

2024 FIAPAS Award Finalist

How Old Are Your Ears?

¿Qué edad tienen tus oídos?

COORDINATING TEACHERS:

Rocío Martínez Ruiz and Elena León Rodríguez

STUDENTS:

Lucía Guerrero Coca, Adrián Menor Jiménez, Sonia Ortiz Gil, Ismael Ounifli Luque, Blanca Sánchez Medina and Victoria Viso Vargas

FIDICIENCIA (PIN 140/20) – Educational Innovation and Curricular Development Project (Department of Educational Development and Professional Training, Regional Government of Andalusia)

IES FIDIANA SECONDARY SCHOOL, CÓRDOBA

To cite this article:

Martínez Ruiz, R. and León Rodríguez, E. (2024). How Old Are Your Ears? *FIAPAS Special Supplement* (184).

ABSTRACT

This scientific research, conducted by and for the students, has shown the extent of intensive use of high-powered earphones among young people and aims to determine the auditory age of our students to foresee future problems. Our aims were: to assess the link between earphone use and hearing age, to compare hearing and biological age in students aged 12 to 18 years, and to investigate differences in these relationships based on gender. To obtain a representative population of the school, a sample of 219 students (half girls and half boys) was selected out of a total of 700, with a margin of error of 5% and a confidence interval of 95%.

The study shows that the hearing age of secondary-school students is significantly older than their biological age at all educational levels. The hearing age of students aged between 12 and 18 years was between 20 and 25 years. Moreover, while boys wear their earphones for longer, hearing loss is more pronounced in girls, so their ears deteriorate more easily. Furthermore, those who wear earphones for longer periods have premature hearing ageing and a decreased ability to perceive high frequencies.

These findings stress the urgent need to adopt healthy practices in the use of earphones, by respecting recommended volume limits and reducing exposure time to prevent hearing damage. The study also highlights the significance of educational campaigns targeting users and those conducted in educational centres. It is crucial to raise awareness of these risks and to adapt preventive measures according to gender differences.

KEYWORDS

Hearing age, premature hearing ageing, use of earphones

RESUMEN

Esta investigación científica, realizada por y para el alumnado, ha demostrado la magnitud del uso intensivo de auriculares de alta potencia entre los jóvenes y pretende determinar la edad auditiva de nuestro alumnado para prever futuros problemas. Nuestros objetivos han sido: evaluar la relación entre el uso de auriculares y la edad auditiva, comparar la edad auditiva y biológica en estudiantes de 12 a 18 años, e investigar las diferencias en estas relaciones según el sexo. Para obtener una población representativa del IES, se seleccionó una muestra de 219 alumnos (mitad chicas y mitad chicos) de un total de 700, con un margen de error del 5 % y un margen de confianza del 95 %.

Este estudio revela que los estudiantes del IES muestran una edad auditiva significativamente mayor que su edad biológica en todos los niveles educativos. La edad auditiva de los estudiantes entre 12 y 18 años, se situó entre 20 y 25 años. Además, aunque los chicos usan auriculares más tiempo, las chicas presentan una pérdida auditiva más pronunciada, por lo que sus oídos se deterioran más fácilmente. Por otro lado, los que utilizan auriculares por períodos más prolongados manifiestan un envejecimiento auditivo prematuro y una disminución en la capacidad para percibir frecuencias altas.

Estos hallazgos subrayan la necesidad urgente de adoptar prácticas saludables en el uso de auriculares, respetando los límites de volumen recomendados y reduciendo el tiempo de exposición para prevenir el deterioro auditivo. Además, se destaca la importancia de las campañas educativas dirigidas tanto a los usuarios como las llevadas a cabo en los centros educativos. Es crucial sensibilizar sobre estos riesgos, adaptando las estrategias preventivas según las diferencias observadas entre géneros.

