comparison of some functional and anthropometric parameters as risk factors for gender fragility in the elderly people

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### Sažetak

**Uvod.** Specifična karakteristika starijih osoba je njihova krhlost /ili fragilnost. Zbog rasprostranjenosti, fragilnost je potrebno shvatiti kao prioritet javnog zdravlja.

**Cilj rada.** Ispitati povezanost funkcionalnih i antropometrijskih parametara sa fragilnošću kod osoba starosti preko 65 godina.

**Metod.** Istraživanje je dizajnirano kao studija preseka i obuhvatilo je 446 starijih lica. Kao instrumenti istraživanja korišćeni su opšti upitnik, za procjenu funkcionalnog statusa *Tinetti test* i od antropometrijskih parametara obim nadlaktice i obim srednje cirkumferencije potkoljenice. Od statističkih testova koristili smo  $\chi^2$  test, a Pirsonova (*Pearson*) korelacijska analiza korišćena je za analizu korelacije.

**Rezultati.** Osobe ženskog pola su imale lošiji funkcionalni status, hod i ravnotežu u odnosu na osobe muškog pola ( $\chi^2=4,125; p<0,127$ ). Uočeno je da su ispitanici muškog pola imali veće vrijednosti obima nadlaktice ( $26,96 \pm 3,44$ ) u odnosu na ženski pol, dok su osobe ženskog pola imale veće vrijednosti obima srednje cirkumferencije potkoljenice ( $32,66 \pm 6,29$ ). Analizirajući povezanost antropometrijskih mjerenja sa ukupnim skorom *Tinetti testa* i u odnosu na pol ispitanika, uočeno je da između parametara postoji korelaciona analiza

**Zaključak.** Visok procenat ispitanika starijih od 65 godina ima loš funkcionalni status, kao i niže vrijednosti antropometrijskih markera, što ukazuje na to da oni mogu biti potencijalni faktori rizika za nastanak fragilnosti kod osoba starijeg životnog doba.

**Ključne riječi.** Stare osobe, fragilnost, funkcionalni status, antropometrijski parametri.

### Abstract

**Introduction.** A specific characteristic of the elderly is brittleness or fragility, and due to its prevalence, fragility needs to be understood as a public health priority. The aim of the study was to examine the association of functional and anthropometric parameters with fragility in persons over 65 years of age.

**Method.** The study was designed as a cross-sectional study and included 446 elderly people. As research instruments, a general questionnaire was used to assess the functional status of the Tinetti test and, of anthropometric parameters, the circumference of the upper arm and the circumference of the middle part of the lower leg. We used the  $\chi^2$  test and Pearson's correlation analysis as statistical tests.

**Results.** Females had poorer functional status, walking, and balance compared to males ( $\chi^2 = 4.125; p < 0.127$ ). It was observed males subjects had higher values of upper arm circumference ( $26.96 \pm 3.44$ ) compared to females, while females had higher values of the middle circumference of the lower leg ( $32.66 \pm 6.29$ ). Analyzing the correlation of anthropometric measurements with the total score of the Tinetti test and in relation to subjects' gender, it was noticed there is a correlation analysis between the parameters.

**Conclusion.** A high percentage of people over the age of 65 have poor functional status, as well as lower values of anthropometric markers, suggesting that they may be potential risk factors for the fragility in the elderly.

**Keywords.** Elderly, fragility, functional status, anthropometric parameters.

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## Uvod

Tokom proteklih decenija, starosna struktura stanovništva se mijenja s porastom broja starijih od .65 godina. Specifična karakteristika starijih osoba je njihova krhkost ili fragilnost (eng. *fragility*). Zbog rasprostranjenosti, fragilnost je potrebno shvatiti kao prioritet javnog zdravlja, jer ne samo da negativno utiče na kvalitet života starijih osoba, već sa sobom nosi brojne ekonomske i socijalne posledice. Smatra se da je fragilnost ili krhkost vrlo učestala u populaciji starih osoba i da sa sobom nosi visok rizik od loših zdravstvenih ishoda, uključujući povećanu smrtnost, institucionalizaciju, padove i hospitalizaciju. Stoga je tokom poslednje decenije poraslo interesovanje u vezi sa ovom temom<sup>1</sup>. Glavni razlog je vjerovanje da bi rana identifikacija rizičnih faktora mogla pomoći u odlaganju ili spriječavanju negativnih ishoda krhkosti. Uprkos znatnim istraživanjima, i dalje se vode rasprave o prirodi, definiciji, prevalenciji i karakteristikama starijih ljudi u različitim fazama krhkosti<sup>2</sup>. U oblasti gerijatrije sve češće definišu krhkost kao biološki sindrom smanjene rezerve i otpornosti na stresore, što je rezultat ukupnog opadanja u više fizioloških sistema, što dovodi do gore pomenutih loših ishoda. Iako ga često poistovjećuju sa invalidnošću, sindrom krhkosti može biti fiziološki predznak i etiološki faktor invalidnosti zbog svojih glavnih karakteristika slabosti, smanjene izdržljivosti i usporenih performansi<sup>3</sup>. Kada govorimo o fragilnosti ne možemo da ne spomenemo sarkopeniju i malnutriciju, koje su usko povezane sa ovim sindromom. Možemo reći da se sarkopenija i fragilnost preklapaju u tri karakteristike: mala mišićna snaga, brzina hoda i mišićna masa, što bi značilo da su sarkopenija i fragilnost u ovim segmentima podudarne, jer dijele tri iste karakteristike. Prema dosadašnjim istraživanjima, osoba koja ima sarkopeniju je uvijek fragilna, ali ne i obavezno. Obrnuto, malnutricija može biti udružena sa oba ova stanja<sup>4</sup>.

