

STARENJE KAO INDIKATOR PROMENE KVALITETA GLASA I GOVORA

Ivana Ilić Savić¹, Mirjana Petrović-Lazić²

¹ Fakultet za specijalnu edukaciju i rehabilitaciju, Univerzitet u Beogradu, Beograd, Republika Srbija

² Fakultet za specijalnu edukaciju i rehabilitaciju, Univerzitet u Beogradu, Beograd, Republika Srbija

* Korespondencija: Ivana Ilić Savić, Fakultet za specijalnu edukaciju i rehabilitaciju, Univerzitet u Beogradu, Visokog Stevana 2, 11000 Beograd, Republika Srbija; e-mail: ivana.ilic558@gmail.com

SAŽETAK

Tokom procesa starenja dolazi do određenih promena u glasu i govoru. Glas osobe se tokom starenja menja, postaje nestabilniji, manje fleksibilan i javlja se promuklost. Ova studija ima za cilj da analizira efekte starenja na frekvenciju glasa, intenzitet glasa i ritam i tempo govora. Literatura je proučavana korišćenjem elektronskih baza podataka, posebno Google Scholar Advanced Search i Konzorcijuma biblioteka Srbije za objedinjenu nabavku - KoBSON. Rezultati pokazuju da postoji pogoršanje akustičkih parametara glasa (frekvence i intenziteta glasa) sa godinama. Takođe je primećeno da je proces starenja u glasu izraženiji kod žena nego kod muškaraca. To se može objasniti hormonskim promenama koje su posebno izražene kod žena u periodu menopauze. Posle šezdesete godine intenzitet glasa postaje niži nezavisno od pola osobe. U zavisnosti od starosti osobe, menja se i ritam i tempo kojim govori. Utvrđeno je da starijim ispitanicima treba više vremena da izgovore određene glasove, što je povezano sa odlaganjem početka fonacije pri izgovoru alveolarnih i bilabijalnih glasova, a što se najčešće pripisuje degradaciji vilice. Studije pokazuju da starenje glasa i govora protiče postepeno i očekivano, sa jasno izraženim posledicama po svakodnevni život, što treba imati u vidu u kliničkoj praksi radi unapređenja kvaliteta života starijih osoba.

Ključne reči: starenje, frekvencija glasa, intenzitet glasa, ritam i tempo govora

Uvod

Starenje je prirodan i univerzalan biološki proces u životnom ciklusu svakog ljudskog bića. Kada govorimo o starenju, to je nepovratan fiziološki proces, koji utiče na smanjenje fizičkih i mentalnih sposobnosti osobe, a takođe utiče i na kvalitet samog glasa, u zavisnosti od starosne dobi te osobe (1). Veoma je važno razlikovati hronološko od biološkog starenja, zato što neki stariji ljudi mogu da budu funkcionalno sposobni (1,2,3).

Tokom procesa starenja dolazi do određenih promena u glasu i govoru. Glas osobe se menja tokom starenja, postaje nestabilniji, manje fleksibilan i javlja se promuklost. Kada dođe do promena glasa zbog starenja, taj proces se naziva prezbi-fonija. Primećeno je takođe da je proces starenja glasa izraženiji kod muškaraca nego kod žena (4).

Promene tokom proizvodnje glasa dešavaju se tokom celog života, i povezuju se sa brojnim činje-

nicama koje postoje u ljudskom životu, kao što su kognitivno, socijalno, biološko i emocionalno sazrevanje čoveka (1).

Od samog početka ljudskog života, fiziološke potrebe se izražavaju kroz fonaciju različitih glasova. Na primer, beba izražava i pokazuje glad, zadovoljstvo, sreću i tugu plakanjem ili kasnije gukanjem. U kasnijim fazama, postepeno se razvija govor, i na te načine dete počinje da izražava svoje misli, osećanja, zadovoljstvo i nezadovoljstvo. Nakon toga, od osamnaeste godine, glas postaje zreliji i pojedinac je u stanju da kontroliše svoj glas, kao i da menja frekvencije. Međutim, odrasle osobe često podižu tonalitet govora, i u tim situacijama dolazi do oštećenja glasa (5).

Veličina farinksa i usta varira čak i kod vrlo mlade dece. Međutim, kada je u pitanju larinks, on se ne razlikuje kod dečaka i devojčica sve do

AGING AS AN INDICATOR OF CHANGES IN VOICE AND SPEECH QUALITY

Ivana Ilić Savić¹, Mirjana Petrović-Lazić²

¹ Faculty of Special Education and Rehabilitation, University of Belgrade, Belgrade, Republic of Serbia

² Faculty of Special Education and Rehabilitation, University of Belgrade, Belgrade, Republic of Serbia

* Correspondence: Ivana Ilić Savić, Faculty of Special Education and Rehabilitation, University of Belgrade, Visokog Stevana 2, 11000 Belgrade, Republic of Serbia; e-mail: ivana.ilic558@gmail.com

SUMMARY

During the aging process, certain changes occur in the voice and speech. A person's voice changes during aging, becoming more unstable, less flexible, and hoarseness occurs. This study aims to analyze the effects of aging on voice frequency, voice intensity, and the rhythm and tempo of speech. The literature was studied using electronic databases, in particular Google Scholar Advanced Search and the Serbian Library Consortium for Coordinated Acquisition - KoBSON. The results show that there is a deterioration in the acoustic parameters of the voice (voice frequency and intensity) with age. It has also been observed that the aging process in the voice is more pronounced in women than in men. This can be explained by hormonal changes that are especially pronounced in women during menopause. After the age of sixty, the intensity of the voice becomes lower regardless of the person's gender. Depending on the person's age, the rhythm and tempo of speech also change. It was found that older subjects take longer to pronounce certain sounds, which is associated with a delay in the onset of phonation when pronouncing alveolar and bilabial sounds, which is most often attributed to jaw degradation. Studies show that voice and speech aging occurs gradually and as expected, with clearly expressed consequences for everyday life, which should be taken into account in clinical practice in order to improve the quality of life of older people.