PALABRAS CLAVE

Edad auditiva, envejecimiento auditivo prematuro, uso de auriculares

CONTENTS

1. INTRODUCTION
2. RESEARCH OBJECTIVES
3. MATERIALS AND METHODS
 - 3.1. EXPERIMENTAL DESIGN
4. RESULTS
 - 4.1. HEARING AGE VS USE OF EARPHONES
 - 4.2. RELATIONSHIP BETWEEN HEARING AGE AND BIOLOGICAL AGE
 - 4.3. GENDER-DIFFERENTIATED STUDY
5. DISCUSSION
6. CONCLUSIONS
7. EDUCATION CAMPAIGN UNDERTAKEN
8. GRAPHS AND IMAGES
9. REFERENCES



SPANISH CONFEDERATION OF FAMILIES OF DEAF PEOPLE
PROMOTING INCLUSION. SUPPORTING PEOPLE. ADVANCING TOGETHER.

1. INTRODUCTION

The increase in sound reproduction devices, including high-powered earphones that are inserted close to the eardrums, has resulted in the young people who use these devices frequently being exposed to hearing impairment that is uncharacteristic for their age. A study by a secondary school found that 99.21% of its adolescent students use earphones to listen to music on their mobile phones, 25.79% to listen to music on a tablet or iPad, 15.53% to listen to music on an iPod or MP3 player, and 73.43% use earphones with their desktop computer or laptop (López de Pariza-Sanz, 2019). These data show that we are dealing with a population at real risk. This situation, coupled with the fact that we are one of the noisiest countries in the world, led us to carry out this research.

The increase in sound reproduction devices, including earphones, has resulted in young people being exposed to age-inappropriate hearing impairment

Our ears are adapted to hear frequencies between 20 Hz and 20,000 Hz. With age, our hearing, like other senses, deteriorates and we no longer hear the higher frequencies. The problem arises when the deterioration occurs earlier than expected.

As we get older, just as our other senses deteriorate, our ears lose the ability to hear some of these frequencies (usually the higher ones). This loss has a natural expiry date. The problem comes when, for the reasons outlined above, we accelerate that deterioration.

At our secondary school, IES Fidiana, in Córdoba, as part of its Educational Innovation and Curricular Development Project, Fidiciencia (PIN 140/20), we developed the following research, entitled “How Old Are Your Ears?”, to raise awareness among our students of the importance of looking after their hearing health right now to prevent problems appearing in the near future that would require them to use hearing devices due to irreversible hearing loss. We found it very impactful and educational to determine their hearing age, because then they could see to what extent their hearing was being affected by the indiscriminate use of electronic devices with earphones or listening to music at too high a volume.

Having students serve as researchers while also including a significant number of students from our school as a sample has proven highly motivating. This way, the students have seen that the problem we are facing is considerably more extensive than we might have imagined. Our aim has been to awaken the students' scientific curiosity and their ability to question why things happen. The priority has been to give prominence to the students, who become references for their peers, thus facilitating the transfer of knowledge.

Our starting **hypothesis** is that adolescents are misusing electronic devices with earphones for extended periods and that there is a significant relationship between earphone use, biological age and hearing age in students aged 12–18 years, and that this relationship varies according to gender.

2. RESEARCH OBJECTIVES

Our aim is to determine the hearing age of our students to understand the problem we will face in the near future. To this end, we have set the following specific objectives:

1. To assess the relationship between earphone use and hearing age in individuals from different age groups.
2. To establish the relationship between hearing age and biological age in the population sample aged 12 to 18 years in a secondary school.
3. To investigate differences in the relationship between hearing age, earphone use and biological age according to gender.

3. MATERIALS AND METHODS

The materials used in this research were earphones, a computer, online hearing tests and a laboratory.