Fragilnost je povezana s porastom starosnog doba, ali nije neizbježna posljedica starenja. Fragilnost postoji kod približno 10% starijih od 65 godina, dok je kod starijih od 85 godina ovaj procenat znatno veći i iznosi između 25% i 50%<sup>5,6,7,8</sup>. Veća je u žena nego u muškaraca, a prevladuje kod ljudi s nižim obrazovanjem i prihodima, s lošijim zdravstvenim stanjem, hroničnim bolestima i kod onih koji imaju lošiji funkcionalni status<sup>9</sup>. Prevalencija fragilnosti pojavljuje se u svijetu u rasponu od 4% do 59,1%<sup>10</sup>. Budući da još uvijek ne postoji jasna saglasnost za detaljnu procjenu indikatora fragilnosti niti sarkopenije, daljnja istraživanja u ovoj oblasti su hitno potrebna.

## Cilj rada

Cilj rada je bio da se ispita povezanost funkcionalnih i antropometrijskih parametara sa fragilnošću kod osoba preko 65 godina starosti.

## Introduction

Over the past decades, the age structure of the population has changed with the increase in the number of elderly people over 65. A specific characteristic of the elderly is fragility, and due to its prevalence, fragility should be understood as a priority of public health, because it not only negatively affects the quality of life of the elderly but also brings along numerous economic and social consequences. It is thought fragility is very common in the elderly population and carries a high risk of poor health outcomes, including increased mortality, institutionalization, falls, and hospitalization. As a result, interest in this topic has grown over the last decade (1). The main reason is the belief that early identification of risk factors could help delay or prevent negative fragility outcomes. Despite considerable research, there is still debate about the nature, definition, prevalence, and characteristics of older people in different "phases" of fragility (2). In the geriatrics domain, fragility is increasingly defined as a biological syndrome of reduced reserve and resistance to stressors, which is the result of a cumulative decline in several physiological systems leading to the above-mentioned poor outcomes. Although often equated to a disability, the fragility syndrome can be a physiological precursor and etiological factor of disability due to its main characteristics of weakness, reduced endurance, and slow performance (3). When talking about fragility, we rarely fail to mention sarcopenia and malnutrition, which are closely related to this syndrome. We can freely say sarcopenia and fragility overlap in three characteristics: low muscle strength, walking speed, and muscle mass, which would imply sarcopenia and fragility, in these segments, coincide because they share three of the same characteristics. According to previous research, a person with sarcopenia is always fragile, but not necessarily the other way around, while malnutrition may be associated with both of these conditions (4).

Fragility correlates with aging but is not its inevitable consequence. Fragility is present in approximately 10% of people over the age of 65, while in those over 85 this percentage is significantly higher and amounts to between 25% and 50% (5,6,7,8). It is higher in women than in men and is prevalent in people with lower education and income, poorer health, chronic diseases, and those with poorer functional status (9). The prevalence of fragility occurs worldwide and ranges from 4 to 59,1% (10). As there is still no clear consensus for a detailed assessment of fragility or sarcopenia indicators, further research in this area is urgently needed.

## Objective

The study aimed to examine the association of functional and anthropometric parameters with fragility in persons over 65 years of age.

## Metod

### Ispitanici

Studija presjeka je sprovedena kod osoba starijeg životnog doba, a uzorak su činila 446 ispitanika oba pola. Kriterijum za uključivanje u studiju je bila orijentisanost u vremenu, a kriterijumi za isključivanje -su bile osobe sa akutnim oboljenjem, nedavna hospitalizacija, nemogućnost uspostavljanja saradnje, hronična bubrežna insuficijencija, individue koje su imale prelom kuka, te prisustvo psihičkih oboljenja, demencije, malignih oboljenja, moždanog udara. Anketiranje je sprovedeno od strane istraživača u domovima zdravlja u Foči, Rogatici i Istočnom Sarajevu, u periodu od novembra 2020 do marta 2021. godine. Od svakog ispitanika tražena je pismena saglasnost za dobrovoljno učestvovanje u istraživanju. Istraživanje je sprovedeno u skladu sa Helsinškom deklaracijom uz saglasnost Etičkog odbora Medicinskog fakulteta u Foči i Domova zdravlja koji su bili uključeni u istraživanje.

### Instrumenti istraživanja

Standardizovani upitnik korišćen je za prikupljanje sociodemografskih podataka o ispitanicima u studiji (pol, doba ispitanika, obrazovanje, mjesto stanovanja, prihodi, socijalna aktivnost i integracija, druženje, hobi, korišćenje pomagala za mobilnost).