Key words: aging, voice frequency, voice intensity, rhythm and pace of speech

Introduction

Aging is a natural and universal biological process in the life cycle of every human being. When we talk about aging, it is an irreversible physiological process, which affects the reduction of a person's physical and mental abilities, and also leads to an impact on the quality of the voice itself, depending on the person's age (1). It is very important to distinguish chronological aging from biological aging, because some people who are older may be more functionally capable (1,2,3).

During the aging process, there are certain changes in the voice and speech. A person's voice changes during aging, becoming more unstable, less flexible and hoarseness occurs. When voice changes occur due to aging, the process is called presbyphonia. It has also been observed that the aging process in the voice is more pronounced in women than in men (4).

Changes during voice production occur throughout life, and are related to numerous facts that exist in human life, such as the cognitive, social, biological and emotional maturation of a human being (1).

From the very beginning of human life, physiological needs have been expressed through the phonation of various voices. For example, a baby expresses and shows its hunger, contentment, happiness and sadness by crying and later cooing. In the later stages, speech gradually develops, and in these ways the child begins to express his thoughts, feelings, satisfaction and dissatisfaction. After that, from the age of eighteen, the voice becomes more mature, and the individual is able to control his voice, as well as change frequencies. However, adults often raise the tonality of their speech, and in those situations lead to voice damage (5).

puberteta. Mutacija glasa kod dečaka obično traje od 11. do 14. godine, a zatim dolazi do rasta larinksa. Kada su u pitanju devojčice, primećene su određene promene tokom puberteta, međutim, farinks i larinks rastu proporcijalno sa ostalim delovima tela. Značajnija razlika između dečaka i devojčica i promene koje nastaju ogledaju se u promenama na membrani glasnih žica, koje se dešavaju različitom brzinom kod dečaka i devojčica što dovodi do brojnih razlika koje se ogledaju u karakteristikama glasa (6).

Larinks, odnosno njegova struktura i funkcija opadaju kako osoba sazreva i stari. U starosti dolazi do narušavanja strukturnog, ćelijskog i neuromuskularnog integriteta. Promene koje nastaju u larinksu, a nastaju zbog starenja dovode do uništavanja površine zgloba, hrskavice, potpornih struktura, ligamenata i glasnih žica. Kada su u pitanju osobe starosti do 80 godina, iako u nekim slučajevima to može biti ranije, javlja se takozvani „senilni glas“, kada dolazi do promene rezonancije i visine tona glasa. Do ovoga dolazi zbog gubitka fleksibilnosti hrskavice. Zglobne hrskavice postaju nepravilne, što dovodi do promena u vokalnim ligamentima, koje uzrokuju pojavu F_0 varijabilnosti (vibracije glasnih žica, koje dovode do promuklosti tokom govora) (7).

Promene starosne dobi takođe dovode do promena visine glasa, tako da sa većom starosnom dobi kod muškaraca raste i visina glasa, dok kod žena postaje niža. Praćenjem i slušanjem moguće je zaključiti kog je uzrasta određena osoba (8,9,10,11).

Takođe, atrofija određenih vokalnih mišića dovodi do toga da glasne žice postanu tanje, a kod muškaraca to dovodi do povećanja treperenja, titranja i F_0 vrednosti. Kod ljudi starijih od 60 godina ima manje vlakana u larinksu (12).

Cilj ovog rada je da se pregledom relevantne literature analiziraju promene frekvencije glasa, intenziteta glasa, ritma i tempa govora koje su izazvane starenjem.

Metod

Literatura je proučavana uz pomoć elektronskih baza podataka, posebno *Google Scholar Advanced Search* i Konzorcijuma biblioteka Srbije za objedinjenu nabavku – KoBSON u periodu od 1990. do 2025. godine. Prikupljeni podaci analizirani su kombinovanjem sistematskog i narativnog pristu-

pa. U početnoj fazi istraživanja, pregledan je veliki broj radova na osnovu odabranih ključnih reči (starenje, glas, govor, kvalitet glasa, promene u govoru, prezvifonija, komunikacija, stariji/gerijatrija). Međutim, za potrebe ove analize, detaljno su razmatrana 24 pregledna i istraživačka rada, kao i 2 monografije. Analiza je uključila studije napisane na srpskom i engleskom jeziku.

Promene frekvencije glasa izazvane starenjem

Osnovna frekvencija je frekvencija osnovnog tona larinksa. Njena oznaka je F_0 , a vrednost je označena sa Hz. Osnovna frekvencija se menja tokom života. Tokom puberteta, frekvencija se menja zbog rasta glasnih žica. Kada odrastu, frekvencija glasa devojčica može pasti na 220 Hz, dok je kod dečaka do 18 godina frekvencija oko 130 Hz. Promene postoje u vidu zadebljanja glasnih žica, glasne žice menjaju oblik, a takođe raste i deo tiroaritenoidnog mišića, što dovodi do promene frekvencije (13).