3.1. Experimental design

To obtain a representative population of the entire student community of the secondary school, it was necessary to conduct a preliminary analysis of the number of students required for the trial. Our secondary school has 700 students, so a sample size of 219 students was selected to give a margin of error of 5% and a 95% confidence interval. For the data collection, five boys and five girls were randomly selected from each of the different year groups at our school. They were asked to complete

a questionnaire about their age, weekly hours of earphone use and whether they complied with the recommended limit for phone volume. Hearing tests that are available free of charge online were used:

- [Frequency limit test](#)
- [Hearing age test](#)

The specific objectives are to assess the relationship between earphone use and hearing age in a population sample from 12 to 18-year-olds at a secondary school and to investigate their differences

Each participant was given two hearing tests using earphones:

- **Frequency limit test.** This measured the upper limit of hertz that participating students were able to hear.
- **Auditory age test.** This test determines the hearing age corresponding to the hertz detected by the participants.

Lastly, all the collected data were entered into an Excel database to create graphs using the study variables.

4. RESULTS

4.1. Hearing age vs earphone use

Graph 1 shows that the increase in hearing age rises as the time of weekly earphone use increases, indicating a direct relationship between the two variables and that greater use of earphones induces greater hearing loss and, therefore, a greater increase in hearing age.

At all levels of the school, hearing age is significantly higher than biological age (Graph 1). Although the students at the school are between 12 and 18 years old, their hearing ages are in the 20–25 years range, with the mean indicating an increase from 8 to 10 years over their biological age.

The majority of adolescents use electronic devices with earphones extensively in their daily lives, starting this habit at a very early age, which poses a clear risk to hearing health.

4.2. Relationship between hearing age and biological age

Graph 2 shows that, between the ages of 12 and 16 years, hearing age is much higher than biological age. However, between 16 and 18 years, the difference between biological age and hearing age is less significant.

With regard to the trend in earphone use by age (Graph 3), fluctuations in patterns of use can be observed. Compared to the other age groups, 14-year-olds are least likely to use earphones. By contrast, young people aged 15 to 16 years have a significantly higher usage: up to 7 hours more per week.

The hearing age of students is much higher than their biological age. Boys have a higher hearing age than girls, although they experience less hearing impairment

It should be noted that this research was conducted during the pandemic and that, due to COVID-19 restrictions, people generally had to stay at home and continue their studies digitally and online, which led to a sharp increase in the use of electronic devices. This could be one of the causes of this excessive use of earphones.

4.3. Gender-differentiated study

Figure 4 shows the relationship between hearing age and the time that earphones were used by gender. It is clear that males (shown in blue) have a higher hearing age than females (shown in red). However, when we analyse the difference between the hearing age and earphone use of males, the difference is less than for females. In other words, although males use earphones for a longer period, they experience less hearing impairment than females. This suggests that girls' hearing deteriorates more easily than boys' with earphone use.

5. DISCUSSION

The data from this study show that the extended use of earphones is directly related to increased hearing loss, as evidenced by the increased hearing age and reduced ability to hear high frequencies. These data were corroborated by other educational establishments according to the study carried out on students at Instituto Pio Baroja in Irún (Gipuzkoa), in which 99.21% of its students used earphones excessively (López de Pariza-Sanz, 2019).

There is also evidence of earphone-induced hearing loss in college students, with a study reporting that 17.1% had tinnitus and 9.4% acoustic trauma. The mean time of earphone use in months was significantly longer among students with acoustic trauma (37.19 ± 24.04 months) compared to those without (20.4 ± 22.95 months), and this difference was statistically significant according to the study by Mogrovejo et al. (2019). Therefore, we can deduce that extended, excessive use for more than 24 months increases the risk of hearing damage.

Our research found that boys use earphones more often than girls, although girls experience greater hearing impairment. However, previous studies indicate that there are no statistically significant differences between the two genders in terms of willingness to change listening habits, weekly listening time, listening volume and level of concern over the health problems resulting from these behaviours (López de Pariza-Sanz, 2019). It is, therefore, essential to provide gender-differentiated information, focusing on making girls aware of their increased predisposition to hearing damage. It would be interesting for future research to determine whether this

difference is due to differing behaviours between boys and girls, or to biological characteristics inherent to gender.