*Tinetti upitnik* za procjenu hoda i ravnoteže (engl. *The Tinetti Gait and Balance Instrument*) je kreiran da odredi rizik od padova kod starijih u toku narednih godinu dana. Koristeći ovaj upitnik, izvršili smo fizikalni pregled pacijenta. Ustanovili smo stanje njegove ravnoteže za koju smo izračunali poseban skor, kao i hod pacijenta ožji smo, takođe, izračunali skor. Na kraju, dobili smo konačni skor na osnovu kojeg se može procijeniti rizik od pada za pacijenta u narednih godinu dana. Instrument je veoma dobar, tj. pouzdan za procjenu funkcionalnog statusa i može se pristupiti daljnjoj interpretaciji i generalizaciji rezultata. Test se izvodi tako što ispitanik hoda preko prostorijske, prvo svojim, *uobičajenim ritmom*, a zatim *brzim, ali sigurnim ritmom* koristeći, ukoliko je potrebno, uobičajenu pomoć za hodanje - štap ili hodalicu. Maksimalan rezultat za komponentu ravnoteže je 16 bodova, a za hod je 12. Ukupan skor je 28. Ispitanici koji imaju rezultate ispod 18 su u visokom riziku za pad, oni koji su u rasponu od 19-23 boda imaju umjeren rizik, a skor veći od 24 znači da imaju nizak rizik za pad<sup>11</sup>.

Od antropometrijskih parametara mjereni su obim nadlaktice i obim srednje cirkumferencije potkoljenice. Obim nadlaktice (ON) će se mjeriti pomoću centimetarske trake u nivou sredine nadlaktice sa pruženom rukom uz tijelo, a vrijednost se izražava u *cm*. Ispitanicima će se mjeriti obim srednje cirkumferencije potkoljenice u stojećem položaju, tako da će tokom mjerenja težina tijela biti ravnopravno raspoređena

## Material and methods

### Examinees

The cross-sectional study was conducted with elderly people, and the sample consisted of 446 subjects of both genders. The criterium for inclusion was time orientation, and exclusion criteria were individuals with acute illnesses, recent hospitalization, disorientation, inability to establish cooperation, chronic renal failure, individuals with hip fractures, and the presence of mental illness, dementia, malignancy, disease, stroke, etc. The survey was conducted by researchers at health centers in Foca, Rogatica, and East Sarajevo from November 2020 to March 2021. Each respondent was asked to sign a written consent stating his/her voluntary participation in the research. The research was conducted in accordance with the Declaration of Helsinki, with the consent of the Ethics Committee of the Medical Faculty in Foča, and the Health Centers included in the research.

### Research instruments

A standardized questionnaire was used to collect sociodemographic data on respondents in the study (gender, age, education, place of residence, incomes, social activity, and integration, socializing, hobbies, use of mobility aids).

*The Tinetti Gait and Balance Instrument* questionnaire was created to determine the risk of falls in the elderly over the next year. Using the questionnaire, we performed a physical examination of the patient and established the state of his balance, and calculated a special score, as well as the patient's gait for which we also calculated the score and got the final score. The final score may assess the risk of falling for the patient in the coming year. The instrument is very good, ie. reliable for assessing the functional status, and can be approached for further interpretation and generalization of results. The test is performed by the subject walking across the room, first in his "usual rhythm" and then in a "fast but safe" rhythm, using, if necessary, the usual walking aids such as a cane or walker. The maximum score for the balance is 16 points and for gait 12. The total score is 28. Respondents who score below 18 are at high risk for falling, those in the range of 19-23 have a moderate risk, and a score higher than 24 represents a low risk of fall (11).

Out of the anthropometric parameters, the circumference of the upper arm and the middle circumference of the lower leg were measured. The circumference of the upper arm (UAC) was measured using a centimeter tape in the middle of the upper arm, with the arm extended alongside the body, and the value was expressed in centimeters. Subjects would have the middle circumference of the lower leg measured in a standing position so that during the measurement

sa vodoravno postavljenom centimetarskom trakom (najšira cirkumferencija - obim) na najširi dio potkoljenice<sup>12</sup>. Dobijene vrijednosti će se porediti sa uobičajenim referentnim vrijednostima za oba pola. Kod ispitanika kod kojih su dobijene vrijednosti krajnjeg skora bile ispod referentnih vrijednosti, smatralo se daimaju narušen hod i ravnotežu, što predstavlja potencijalne faktore rizika za nastanak fragilnosti.

## Statistička analiza

U ovom istraživanju podaci su obrađeni pomoću SPSS softverskog statističkog paketa. Od statističkih testova korišćen je  $\chi^2$  kvadrat test, neparametarski test. Za analizu povezanosti, korišćena je Pearsonova korelaciona analiza. Podaci su prikazani tabelarno. Kao nivo statističke značajnosti razlika uzeta je uobičajena vrijednost  $p < 0,05$ , tj. sve prvijednosti manje od 0,05 su smatrane statistički značajnim.

## Rezultati

Studija je uključila 446 ispitanika starosti preko 65 godina, od toga 251 (56,3%) žena i 195 (43,7%) muškaraca prosječne starosti od  $75,96 \pm 7,41$  godina. Kada je u pitanju doba ispitanika, 50,0% je pripadalo mlađoj grupi ispitanika 65–75 godina, 39,0% je imalo 75–85 godina, dok je 11% ispitanika imalo >85 godina. Većina učesnica su bile udate, (njih 47%), osnovno obrazovanje imalo je (67%), specifičan hobi (56%), penzije (87%). Skoro svi ispitanici (95,5%) su bili mišljenja da vole da se druže sa prijateljima i 70% ispitanika nije koristilo pomagala za mobilnost (Tabela 1).

the body weight can be evenly distributed with a horizontally placed centimeter strip (widest circumference - volume) to the widest part of the lower leg (12). The values obtained would be compared with the usual reference values for both genders. Subjects in whom the obtained endpoint values were below the reference values were considered to have impaired gait and balance, which is a potential risk factor for fragility.