Pored toga, činjenica da se larinks spušta veoma je važna za govor i frekvenciju. Kada se dete rodi, larinks se nalazi visoko u vratu. Resice dodiruju meko nepce, a larinks se nalazi u nivou trećeg vratnog pršljena. Činjenica da se larinks nalazi visoko omogućava da dete diše tokom dojenja, i takođe doprinosi da se dete ne guši tokom dojenja. Nakon određenog vremena, grkljan se spušta, a do pete godine grkljan se nalazi u nivou šestog vratnog pršljena. Čak i nakon toga se larinks spušta, tako da se između petnaeste i dvadesete godine nalazi u nivou sedmog vratnog pršljena (14).

Kada su u pitanju glasne žice, bez obzira na pol, glasne žice su duge 3 mm, međutim, njihov rast se razlikuje kod žena i muškaraca, i glasne žice muškaraca rastu za 0,7 mm, a žena za 0,4 mm. Do dvanaeste godine, nema razlika između muškaraca i žena. Međutim, nakon ulaska u pubertet dolazi do promena i rast glasnih žica kod muškaraca se ubrzava, tako da brzo rastu do 10 mm, a pored toga se i zadebljavaju, što rezultira smanjenjem frekvencije glasa kod muškaraca. Kada su u pitanju žene, glasne žice rastu sporijim tempom nego kod muškaraca i iznose do 4 mm. Glasne žice žena se histološki ne zadebljavaju, ali dolazi do smanjenja frekvencije glasa kod žena za samo tri tona. Nakon puberteta, glasne žice kod žena su 12,5 do 17 mm duge, a kod muškaraca do 20 mm (6).

The size of the pharynx and mouth varies even in very young children. However, when it comes to the larynx, it does not differ in girls and boys until puberty. The mutation of a boy's voice usually lasts from 11 to 14 years of age, and then the growth of the larynx occurs. When it comes to girls during puberty, certain changes have been noticed, however, the pharynx and larynx grow in proportion to other parts of the body. A more significant difference between boys and girls and the changes that occur are reflected in the changes in the vocal cord membrane, which is of different speed in girls and boys and which lead to numerous differences that are reflected in the characteristics of the voice (6).

The larynx, (i.e. its structure and function), deteriorates as an individual matures and ages. Destruction of structural, cellular, as well as neuromuscular integrity occurs in old age. The changes that occur in the larynx, which occur due to aging, lead to the destruction of the joint surface, cartilage, supporting structures, ligaments, and the vocal cords. When it comes to individuals up to the age of 80, although in some cases it can be earlier, the so-called "senile voice" appears, in which there are changes in the resonance and pitch of the voice. This occurs due to the fact that there is a loss of cartilage flexibility. The articular cartilages become irregular, which lead to changes in the vocal ligaments, which lead to the occurrence of F_0 variability (vibrations of the vocal cords, which lead to hoarseness during speech) (7).

Changes in age also lead to changes in the pitch of the voice, so with age in men the pitch of the voice rises, while in women it becomes lower. By following and listening, it is possible to conclude in which age a certain individual is (8, 9, 10, 11).

Also, atrophy of the vocal muscles causes the vocal cords to thin, and in men this leads to an increase in jitter, shimmer, and F_0 value. There are fewer fibers in the larynx in people over 60 years old (12).

The aim of this paper is to analyze changes in voice frequency, voice intensity, rhythm and pace of speech caused by aging by reviewing the relevant literature.

Method

The literature was studied using electronic databases, specifically Google Scholar Advanced

Search and the Serbian Library Consortium for Coordinated Acquisition –KoBSON, in the period from 1990 to 2025. The collected findings were processed by combining a systematic and narrative approach. In the initial phase of the research, a large number of papers were reviewed based on selected keywords (aging, voice, speech, voice quality, changes in speech, presbyphonia, communication, elderly/geriatrics). However, for the purposes of this analysis, 24 review and research papers, as well as 2 monographs, were considered in detail. The analysis included studies written in Serbian and English.

Changes in voice frequency caused by aging

The fundamental frequency is the frequency of the basic tone of the larynx. Its marking sign is F_0 , and the value is marked with Hz. The fundamental frequency changes during life. During puberty, due to the growth of the vocal cords, the frequency changes. When they grow up, the frequency of a girl's voice can drop to 220 Hz, while when it comes to boys up to the age of eighteen, the frequency is around 130 Hz. Changes exist in the form of thickening of the vocal cords, the vocal cords change their shape, and also part of the thyroarytenoid muscle grows, and this leads to changes in frequency (13).

In addition, the fact that the larynx moves down is very important for speech and frequency. When a child is born, the larynx is located high in the neck. The soft palate is touched by villi, and the larynx is located at the third cervical vertebra. The fact that the larynx is located high allows the child to breathe during breastfeeding, and also contributes to the fact that the child does not suffocate during breastfeeding. After a certain time, the larynx descends, and by the age of five the larynx is located at the sixth cervical vertebra. Even after that, the larynx descends, so between the ages of fifteen and twenty, the larynx is located at the seventh cervical vertebra (14).

When it comes to the vocal cords, regardless of gender, the vocal cords are 3 mm long, however, their growth differs between men and women, and men's vocal cords grow by 0.7 mm and women's by 0.4 mm. Until the age of twelve, there are no differences between men and women. However, upon entering puberty, changes occur, and the growth of the vocal cords in men accelerates,

Tokom života, frekvencija glasa se menja kod oba pola. Muškarac dostiže svoju najvišu vrednost frekvencije do 85. godine. Frekvencija kod žena ostaje skoro identična od 20. do 50. godine starosti. Čak i nakon 50. godine nema promene frekvencije kod žena. Karakteristično je za žene da ulazak u menopauzu zbog hormonskih poremećaja izaziva promene frekvencije (15).

Frekvencija muškog glasa je mnogo niža nego frekvencija ženskog glasa, a to rezultira time da je muški glas mnogo dublji od ženskog glasa (16).