The data from this study show that extended use of earphones is directly related to increased hearing loss

Since noise-induced hearing loss is irreversible, prevention is the best strategy. According to surveys conducted by López de Pariza-Sanz (2019), 71.81% of participants would be likely to turn down earphone volume as a form of hearing protection. In addition, 58.62% would buy earphones specially designed to protect hearing and 51.85% would avoid listening to music in noisy environments. However, less than half of participants (45.50%) would reduce the time that they used earphones.

All these results demonstrate a strong need to raise awareness among the adolescent population about the risk of hearing loss due to poor earphone habits when listening to sounds and music. To this end, schools should carry out educational campaigns to address the issue.

6. CONCLUSIONS

- The hearing age of students at IES Fidiana is much higher than their biological age at every level.
- Boys have a higher hearing age than girls. However, despite girls using earphones for less time, their hearing loss is greater.
- Students who use earphones for longer periods tend to hear a smaller range of frequencies and have a higher hearing age than those who use earphones for less time.

Final conclusion: The striking difference between hearing age and biological age at every level indicates a widespread problem of hearing loss among adolescent students. To preserve our hearing health, it is essential to respect the recommended volume limits and avoid excessive use of earphones or headphones. Reducing exposure time and keeping the volume at safe levels can help prevent hearing impairment.

7. EDUCATION CAMPAIGN UNDERTAKEN

Prevention is the responsibility of both earphone users and schools. Institutions should carry out informative research such as this and develop educational programmes with the primary goals of preventing hearing loss and promoting healthy habits in the use of audio devices. For this reason, our results were circulated among the entire educational community, giving students a leading role. The student researchers presented the research at the 1st International Science Congress *Eurociencia Joven*, an event organised as part of the Education-

al Innovation and Curricular Development Project, Fidiciencia (PIN 140/20), of IES Fidiana in Córdoba. Our conclusions were presented as a lecture to students from the different participating schools, with the target audience being adolescents aged 12 to 18 years. A scientific poster with the most relevant findings was also produced to communicate our research during the poster sessions of the event (Image 1). The authors stood alongside the posters to answer questions both from the students and the attending teachers. In addition, the student researchers conducted on-site hearing tests for participants interested in finding out their hearing age, who were subsequently informed about good habits for hearing health.

To prevent hearing impairment, it is essential to respect recommended volume limits and avoid excessive use of earphones or headphones, as well as to reduce exposure time and maintain safe volume levels

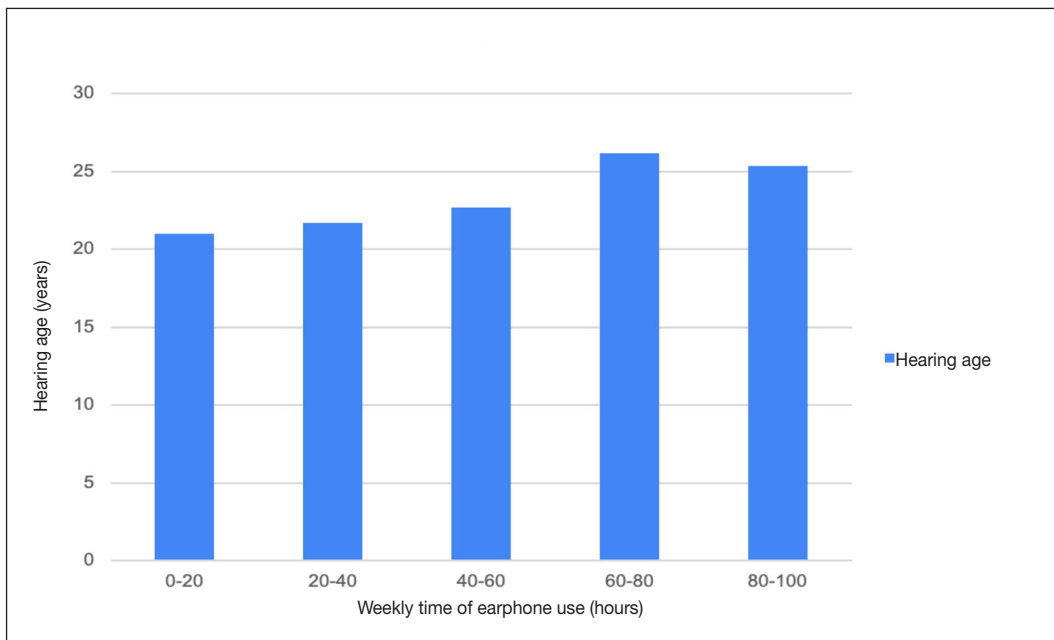
Since the “How Old Are Your Ears?” research project, every year we try to familiarise students with hearing care and the consequences of the overuse of earphones and overexposure to noise. To continue raising awareness about proper care for hearing health, this year, the students attended a very special laboratory. Working with the Andalusian Cochlear Implant Association, we had the opportunity to participate in what we called a “Soundless Laboratory”. During this experience, we were guided through a detailed explanation of cochlear implants that used a sound level meter to illustrate the concepts. We were also introduced to the TLeo app, which transcribed their explanations in real