## Statistical analysis

In this research, the data were processed using the SPSS software statistical package. The  $\chi^2$  square test, a nonparametric test, was used as a statistical test. The Pearson correlation analysis was used for the correlation analysis. The data are presented in tables. The usual value of  $p < 0.05$  was taken as the level of statistical significance of the difference, ie. all  $p$  values less than 0.05 were considered statistically significant.

## Results

The study included 446 subjects over 65, of which 251 (56.3%) were women and 195 (43.7%) men, with an average age of  $75.96 \pm 7.41$ . When it comes to the age of the respondents, 50.0% belonged to the younger group aged 65–75, 39.0% were from 75–85, while 11% of the respondents were > 85. Most of the participants were married (47%), had primary education (67%), specific hobbies (56%), and pensions (87%). Almost all respondents (95.5%) were of the opinion that they like to hang out with friends and 70% did not use mobility aids (Table 1).

**Tabela 1.** Sociodemografske karakteristike ispitanika

**Table 1.** Socio-demographic characteristics of the participants

Varijable <i>Variables</i>	Broj (N) <i>Number(N)</i>	Procenat (%) <i>Percentage (%)</i>
Pol <i>Gender</i>		
Muški <i>Male participants</i>	195	43,7%
Ženski <i>Female participants</i>	251	56,3%
Doba <i>Years of age</i>		
65–75	222	50,0%
75–85	174	39,0%
>85	50	11%

Ispitivanjem funkcionalne sposobnosti pomoću *Tinetti testa*, uočeno je da između ispitanika muškog i ženskog pola ne postoji statistički značajna razlika kada je u pitanju funkcionalni status. Osobe ženskog pola su imale lošiji funkcionalni status, hod i ravnotežu u odnosu na osobe muškog pola ( $\chi^2=4,125$ ;  $p<0,127$ ). (Tabela 2)

By examining functional ability, using the *Tinetti test*, it was observed there was no statistically significant difference between male and female subjects when it comes to functional status. Females had lower functional status, gait, and balance compared to males (Table 2) ( $\chi^2 = 4.125$ ;  $p < 0.127$ ).

**Tabela 2.** Funkcionalni status u odnosu na pol ispitanika

**Table 2.** Functional status in relation to the gender of the participants

<i>Tinetti test</i>	Muškarci <i>Male</i> (N=195)	Žene <i>Female</i> (N=251)	$\chi^2$	p
<18 visok rizik <18 <i>high risk</i>	40,0%	44,6%	4,125	0,127
19-23,00 umjeren rizik 19-23,00 <i>moderate risk</i>	25,6%	21,7%		
>24,00 nizak rizik >24,00 <i>low risk</i>	34,4%	33,6%		

*Tinetti test* procjene hoda i ravnoteže; N – broj; \* $p<0,05$

The *Tinetti Gait and Balance Instrument*; N – number\* $p<0,05$

U tabeli 3 su prikazani rezultati srednjih vrijednosti izmjenjenih antropometrijskih parametara kod ispitanika u odnosu na pol. Uočeno je da su ispitanici muškog pola imali veće vrijednosti obima nadlaktice ( $26,96 \pm 3,44$ ) u odnosu na ženski pol, dok su osobe ženskog pola imale veće vrijednosti obima srednje cirkumferencije potkoljenice ( $32,66 \pm 6,29$ ).

Table 3 shows the results of the intermediate values of the measured anthropometric parameters in relation to gender. It was observed male subjects had higher values of upper arm circumference ( $26.96 \pm 3.44$ ) compared to females, while females had higher values of the middle circumference of the lower leg ( $32.66 \pm 6.29$ ).

**Tabela 3.** Srednje vrijednosti antropometrijskih mjerenja ispitanika

**Table 3.** Mean values of anthropometric measurements of participants

	Pol/ Gender			
	Muški/ Male		Ženski/Female	
	Mean	SD	Mean	SD
Obim nadlaktice <i>Mid-arm circumference</i>	26,96	3,44	26,75	3,68
Obim srednje cirkumferencije potkoljenice <i>Calf circumference</i>	32,53	4,13	32,66	6,29

SD – standardna devijacija; Mean- srednja ili aritmetička sredina

SD - standard deviation; Mean- mean or arithmetic middle

Analizirajući povezanost antropometrijskih mjerenja sa ukupnim skorom *Tinetti testa* i u odnosu na pol ispitanika, uočeno je da postoji korelaciona analiza između parametara. Utvrđene su značajne negativne korelacije po pitanju obima nadlaktice i kod žena ( $p < 0,001$ ) i muškaraca ( $p < 0,001$ ). Značajne negativne korelacije kod muškaraca su utvrđene za obim nadlaktice ( $p < 0,001$ ), gdje je uočeno da su ispitanici sa nižim vrijednostima pomenutih mjerenja imali lošiji funkcionalni status. Takođe, ispitanici su imali lošiji funkcionalni status i u odnosu na vrijednosti obima srednje cirkumferencije potkoljenice (Tabela 4).