Promene intenziteta glasa usled starenja

Intenzitet glasa se označava kao jačina glasa, odnosno, glasnoća. Sam intenzitet zavisi od subglotičke visine vazduha i amplitude vibracija glasnih žica. Što je veća amplituda vibracija glasa, to je veći intenzitet glasa. Intenzitet glasa se označava u decibelima (dB). Promene intenziteta glasa se javljaju tokom starenja. Na promene intenziteta takođe utiče pol osobe. Intenzitet kod muškaraca se povećava do šezdesete godine, kada može da dostigne svoj maksimum, dok kod žena to nije slučaj. Međutim, isto je kod muškaraca i žena da se intenzitet glasa smanjuje nakon 60. godine (17).

Promene ritma i tempa govora koje nastaju tokom starenja

U zavisnosti od starosti osobe, menja se i brzina kojom govori. Upoređivanjem govora mlađih i starijih ljudi, može se videti jasna razlika brzine kojom izgovaraju reči. Brzina govora neke osobe može se proceniti čitanjem reči, rečenica i dužih pasusa. Takođe, kao jedna od metoda za merenje tempa govora može se koristiti vremenski raspon potreban za početak fonacije nakon pauze u govoru. Vremenski raspon za početak fonacije nakon pauze u govoru varira u zavisnosti od starosti osobe (18,19,20).

U jednom istraživanju u kojem su učestvovali ispitanici starosti od 70 do 80 godina i mlađi ispitanici starosti od 20 do 30 godina, zaključeno je da ne postoje značajne razlike kada se izgovaraju zvučni i bezzvukni glasovi među ispitivanim starosnim grupama (21). Kada je sprovedena studija, u kojoj su učestvovala samo žene, utvrđene su određene razlike. Naime, kod starijih žena je primećeno kraće vreme za početak fonacije samoglasnika i suglasnika. Imajući u vidu da je istraživanje uključilo izgovaranje različitih glasova

od strane muškaraca i žena, zaključeno je da se brzina govora u odnosu na starosnu dob razlikuje u zavisnosti od glasova koji se izgovaraju (21).

Isto istraživanje je ponovljeno kod ispitanika starosti od 70 do 90 godina i mlađih ispitanika starosti od 21 do 32 godine (22). Tokom istraživanja, utvrđeno je da se odlaže početak fonacije kada se izgovaraju alveolarni i bilabijalni glasovi kod starijih ispitanika u poređenju sa mlađim ispitanicima. Takođe je utvrđeno da starijim ispitanicima treba više vremena da izgovore određene glasove. U daljem istraživanju, uključeni su ispitanici starosti od 5 do 17 godina. Zaključeno je da se brzina izgovora samoglasnika i suglasnika smanjuje u zavisnosti od uzrasta ispitanika (22).

Veoma je važno utvrditi tempo govora. Da bi se utvrdilo da li ima određenih promena tempa govora u zavisnosti od starosne dobi osobe, ispitanici su bili 16 starijih muškaraca koji su imali 82 godine i 14 mlađih muškaraca koji su imali približno 24 godine (23). Dobijeni rezultati su ukazali da je tempo govora kod starijih ispitanika bio sporiji u poređenju sa mlađim ispitanicima, dok je frekvencija govora kod starijih ispitanika bila viša u poređenju sa mlađim ispitanicima (23).

Kao rezultat fizičkih promena koje se javljaju sa starenjem respiratornog sistema, smanjuje se kapacitet pluća. Zbog histoloških promena na glasnim žicama, starijim ljudima takođe treba više vazduha tokom fonacije nego mlađim ljudima. Tokom procesa fonacije, glotis se ne zatvara adekvatno, i zbog toga dolazi do povećanog protoka vazduha kroz larinks, što dovodi do znatno veće potrošnje vazduha (24,25,26).

U tabeli su prikazane tipične akustičke promene u glasu kod muškaraca i žena u odnosu na deceniju života. Kako godine rastu, primećuje se opadanje frekvencije i intenziteta glasa, kao i ograničenje vokalnog raspona. Kod muškaraca se glas obično snižava i postaje promukao sa godinama, dok kod žena dolazi do blagog smanjenja frekvencije i snižavanja tonaliteta.

Promene se povezuju sa fiziološkim starenjem glasnih žica, smanjenjem elastičnosti i tonusa laringealnih mišića, kao i degenerativnim promenama drugih anatomskih i fizioloških struktura uključenih u fonaciju. Ove karakteristike glasa su ključni indikatori prezbifonije i mogu imati značajan uticaj na komunikaciju i kvalitet života starijih osoba.

which grow rapidly, up to 10 mm, and in addition, they also thicken, which results in a decrease in the frequency of the voice in men. When it comes to women, the vocal cords grow at a slower pace than men's vocal cords and they amount to 4 mm. The vocal cords of women do not thicken histologically, but there is a decrease in the frequency of the voice in women by only three tones. After puberty, female vocal cords are up to 12.5 to 17 mm long, and male vocal cords are up to 20 mm long (6).

During life, the voice frequency changes in both sexes. A man reaches his highest frequency value by the age of 85. The frequency remains almost identical in women from 20 to 50 years of age. Even after the age of 50, there is no change in frequency in women. It is characteristic for women that entering menopause due to hormonal disorders causes frequency changes (15).

The male voice frequency is much lower than the female voice frequency, and this results in the male voice being much deeper than the female voice (16).