time and gave valuable hearing care tips, including proper use of earphones, ear cleaning and the precautions to be taken with ototoxic medications.

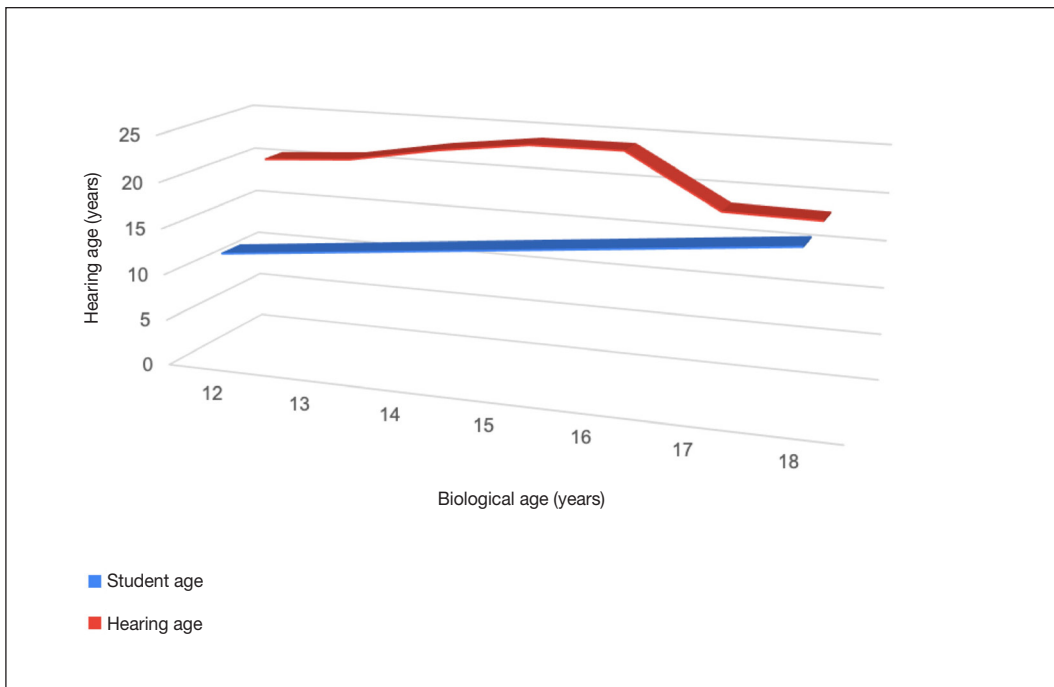
They conducted audiometries in an adjacent workshop and offered hearing assessments to the students who attended. The results of these tests were passed on to their families so that they could put in place the necessary prevention mechanisms and, in cases where hearing loss was present, treat it appropriately. This experience gave us a deeper understanding of the challenges and care associated with hearing health, as well as the technologies and practices available to address them.