Analyzing the correlation of anthropometric measurements with the total score of the *Tinetti test* and concerning the subjects' gender, it was noticed there was a correlation analysis between the parameters. Significant negative correlations were found in upper arm circumference in both women ( $p < 0.001$ ) and men ( $p < 0.001$ ). Significant negative correlations in men were found for upper arm circumference ( $p < 0.001$ ) where it was observed the subjects with lower values of the mentioned measurements had poorer functional status. Also, the subjects had a poorer functional status concerning to the values of the middle circumference of the lower leg (Table 4).

**Tabela 4.** Korelacija mjerenja obima srednje cirkumferencije potkoljenice i obima nadlaktice u odnosu na *Tinetti test* i pol  
**Table 4.** Correlation of measurements of the circumference of the middle circumference of the lower leg and the circumference of the upper arm in relation to the *Tinetti test* and gender

Varijable <i>Variables</i>	Obim nadlaktice <i>Mid-arm circumference</i>		Obim srednje cirkumferencije potkoljenice <i>Calf circumference</i>	
	r	p	r	p
<i>Tinetti test/Tinetti test</i>				
M (male)	0,207	0,004	0,285	<0,001
Ž (female)	0,265	<0,001	0,404	<0,001

## Diskusija

U starosti dolazi do smanjenja mišićne mase. Skeletni mišići čine oko 50% ukupnih tjelesnih proteina. Značajan gubitak mase skeletnih mišića ugrožava metabolizam, imunokompetenciju i snagu. Gubitak mišićne mase, funkcionalna nesposobnost i krhkost predstavljaju faktore rizika za padove, prelome akostiju, invalidnost, sarkopeniju, institucionalizaciju i hospitalizaciju kod osoba starijeg životnog doba. U kliničkom okruženju, niska mišićna masa kod hospitalizovanih pacijenata povećava bolnički boravak i smanjuje njihovo preživljavanje (13). Kod pojedinaca s prekomjernom tjelesnom težinom, manja mišićna masa može biti maskirana viškom kilograma. Dokazano je da se mišićna masa smanjuje za oko 30% u dobi od 20 do 80 godina, odnosno oko 6 kg (12).

Naši rezultati su pokazali da su žene imale veći procenat zastupljenosti rizika od povreda, lošiji funkcionalni status, lošiji hod i ravnotežu u odnosu na muškarce. Na osnovu rezultata našeg istraživanja može se zaključiti da analiza podataka vezanih za funkcionalni status pokazuje individualne razlike između ispitanika. Postoji određen broj starijih ispita-

## Discussion

There is a decrease in muscle mass in old age. Skeletal muscles make up to 50% of total body protein. Significant loss of skeletal muscle mass threatens metabolism, immunocompetence, and strength. Loss of muscle mass, functional disability, and fragility are risk factors for falls, bone fractures, disability, sarcopenia, institutionalization, and hospitalization in the elderly. In the clinical setting, low muscle mass in hospitalized patients increases hospital stay and reduces their survival (13). In overweight individuals, low muscle mass can be masked by being overweight. It has been proven muscle mass decreases by about 30% at the age of 20 to 80 years, or about 6 kg (12).

Our results showed women had a higher percentage of injury risk, lower functional status, slower gait, and balance compared to men. Based on the results of our research, it can be concluded the analysis of data related to functional status showed individual differences between respondents. There are some older respondents with excellent functional status, but on the other hand, there are younger ones with lower functional status because their daily activities are lim-

nika sa odličnim funkcionalnim statusom, ali sa druge strane postoje oni mlađi sa lošijim funkcionalnim statusom, jer su im aktivnosti dnevnog života ograničene. Slična zapažanja navodili su i drugi autori ukazujući na heterogenost populacije starih. Među starima postoje oni sa zadovoljavajućim funkcionalnim statusom i potpuno nezavisni od tuđe pomoći, ali i slabi i zavisni od tuđe pomoći, kao i oni sa različitim stepenom rizika od pogoršanja funkcionalnog stanja, slabosti, pa čak i smrti (14,15).

Na osnovu dobijenih rezultata, analizirajući povezanost antropometrijskih mjerenja sa ukupnim skorom Tinetti testa u odnosu na pol ispitanika, uočeno je da postoji korelaciona analiza između nekih parametara. Rezultati pokazuju da se ispitanici muškog i ženskog pola statistički razlikuju po pitanju antropometrijskih mjerenja, posebno za obim nadlaktice.

Koncept funkcionalnog sastava tijela integriše dijelove tijela u regulatorne sisteme povezivanjem tjelesnih komponenti s odgovarajućim metaboličkim procesima. Promjene u sastavu tijela povezane s dobi imaju implikacije za zdravlje i dobru fizičku funkciju. Lošiji funkcionalni status ima uticaja i na nutritivni status i na kognitivni status što dovodi do brojnih kolaborativnih problema kao što su fragilnost i sarkopenija. Različiti fenotipovi sarkopenije moraju se posmatrati u odnosu na funkcionalne i zdravstvene aspekte.