Changes in voice intensity due to aging

The intensity of the voice is denoted as the volume of the voice, that is, loudness. The intensity itself depends on the subglottic height of the air and the amplitude of the vibrations of the vocal cords. The greater the amplitude of the voice vibration, the greater the intensity of the voice. Voice intensity is indicated in dB (decibels). Changes in voice intensity occur during aging. Changes in intensity are also influenced by a person's gender. The intensity in men increases until the age of 60, when it can reach its maximum, while in women this is not the case. However, it is the same for men and women that after the age of 60 the volume of the voice decreases (17).

Changes in the rhythm and tempo of speech occurring with aging

Depending on a person's age, the speed at which they speak also changes. Comparing the speech of younger and older people, a clear difference can be seen based on the speed with which they pronounce words. A person's speaking speed can be assessed by reading words, sentences and longer paragraphs. Also, as one of the methods for measuring the tempo of speech, the range in time required for the beginning of phonation after

a pause in speech can be used. The time span for the onset of phonation after a pause in speech varies with the age of the individual (18, 19, 20).

In one research in which people from 70 to 80 years of age and younger respondents from 20 to 30 years of age participated, it was concluded that there are no significant differences when pronouncing voiced and voiceless sounds among the examined age group (21). When a study was conducted in which only women participated, certain differences were found. Namely, in older women, a shorter time was observed for the beginning of phonation of vowels and consonants. Bearing in mind that the research involved the pronunciation of different voices by men and women, it was concluded that the speed of speech related to age differs depending on the voices that are spoken (21).

The same research was repeated with respondents from 70 to 90 years of age and younger respondents from 21 to 32 years of age (22). During the research, it was determined that the onset of phonation when pronouncing alveolar and bilabial sounds in older subjects was delayed compared to younger subjects. It was also found that older subjects took longer to pronounce certain sounds. Through further investigation, respondents aged 5 to 17 were also included in the research. It was concluded that the speed of pronouncing vowels and consonants decreased depending on the age of the subjects (22).

It is very important to determine the pace of speech. In order to determine whether the pace of speech has certain changes depending on the age of the person, 16 older men who were 82 years old and 14 younger men who were approximately 24 years old were examined (23). The obtained results indicated that the pace of speech in older respondents was slower compared to younger respondents, while the frequency of speech in older respondents was higher compared to younger respondents (23).

As a result of physical changes that occur with aging in the respiratory system, lung capacity decreases. Due to histological changes in the vocal cords, older people also need more air during phonation than younger people. During the phonation process, the glottis does not close adequately, as a result of which there is an increased flow of air through the larynx, which leads to significantly more air consumption (24, 25, 26).

Tabela 1. Akustičke promene koje se javljaju sa starenjem u odnosu na pol

Starosna grupa	Pol	Frekvencija glasa (Hz)	Intenzitet (dB)	Raspon glasa	Ton/Kvalitet	Zapažanja
20–29	M	110–130	70–75	Normalan	Jasan, fleksibilan	Referentna grupa mladih
	Ž	200–220	70–75	Normalan	Jasan, fleksibilan	—
30–39	M	108–128	68–73	Blago smanjen	Neznatno dublji	Rane promene elastičnosti glasnih žica
	Ž	195–215	68–73	Blago smanjen	Neznatno dublji	—
40–49	M	105–125	65–70	Smanjen	Dublji, blago promukao	Početak prezbifonije
	Ž	190–210	65–70	Smanjen	Niži, blago promukao	—
50–59	M	100–120	63–68	Značajno smanjen	Promukao, manje fleksibilan	Degeneracija mišića glasnih žica
	Ž	185–205	63–68	Značajno smanjen	Promukao, niža visina tona	—
60–69	M	95–115	60–65	Ograničen	Veoma promukao, slab intenzitet	Otežana fonacija i artikulacija
	Ž	180–200	60–65	Ograničen	Promukao, slabiji ton	—
70+	M	90–110	55–60	Veoma ograničen	Grub, slab	Tipični znaci prezbifonije
	Ž	175–195	55–60	Veoma ograničen	Grub, slab	—

Predstavljanje ovih karakteristika u odnosu na deceniju života i pol omogućava bolje razumevanje normalnog procesa starenja glasa i može pomoći u planiranju logopedске terapije i gerijatrijskih intervencija.

Zaključak

Ova studija ispituje kako se glas menja sa starenjem ljudi, odnosno analizira promene frekvencije glasa, jačine (intenziteta), kao i promene ritma i tempa govora. Sve ove promene mogu značajno da utiču na svakodnevni život osobe, i stoga je važno uzeti ih u obzir ne samo u naučnim istraživanjima, već i u praktičnom, kliničkom radu. Zbog toga je neophodno uraditi detaljne testove glasa i sveobuhvatan lekarski pregled da bi se tačno utvrdilo da li postoje problemi sa glasom i šta ih uzrokuje.

S obzirom da se broj starijih osoba u svetu brzo povećava, ova vrsta istraživanja postaje sve više važna za istraživače, edukatore i praktičare. Njihov cilj je da bolje razumeju kako starenje utiče na sve aspekte govora i jezika kod ljudi. Glas igra ključnu ulogu u komunikaciji, a sa godinama dolazi do promena u glasu, što takođe menja način na koji ljudi komuniciraju. Ako se ovom problemu pristupi na vreme, to bi moglo da otvori prostor za dodatna istraživanja u oblasti logopedске terapije, kako bi se pronašao najefikasniji logopedski tretman za ovu starosnu grupu.

Preporuke za kliničku praksu:

- Uvođenje redovnog fonijatrijskog skrininga za osobe starije od 65 godina kako bi se rano otkrile promene glasa i potencijalna patološka stanja.