8. GRAPHS AND IMAGES

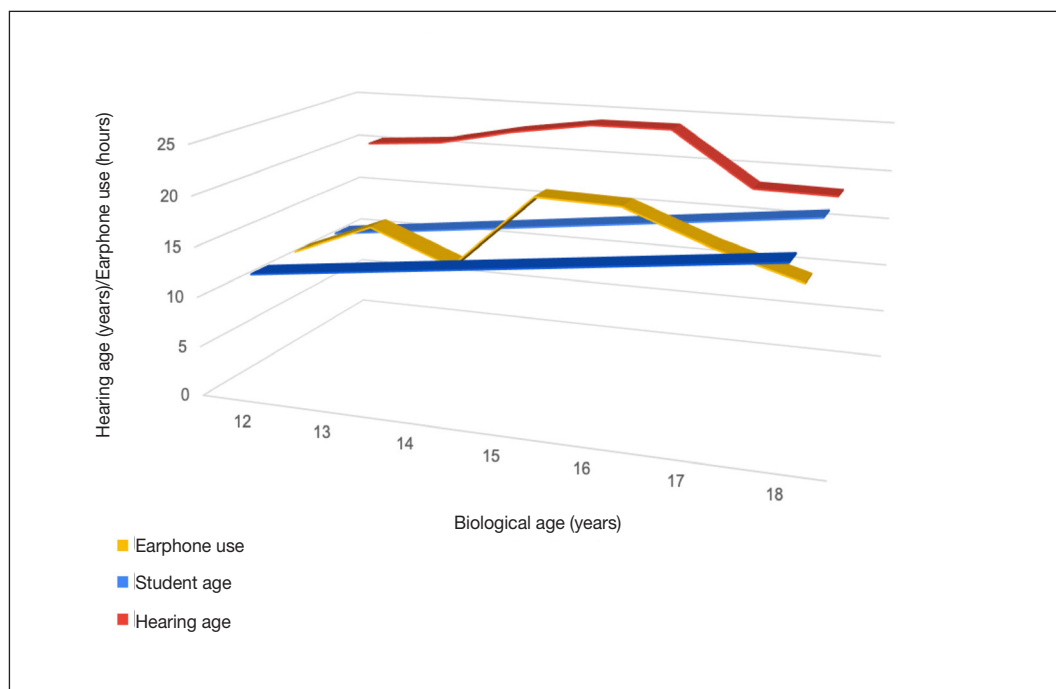
Graph 1. Hearing age of students at the school based on length of time of earphone use



Graph 2. Relationship between the hearing age and biological age of the students at the school



Graph 3. Relationship between hearing age, biological age and time of earphone use by students at the school