Mišićna snaga, mišićna masa i funkcionalna sposobnost su vrlo važne tri komponente za procjenu i dijagnozu sarkopenije. Istraživanja su pokazala da dodatak esencijalnih aminokiselina i peptida ishrani može povoljno djelovati na liječenje sarkopenije. Takođe, poznat je i pozitivan uticaj unosa vitamina D na povećanje mišićne mase i snage. Za ublažavanje posljedica sarkopenije najboljom se pokazala kombinacija fizičke aktivnosti, vježbe izdržljivosti i povećanog unosa aminokiselina u ishrani (16, 17).

Invaliditet može povećati rizik od smrti, pa stoga postoji prirodna pretpostavka da su subjekti sa sarkopenijom ili sarkopenskom pretilošću izloženi većem riziku od smrti. Nedovoljna tjelesna aktivnost jedan je od vodećih faktora rizika za smrt u svijetu, ali i za razvoj nezaraznih bolesti, kao što su kardiovaskularne bolesti, rak i dijabetes. Tjelesna aktivnost ima značajne zdravstvene koristi i doprinosi sprečavanju nastanka prethodno navedenih nezaraznih bolesti (18). Redovna tjelesna aktivnost, uključujući aerobnu i anaerobnu aktivnost, značajan je i promjenjivi faktor u prevenciji i liječenju pretilosti u opšoj populaciji ili sarkopenije u starijih odraslih osoba. Tjelesna aktivnost sprječava debljanje i smanjuje udio masnog tkiva kod pretilih osoba, a istovremeno poboljšava. odnosno povećava mišićnu masu i snagu kod starih ljudi sa sarkopenijom (19). Snaga nogu i ruku, okretnost, brzina hodanja i ravnoteža kod muškaraca te okretnost i ravnoteža kod žena bile su snažnije povezane sa razvojem sarkopenije pretilosti. Slični rezultati su pronađeni i u drugim studijama, koje ukazuju da su neredovne tjelesne aktivnosti povezane s većim rizikom od razvoja sarkopenije. Osim sarkopenije i

ited. Similar observations were made by other authors, pointing to the heterogeneity of the elderly population. Among the elderly, there are those with satisfactory functional status and completely independent of other people's help, but also those who are weak and dependent on others' help, as well as those with varying degrees of risk, of deteriorating functional condition, weakness, and even death (14, 15).

Based on the obtained results, analyzing the correlation of anthropometric measurements with the total score of the Tinetti test in relation to the sex of the subjects, it was noticed that there is a correlation analysis between some parameters. The results show that male and female subjects differ statistically in terms of anthropometric measurements, especially for upper arm circumference.

The concept of functional body composition integrates body parts into regulatory systems by connecting body components with appropriate metabolic processes. Age-related changes in body composition have implications for health and good physical function. Poor functional status has an impact on both nutritional status and cognitive status leading to a number of collaborative problems such as fragility and sarcopenia. Different phenotypes of sarcopenia must be observed in relation to functional and health aspects.

Muscle strength, muscle mass, and functional ability are three very important components for the assessment and diagnosis of sarcopenia. Studies have shown that the addition of essential amino acids and peptides to the diet can have a beneficial effect on the treatment of sarcopenia. Also, the positive effect of vitamin D intake on increasing muscle mass and strength is well known. To alleviate the effects of sarcopenia, a combination of physical activity, endurance exercise, and increased dietary amino acid intake have been shown to be best (16, 17).

Disability can increase the risk of death, so there is a natural assumption that subjects with sarcopenia or sarcopenic obesity are at a higher risk of death. Insufficient physical activity is one of the leading risk factors for death in the world but also for the development of non- contagious diseases, such as cardiovascular disease, cancer and diabetes. Physical activity has significant health benefits and contributes to the prevention of the before mentioned non- contagious diseases (18). Regular physical activity, including aerobic and anaerobic activity, is a significant and variable factor in the prevention and treatment of obesity in the general population or sarcopenia in older adults. Physical activity prevents weight gain and reduces the proportion of adipose tissue in obese people, and while improving it, at the same time it increases muscle mass and strength in elderly people with sarcopenia (19). Leg and arm strength, agility, gait speed and balance in men, and agility and balance in women were more associated with the development of obesity sarcopenia. Similar results have been found in other studies, which indicate irregular physical activity is associated with a higher risk of develop-

hronične bolesti mogu takođe uzrokovati tjelesnu neaktivnost zbog smanjene sposobnosti vježbanja (smanjena kardiorespiratorna kondicija i mišićna snaga), fizičkih ograničenja i povećan umor nakon vježbanja (17, 20). Loš kvalitet života, posljedice poput invalidnosti i fragilnosti, te nesamostalnost, samo su neke od niza obilježja sarkopenije. Korištenjem konceptualnog modela u prikazu ovakvog hroničnog oboljenja pojednostavljuje se i ukazuje na ozbiljnost problema (21, 22, 23, 24,25).