Table 1. Acoustic changes that occur with aging in relation to gender

Age Group	Gender	Voice Frequency (Hz)	Intensity (dB)	Vocal Range	Tone/Quality	Notes
20–29	M	110–130	70–75	Normal	Clear, flexible	Reference young adult group
	F	200–220	70–75	Normal	Clear, flexible	—
30–39	M	108–128	68–73	Slightly reduced	Slightly deeper	Early changes in vocal fold elasticity
	F	195–215	68–73	Slightly reduced	Slightly deeper	—
40–49	M	105–125	65–70	Reduced	Deeper, slightly hoarse	Beginning of presbyphonia
	F	190–210	65–70	Reduced	Darker, slightly hoarse	—
50–59	M	100–120	63–68	Significantly reduced	Hoarse, less flexible	Vocal fold muscle degeneration
	F	185–205	63–68	Significantly reduced	Hoarse, lower pitch	—
60–69	M	95–115	60–65	Limited	Very hoarse, weak intensity	Difficult phonation and articulation
	F	180–200	60–65	Limited	Hoarse, weaker tone	—
70+	M	90–110	55–60	Greatly limited	Rough, weak	Typical signs of presbyphonia
	F	175–195	55–60	Greatly limited	Rough, weak	—

The table shows typical acoustic changes in the voice in men and women by decade. As age progresses, a gradual decrease in the frequency and intensity of the voice, as well as a limitation of the vocal range, is observed. In men, the voice usually drops and becomes hoarse with age, while in women there is a slight decrease in frequency and darkening of the tonality.

The changes are associated with physiological aging of the vocal cords, a decrease in the elasticity and tone of the laryngeal muscles, as well as degenerative changes in other anatomical and physiological structures involved in phonation. These acoustic characteristics are key indicators of presbyphonia and can have a significant impact on the communication and quality of life of older people.

The presentation of these changes by decade and gender allows a better understanding of the normal process of voice aging and can help in planning speech therapy and geriatric interventions.

Conclusion

This study examines how the voice changes as people age - more specifically, it looks at changes in voice frequency, volume (intensity), as well as speech rhythm and tempo. All these changes can significantly affect a person's daily life, and therefore it is important to take them into account not only in scientific research but also in practical, clinical work. That is why it is necessary to do detailed voice tests and a comprehensive medical

- Primena standardizovanih testova glasa i akustičke analize kako bi se pratili parametri glasa (frekvencija, intenzitet, raspon, tonalitet).

- Saradnja logopeda, fonijatara i gerijatrijskih timova u planiranju individualnog tretmana, uključujući vežbe disanja, artikulacije i higijenu glasa.

- Praćenje i edukacija pacijenata i njihovih porodica o prirodnim promenama glasa i tehnikama koje mogu očuvati kvalitet govora.

- Korišćenje preventivnih programa i glasovnih vežbi kako bi se odložile ili ublažile posledice prezbifonije.

Ove preporuke omogućavaju blagovremenu intervenciju, poboljšavaju komunikaciju i kvalitet života kod starijih ljudi, i pružaju osnovu za dalja istraživanja u oblasti logopedije i gerijatrije.

Zahvalnica

Rad je nastao kao rezultat istraživanja u okviru projekta "Evaluacija tretmana stečenih poremećaja govora i jezika" (ON 200096), koji je finansiralo Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