Graph 4. Hearing age and time of earphone use according to gender

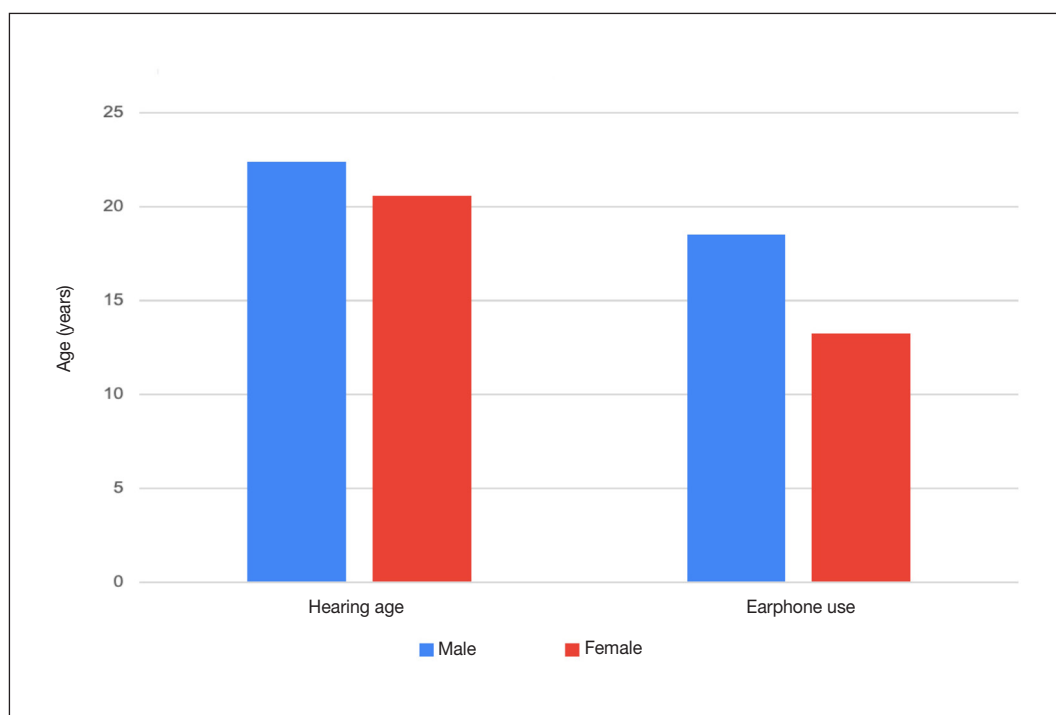


Image 1. Scientific poster



9. REFERENCES

- Levey, S., Levey, T. and Fligor, B., Noise Exposure Estimates of Urban MP3 Player Users, *Journal of Speech, Language, and Hearing Research*, 2011; 54:263–77.
- García Ortiz, MJ., Cuidados de la audición. In: Cruz Sánchez, F., Rodríguez Alonso, B. and Alonso Uría, R.M., editores, *La puericultura en la adolescencia*, Havana, Cuba: MIN-SAP (Ministry of Public Health) and UNICEF, 2014, p. 109–113.
- Rodríguez Valiente, A., Roldán Fidalgo, A., García Berrocal, J.R. and Ramírez Camacho, R., Hearing threshold levels for an otologically screened population in Spain, *International Journal of Audiology*, 2015, Agu;54(8):499–506.
- Rodríguez Valiente, A., Trinidad, A., García Berrocal, J.R., Górriz C. and Ramírez Camacho, R., Extended high-frequency (9-20 kHz) audiometry reference thresholds in 645 healthy subjects, *International Journal of Audiology*, 2014, Agu;53(8):531–45.
- Mogrovejo Friere, L.E., Jácome, L. and Gabriel, A., Doctoral thesis “Hipoacusia inducida por ruido ocasionada por el uso de auriculares en estudiantes del bachillerato de la Unidad Educativa Dr. Trajano Naranjo academic year 2018–2019”, 2019, PUCE-Quito.
- López de Pariza Sanz, A., Final Degree Project. “Encuesta sobre hábitos y uso de aparatos electrónicos con auriculares en adolescentes.” Recolecta. Academic Papers-Faculty of Medicine and Nursing. University of the Basque Country, 2019.
- Hearing test:
<https://onlinetonegenerator.com/hearingtest.html>
- Hearing age:
<https://youtu.be/iN3PBpInNJM>



FOMENTANDO INCLUSIÓN. APOYANDO PERSONAS. AVANZANDO SOLIDARIAMENTE.

SPANISH CONFEDERATION OF FAMILIES OF DEAF PEOPLE
PROMOTING INCLUSION. SUPPORTING PEOPLE. ADVANCING TOGETHER.

Pantoja, 5 (Local) 28002 Madrid
Ph.: 91 576 51 49 Fax: 91 576 57 46
Telesor Service

fiapas@fiapas.es www.fiapas.es www.bibliotecafiapas.es

Follow us on:     

Legal Deposit: M-3698-2025 © FIAPAS 2025

This publication is available for download in PDF at www.bibliotecafiapas.es



POR SOLIDARIDAD
OTROS FINES DE INTERÉS SOCIAL

GOVERNMENT OF SPAIN. MINISTRY OF SOCIAL RIGHTS,
CONSUMER AFFAIRS AND THE 2030 AGENDA.
OUT OF SOLIDARITY
OTHER PURPOSES OF SOCIAL INTEREST