Osim starosti, ostali faktori rizika za sarkopeniju uključuju pasivni način života, nezdravu ishranu, slab apetit. Adekvatna ishrana i fizička aktivnost tokom života su najpouzdanije javnozdravstvene intervencije u suzbijanju ovog stanja, a od vitalne značajnosti jeste adekvatno unošenje proteina, vitamina D, aminokiselina, magnezijuma. Iskustva iz prakse pokazuju da se fragilnost kod osoba starijeg životnog doba u Bosni i Hercegovini sprovodi veoma malo i neadekvatno, te su podaci koliko je fragilnost u staroj populaciji učestala i koji su faktori rizika, jako oskudni. Redovna i detaljna procjena fragilnosti pružila bi teorijski okvir koji bi zdravstveni radnicimogli koristiti za razvijanje sveobuhvatnog pristupa u procijeni i liječenju starijih pacijenata sa složenim multimorbiditetom na jednostavan i prihvatljiv način. Zbog toga je neophodno jasno definisati međunarodno priznatu dijagnostičku metodu za procjenu fragilnosti, jasno definisati indikatore fragilnosti kod starijih osoba, pokazati kako se može raditi njihov skrining u praksi, a zatim odrediti koji će antropometrijski biohemijski marker biti klinički upotrebljiv u praksi, prihvatljiv za pacijenta, a koji će imati visoku senzitivnost i visoku specifičnost za očekivani ishod, kao i obećavajući potencijal za preporučeni sistem dijagnostikovanja fragilnosti. Obzirom da smo svjesni važnosti pravovremenog dijagnostikovanja fragilnosti ili krhkosti, smatramo da je vrijednost ovog istraživanja izuzetno važna za Bosnu i Hercegovinu u svrhu razvijanja dobre kliničke prakse.

Istraživanje je imalo svoje nedostatke ili slabosti istraživanja, jer se za procjenu funkcionalne sposobnosti najčešće koristi Katzov indeks dnevnih aktivnosti i Lowtona skala instrumentalnih aktivnosti na osnovu kojih se vrši detaljna procjena stepena ovisnosti ili neovisnosti osobe za vještine koje su neophodne u životu. U našem istraživanju se koristio Tinetti test za procjenu hoda i ravnoteže, na osnovu kojih se mogu odrediti potencijalni faktori rizika fragilnosti.

ing sarcopenia. In addition to sarcopenia and chronic disease, they can also cause physical inactivity due to reduced ability to exercise (decreased cardiorespiratory form and muscle strength), physical limitations, and increased tiredness after exercise (17, 20). Poor quality of life, consequences such as disability and fragility, and lack of independence are just some of the many features of sarcopenia. The use of a conceptual model in the presentation of such a chronic disease simplifies and indicates the seriousness of the problem (21, 22, 23, 24, 25).

Except for age, other risk factors for sarcopenia include a passive lifestyle, an unhealthy diet, and poor appetite. Adequate nutrition and physical activity during life are the most reliable public health interventions in combating this condition, and adequate intake of proteins, vitamin D, amino acids, and magnesium are of vital importance as well. Experience from practice shows that fragility in the elderly people in Bosnia and Herzegovina is poorly and inadequately tracked, and data on how frequent fragility is in the elderly population and what are the risk factors are very scarce. Regular and detailed assessment of fragility would provide a theoretical framework healthcare professionals could use to develop a comprehensive approach to the assessment and treatment of elderly patients with complex multimorbidity in a simple and acceptable way. Therefore, it is necessary to clearly define an internationally recognized diagnostic method for assessing fragility, define fragility indicators in the elderly people, show how their screening can be done in practice, and then determine which anthropometric biochemical marker will be clinically useful in practice, acceptable to a patient, have high sensitivity and high specificity for the expected outcome, as well as the promising potential for the recommended fragility diagnosis system. Considering we are aware of the importance of timely diagnosis of fragility, we believe the value of this research is extremely important for Bosnia and Herzegovina's clinical practices.

The research had its shortcomings or weaknesses because the Katz Index of Daily Activities and the Lowton Scale of Instrumental Activities are most often used to assess functional ability, as a detailed assessment of a person's dependence or independence for life skills is used. In our study, the Tinetti test was used to assess gait and balance, on the basis of which potential risk factors for fragility can be determined.



## Zaključak

Istraživanje je pokazalo da visok procenat osoba starijih od 65 godina ima loš funkcionalni status vezan za hod i ravnotežu, ali i nezadovoljavajuće vrijednosti antropometrijskih parametara. Lošiji funkcionalni status povećava rizik od invalidnosti, te vodi ka povećanim potrebama zdravstvene njege i povećanim troškovima. Ispitanici muškog pola imali su veće vrijednosti obima nadlaktice, dok su osobe ženskog pola imale veće vrijednosti obima srednje cirkumferencije potkoljenice. Dobijeni rezultati korelacijom pokazuju uticaj antropometrijskih parametara na motoričke sposobnosti starih osoba. Loš funkcionalni status i nezadovoljavajuće vrijednosti antropometrijskih parametara su potencijalni faktori rizika za nastanak fragilnosti kod starih osoba. Prospektivne studije su neophodne kako bi se analizirali trigger faktori onesposobljavanja starih i potencijalni modeli njege koji mogu doprinijeti očuvanju funkcionalne sposobnosti gerontoloških pacijenata.

## Conclusion

The study showed a high percentage of people over the age of 65 have poor functional status related to gait and balance, as well as lower values of anthropometric parameters. Lower functional status increases the risk of disability and leads to increased health care needs and increased costs. Male participants had higher upper arm circumference values, while female participants had higher lower leg circumference values. The results obtained by correlation show the influence of anthropometric parameters on the motor abilities of the elderly. Lower functional status and unsatisfactory values of anthropometric parameters are potential risk factors for the development of fragility in the elderly. Prospective studies are necessary to analyze the trigger factors of disability of the elderly people and potential models of care that may contribute to the preservation of the functional capability of geriatric patients.