Reference

- Dehqan A, Scherer RC, Dashti G, Ansari-Moghaddam A, Fanaie S. The effects of aging on acoustic parameters of voice. *Folia PhoniatrLogop.* 2012;64(6):265-270. doi:10.1159/000343998
- Ilić-Savić I, Petrović-Lazić M. Comparison of voice acoustic parameters in persons with organic voice. *Acta Fac Med Naiss.* 2024;41(3):376-383. doi:10.5937/afmnai41-48292
- Petrović Lazić M, Babac S, Ilić Savić I. Oropharyngeal dysphagia in elderly persons - etiology, pathophysiology and symptomatology. *Sanamed.* 2022;17(3):215-219. doi: 10.5937/sanamed0-40913
- Ryu CH, Han S, Lee MS, Kim SY, Nam SY, Roh JL, et al. Voice Changes in Elderly Adults: Prevalence and the Effect of Social, Behavioral, and Health Status on Voice Quality. *J Am Geriatr Soc.* 2015;63(8):1608-1614. doi:10.1111/jgs.13559
- Lortie CL, Thibeault M, Guitton MJ, Tremblay P. Effects of age on the amplitude, frequency and perceived quality of voice. *Age (Dordr).* 2015;37(6):117. doi:10.1007/s11357-015-9854-1
- Rojas S, Kefalianos E, Vogel A. How Does Our Voice Change as We Age? A Systematic Review and Meta-Analysis of Acoustic and Perceptual Voice Data from Healthy Adults Over 50 Years of Age. *J Speech Lang Hear Res.* 2020;63(2):533-551. doi:10.1044/2019_JSLHR-19-00099
- Oliveira Santos A, Godoy J, Silverio K, Brasolotto A. Vocal Changes of Men and Women from Different Age Decades: An Analysis from 30 Years of Age. *J Voice.* 2023;37(6):840-850. doi:10.1016/j.jvoice.2021.06.003
- Stathopoulos ET, Huber JE, Sussman JE. Changes in acoustic characteristics of the voice across the life span: measures from individuals 4-93 years of age. *J Speech Lang Hear Res.* 2011;54(4):1011-1021. doi:10.1044/1092-4388(2010/10-0036)
- Petrović Lazić M, Babac S, Ilić Savić I. The impact of the COVID-19 pandemic on the quality of life of laryngectomized patients. *Acta Fac Med Naiss.* 2022;39(4):422-432. doi:10.5937/afmnai39-36517
- Petrović Lazić M, Ilić Savić I. Sociological Significance of the General Population's Awareness of Voice Disorders. *God SociolFilozFakNiš.* 2024;20(32):69-77. doi:10.46630/gsoc.32.2024.04
- Petrović Lazić M, Ilić Savić I. Changes in the level of sex hormones with aging and their influence on the voice. *ZdravZašt.* 2023;52(3):56-65. doi:10.5937/zdravzast52-44412
- Vipperla R, Renals S, Frankel J. Ageing voices: The effect of changes in voice parameters on ASR performance. *EURASIP J Audio Speech Music Process.* 2010;1-10.
- Benjamin BJ. Frequency variability in the aged voice. *J Gerontol.* 1981;36(6):722-726. doi:10.1093/geronj/36.6.722
- Nishio M, Niimi S. Changes in speaking fundamental frequency characteristics with aging. *Folia PhoniatrLogop.* 2008;60(3):120-127. doi:10.1159/000118510
- Füllgrabe C, Moore BC, Stone MA. Age-group differences in speech identification despite matched audiometrically normal hearing: contributions from auditory temporal processing and cognition. *Front Aging Neurosci.* 2015;6:347. doi:10.3389/fnagi.2014.00347
- Alain C, Zendel BR, Hutka S, Bidelman GM. Turning down the noise: the benefit of musical training on the aging auditory brain. *Hear Res.* 2014;308:162-173. doi:10.1016/j.heares.2013.06.008
- Manini TM, Clark BC. Dynapenia and aging: an update. *J GerontolA Biol Sci Med Sci.* 2012;67(1):28-40. doi:10.1093/gerona/glr010
- Auer P, Couper-Kuhlen E, Müller F. *Language in time: The rhythm and tempo of spoken interaction.* Oxford University Press; 1999.
- Cumming R, Wilson A, Leong V, Colling LJ, Goswami U. Awareness of Rhythm Patterns in Speech and Music in Children with Specific Language Impairments. *Front Hum Neurosci.* 2015;(9):672. doi:10.3389/fnhum.2015.00672
- Nooteboom S. The prosody of speech: melody and rhythm. *Handbook phonetic scienc.* 1997;5:640-673.
- Pearson DV. Differential sensitivity to speech rhythms in young and older adults. *Front Psych.* 2023;(14):1160236. doi: 10.3389/fpsyg.2023.1160236.
- Goswami U. Language acquisition and speech rhythm patterns: an auditory neuroscience perspective. *Royal Soc Open Sci.* 2022; 9:211855. doi:10.1098/rsos.211855

examination, in order to determine exactly if there are voice problems and what causes them.

As the number of older people in the world increases rapidly, this type of research becomes increasingly important for researchers, educators and practitioners. Their goal is to better understand how aging affects all aspects of speech and language in humans. The voice plays a key role in communication, and with age there are changes in the voice, which also changes the way people communicate. If this problem is approached in time, it could open up space for additional research in the field of speech therapy, in order to find the most effective speech therapy treatment for this age group.

Recommendations for clinical practice:

- Introduction of regular phoniatric screening for people over 65 years of age for early detection of voice changes and potential pathological conditions.
- Application of standardized vocal tests and acoustic analysis to monitor voice parameters (frequency, intensity, range, tonality).
- Collaboration of speech therapists, phoniatricians and geriatric teams in individual treatment planning, including breathing exercises, articulation and voice hygiene.
- Monitoring and education of patients and their families about natural voice changes and techniques that can preserve speech quality.
- Use of preventive programs and voice exercises to delay or mitigate the consequences of presbyphonia.

These recommendations enable timely intervention, improve communication and quality of life in older people, and provide a foundation for further research in speech therapy and geriatrics.

Acknowledgement

The paper was created as a result of research within the project "Evaluation of Treatment of Acquired Speech and Language Disorders" (ON 200096), funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

Competing interests

The authors declared no competing interests.