## Reference/ Literatura

- Karunanathan S, Wolfson C, Bergman H, Beland F, Hogan DB. *A multidisciplinary systematic literature review on frailty: overview of the methodology used by the Canadian Initiative on Frailty and Aging*. BMC Med Res Methodol 2009;9:68.
- Lepeleire JD, Iliffe S, Mann E, Iliffe S, Mann E, Degryse JM, et al. *Frailty: an emerging concept for general practice*. Br J Gen Pract 2009;59: 177-187.
- Rodríguez-Mañas L, Féart C, Mann G, Viña J, Chatterji S, Chodzko-Zajko WJ et al. *Searching for an operational definition of frailty: a delphi method based consensus statement*. The frailty operative definition-consensus conference project. J Gerontol A Biol Sci Med Sci 2013;68: 62-7.
- Fedarko NS. *The Biology of Aging and Frailty*. Clin Geriatr Med 2011;27:27-37.
- Clegg A; Young J; Iliffe S; Rikkert MO; Rockwood K. *Frailty in elderly people*. Lancet. 2013; 381:752-762.
- Xue QL *Frailty Syndrome; Definition and Natural History*. Clin Geriatr Med 2011;27:1-15.
- Buckinx F, Rolland Y, Reginster JY, Ricour C, Petermans J, Bruyère O. *Burden of frailty in the elderly population: perspectives for a public health challenge*. Arch Public Health 2015;73:19.
- Gale CR, Cooper C, Sayer AA. *Prevalence of frailty and disability: findings from the English Longitudinal Study of Ageing*. Age Ageing 2015;44:162-165.
- Carneiro JA, Ramos GCF, Barbosa ATF, Mendonça JMG, Costa FM, Caldeira AP. *Prevalence and factors associated with frailty in non-institutionalized older adults*. Rev Bras Enferm 2016;69:435-42.
- Collard RM, Boter H, Schoevers RA, Oude Voshaar RC. *Prevalence of frailty in community-dwelling older persons: a systematic review*. J Am Geriatr Soc 2012;60:1487-1492.
- Tinetti ME, Williams TF, Mayewski R. *Fall Risk Index for elderly patients based on number of chronic disabilities*. Am J Med 1986;80:429-434.
- Physical status: the use and interpretation of anthropometry. WHO Expert Committee Report. World Health Organ Tech Rep Ser 1995;854:1-452.
- Rolland Y, Abellan van Kan G, Gillette-Guyonnet S, Vellas B. *Cachexia versus sarcopenia*. Curr Opin Clin Nutr Metab Care 2011;14:15-21.
- Peterson SJ, Mozer M. *Differentiating sarcopenia and cachexia among patients with cancer*. Nutr Clin Pract 2017;32: 30-9.
- Saliba D, Elliott M, Rubenstein LZ, Solomon DH, Young RT, Kamberg CJ, et al. *The Vulnerable Elders Survey: a tool for identifying vulnerable older people in the community*. J Am Geriatr Soc 2001;49:1691-9.
- Zhang XS, Liu YH, Zhang Y, Xu Q, Yu Q, Yu Xet al. *Handgrip strength as a predictor of nutritional status in Chinese elderly inpatients at hospital admission*. Biomed Environ Sci 2017;30:802-10.
- Argilés JM, Busquets S, Stemmler B, López-Soriano FJ. *Cachexia and sarcopenia: mechanisms and potential targets for intervention*. Curr Opin Pharmacol 2015;22:100-6.
- Zdzieblik D, Oesser S, Baumstark MW, Gollhofer A, König D. *Collagen peptide supplementation in combination with resistance training improves body composition and increases muscle strength in elderly sarcopenic men: a randomised controlled trial*. Br J Nutr 2015;114: 1237-45.
- Chen LK, Liu LK, Woo J, Assantchia P, Auyeung TW, Bahyah KS, et al. *Sarcopenia in Asia: consensus report of the Asian Working Group for Sarcopenia*. J Am Med Dir Assoc 2014;15:95-101.
- Lee D, Shook RP, Drenowatz C, Blair SN. *Physical activity and sarcopenic obesity: definition, assessment, prevalence, and mechanism*. Future Sci OA 2016;2:FSO127.
- Polyzos SA, Margioris AN. *Sarcopenic obesity*. Hormones (Athens, Greece) 2018;17:321-331.
- JafariNasabian P, Inglis JE, Wendimere R, Kelly OJ, Ilich JZ. *Aging human body: changes in bone, muscle, and body fat with consequent changes in nutrient intake*. J Endocrinol 2017;234:R37-R51.
- Kalinkovich A, Livshits G. *Sarcopenic obesity or obese sarcopenia: a cross talk between age-associated adipose tissue and skeletal muscle inflammation as a main mechanism of the pathogenesis*. Ageing Res Rev 2017;35:200-221.
- Wannamethee SG, Atkins JL. *Muscle loss and obesity: the health implications of sarcopenia and sarcopenic obesity*. Proc Nutr Soc 2015;74:405-12.
- Kwon HJ, Ha YC, Park HM. *The Reference Value of Skeletal Muscle Mass Index for Defining the Sarcopenia of Women in Korea*. J Bone Metab 2015;22:71-5.

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