References

1. Dehqan A, Scherer RC, Dashti G, Ansari-Moghaddam A, Fanaie S. The effects of aging on acoustic parameters of voice. *Folia PhoniatrLogop.* 2012;64(6):265-270. doi:10.1159/000343998
2. Ilić-Savić I, Petrović-Lazić M. Comparison of voice acoustic parameters in persons with organic voice. *Acta Fac Med Naiss.* 2024;41(3):376-383. doi:10.5937/afmnai41-48292
3. Petrović Lazić M, Babac S, Ilić Savić I. Oropharyngeal dysphagia in elderly persons - etiology, pathophysiology and symptomatology. *Sanamed.* 2022;17(3):215-219. doi: 10.5937/sanamed0-40913
4. Ryu CH, Han S, Lee MS, Kim SY, Nam SY, Roh JL, et al. Voice Changes in Elderly Adults: Prevalence and the Effect of Social, Behavioral, and Health Status on Voice Quality. *J Am Geriatr Soc.* 2015;63(8):1608-1614. doi:10.1111/jgs.13559
5. Lortie CL, Thibeault M, Guitton MJ, Tremblay P. Effects of age on the amplitude, frequency and perceived quality of voice. *Age (Dordr).* 2015;37(6):117. doi:10.1007/s11357-015-9854-1
6. Rojas S, Kefalianos E, Vogel A. How Does Our Voice Change as We Age? A Systematic Review and Meta-Analysis of Acoustic and Perceptual Voice Data from Healthy Adults Over 50 Years of Age. *J Speech Lang Hear Res.* 2020;63(2):533-551. doi:10.1044/2019_JSLHR-19-00099
7. Oliveira Santos A, Godoy J, Silverio K, Brasolotto A. Vocal Changes of Men and Women from Different Age Decades: An Analysis from 30 Years of Age. *J Voice.* 2023;37(6):840-850. doi:10.1016/j.jvoice.2021.06.003
8. Stathopoulos ET, Huber JE, Sussman JE. Changes in acoustic characteristics of the voice across the life span: measures from individuals 4-93 years of age. *J Speech Lang Hear Res.* 2011;54(4):1011-1021. doi:10.1044/1092-4388(2010/10-0036)
9. Petrović Lazić M, Babac S, Ilić Savić I. The impact of the COVID-19 pandemic on the quality of life of laryngectomized patients. *Acta Fac Med Naiss.* 2022;39(4):422-432. doi:10.5937/afmnai39-36517
10. Petrović Lazić M, Ilić Savić I. Sociological Significance of the General Population's Awareness of Voice Disorders. *God SociolFilozFakNiš.* 2024;20(32):69-77. doi:10.46630/gsoc.32.2024.04
11. Petrović Lazić M, Ilić Savić I. Changes in the level of sex hormones with aging and their influence on the voice. *ZdravZašt.* 2023;52(3):56-65. doi:10.5937/zdravzast52-44412
12. Vippera R, Renals S, Frankel J. Ageing voices: The effect of changes in voice parameters on ASR performance. *EURASIP J Audio Speech Music Process.* 2010;1-10.
13. Benjamin BJ. Frequency variability in the aged voice. *J Gerontol.* 1981;36(6):722-726. doi:10.1093/geronj/36.6.722
14. Nishio M, Niimi S. Changes in speaking fundamental frequency characteristics with aging. *Folia PhoniatrLogop.* 2008;60(3):120-127. doi:10.1159/000118510
15. Füllgrabe C, Moore BC, Stone MA. Age-group differences in speech identification despite matched audiometrically

23. Rocha S, Attaheri A, NiChoisdealbha Á, et al. Precursors to infant sensorimotor synchronization to speech and non-speech rhythms: A longitudinal study. *Dev Sci.* 2024;27(4):e13483. doi:10.1111/desc.13483
24. Fougeron C, Guitard-Ivent F, Véronique D. Multi-dimensional variation in adult speech as a function of age. *Languages.* 2021;6(4):176. doi:10.3390/languages6040176
25. Fitzgibbons PJ, Gordon-Salant S. Aging and temporal discrimination in auditory sequences. *JAcoustic SocAmer.* 2001; 109(6): 2955-2963.
26. Gordon-Salant S, Yeni-Komshian GH, Fitzgibbons PJ, Barrett J. Age-related differences in identification and discrimination of temporal cues in speech segments. *J Acoust Soc Am.* 2006;119(4):2455-2466. doi:10.1121/1.2171527



License: This is an open access article under the terms of the Creative Commons Attribution 4.0 License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2025 Health Care.

Primljen: 24.04.2025. **Revizija:** 21.08.2025. **Prihvaćen:** 21.08.2025.

- normal hearing: contributions from auditory temporal processing and cognition. *Front Aging Neurosci.* 2015;6:347. doi:10.3389/fnagi.2014.00347
16. Alain C, Zendel BR, Hutka S, Bidelman GM. Turning down the noise: the benefit of musical training on the aging auditory brain. *Hear Res.* 2014;308:162-173. doi:10.1016/j.heares.2013.06.008
 17. Manini TM, Clark BC. Dynapenia and aging: an update. *J GerontolA Biol Sci Med Sci.* 2012;67(1):28-40. doi:10.1093/gerona/glr010
 18. Auer P, Couper-Kuhlen E, Müller F. *Language in time: The rhythm and tempo of spoken interaction.* Oxford University Press; 1999.
 19. Cumming R, Wilson A, Leong V, Colling LJ, Goswami U. Awareness of Rhythm Patterns in Speech and Music in Children with Specific Language Impairments. *Front Hum Neurosci.* 2015;(9):672. doi:10.3389/fnhum.2015.00672
 20. Nooteboom S. The prosody of speech: melody and rhythm. *Handbook phonetic scienc.* 1997;5:640-673.
 21. Pearson DV. Differential sensitivity to speech rhythms in young and older adults. *Front Psych.* 2023;(14):1160236. doi: 10.3389/fpsyg.2023.1160236.
 22. Goswami U. Language acquisition and speech rhythm patterns: an auditory neuroscience perspective. *Royal Soc Open Sci.* 2022; 9:211855. doi:10.1098/rsos.211855
 23. Rocha S, Attaheri A, NíChoisdealbha Á, et al. Precursors to infant sensorimotor synchronization to speech and non-speech rhythms: A longitudinal study. *Dev Sci.* 2024;27(4):e13483. doi:10.1111/desc.13483
 24. Fougeron C, Guitard-Ivent F, Véronique D. Multi-dimensional variation in adult speech as a function of age. *Languages.* 2021;6(4):176. doi:10.3390/languages6040176
 25. Fitzgibbons PJ, Gordon-Salant S. Aging and temporal discrimination in auditory sequences. *J Acoustic Soc Amer.* 2001; 109(6): 2955-2963.
 26. Gordon-Salant S, Yeni-Komshian GH, Fitzgibbons PJ, Barrett J. Age-related differences in identification and discrimination of temporal cues in speech segments. *J Acoust Soc Am.* 2006;119(4):2455-2466. doi:10.1121/1.2171527



License: This is an open access article under the terms of the Creative Commons Attribution 4.0 License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2025 Health Care.

Received: 04/24/2025 Revised: 08/21/2025 Accepted: 08/21/2025