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# Behavior profile of schoolchildren related to exposure to noise in the Federal District

## Perfil comportamental de escolares relacionado à exposição ao ruído no Distrito Federal

## Perfil conductual de los escolares relacionado com la exposición al ruido em el Distrito Federal

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***Abstract***

**Introduction:** Young people have characteristic listening habits that expose them to high sound pressure levels. Currently, there is better and greater access to portable sound equipment, used mainly with headphones, which, together, can compromise the hearing health of school-age young people. Therefore, it is important to identify risk factors and develop preventive strategies. **Objectives:** To describe the behavioral profile related to noise exposure of students from public schools in the Federal District. **Method:** Prospective descriptive study, approved by the ethics committee (nº 1.698.476). The instruments applied were the Questionnaire for Users of Personal Stereos and the "Youth Attitude to Noise Scale" (YANS) questionnaire in students from the public school system of the **F**ederal District in elementary school II and high school. **Results:** Among 257 students aged 12 to 18 years, 88.7% use their

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**Authors´contributions:**
TLSM: study design; methodology; data collection; article outline.
ISMM, MMM: article outline; critical review.
TCGO, VRCP: article outline; critical review; advisory.
IMCS: study design; methodology; data collection; article outline; critical review; advisory.

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cell phones as personal stereos for between 1 and 5 hours a day (52.4%), preferably at home (75.8%), aware of the maximum volume of the device (57.9%), using them at a higher volume (48.6%), with a prevalence of using insert headphones (67.7%), in quiet and noisy environments (53.6%), spending most of the day at school (58.7%) and considering this environment to be moderately noisy (32.2%). In general, the responses indicate neutral attitudes towards sound, which indicates the need for awareness-raising actions aimed at young people. **Conclusion:** Therefore, most participants have harmful listening habits, as well as hearing complaints related to the need to request repetitions of speech and discomfort when exposed to very loud sounds. The students present neutral behavior when making decisions to change habits and environments.

**Keywords:** Noise-Induced Hearing Loss; Language and Hearing Sciences; Health Behavior; Students.

## *Resumo*

**Introdução:** Jovens possuem hábitos auditivos característicos que os expõem a elevados níveis de pressão sonora. Atualmente, há um melhor e maior acesso a equipamentos sonoros portáteis, utilizados principalmente com fones de ouvido, os quais, em conjunto, podem comprometer a saúde auditiva de jovens em idade escolar. Deste modo, é importante identificar os fatores de risco e desenvolver estratégias preventivas. **Objetivos:** Descrever o perfil comportamental relacionado à exposição a ruídos de estudantes de escolas públicas do Distrito Federal. **Método:** Estudo descritivo prospectivo, aprovado pelo comitê de ética (nº 1.698.476). Os instrumentos aplicados foram o Questionário para usuários de estéreos pessoais e o questionário "*Youth Attitude to Noise Scale*" (YANS) em estudantes da rede pública do Distrito Federal do ensino fundamental II e médio. **Resultados:** Dentre 257 alunos com idade entre 12 e 18 anos, 88,7% utilizam o celular como estéreo pessoal, entre 1 e 5 horas por dia (52,4%), preferencialmente em casa (75,8%), cientes do volume máximo do aparelho (57,9%), utilizando-os em um volume mais elevado (48,6%), com prevalência no uso do fone de inserção (67,7%), em ambiente silencioso e ruidoso (53,6%), passando a maior parte do dia na escola (58,7%) e considerando esse ambiente moderadamente barulhento (32,2%). De modo geral, as respostas indicam atitudes de neutralidade frente ao som, o que indica a necessidade de ações de conscientização voltadas aos jovens. **Conclusão:** Verifica-se, portanto, que a maioria dos participantes possui hábitos auditivos nocivos a sua audição, bem como queixas auditivas relacionadas à necessidade de solicitação de repetições de fala e desconforto em exposição a som muito forte. Os estudantes apresentam comportamento neutro frente à tomada de decisão para mudar hábitos e ambientes.

**Palavras-chave:** Perda Auditiva Provocada por Ruído; Fonoaudiologia; Comportamentos Relacionados com a Saúde; Estudantes.

## Resumen

**Introducción:** Los jóvenes tienen hábitos auditivos característicos que los exponen a altos niveles de presión sonora. Actualmente, existe un mayor acceso a equipos de sonido portátiles, utilizados principalmente con auriculares, lo cual, en conjunto, puede comprometer la salud auditiva de los jóvenes en edad escolar. Por lo tanto, es importante identificar los factores de riesgo y desarrollar estrategias preventivas. **Objetivos:** Describir el perfil conductual relacionado con la exposición al ruido de estudiantes de escuelas públicas del Distrito Federal. **Método:** Estudio descriptivo prospectivo, aprobado por el comité de ética (n.º 1.698.476). Los instrumentos aplicados fueron el Cuestionario para Usuarios de Equipos de Sonido Personales y el cuestionario "Escala de Actitud Juvenil ante el Ruido" (YANS) en estudiantes de la red escolar pública del Distrito Federal, de primaria II y secundaria. **Resultados:** Entre 257 estudiantes de 12 a 18 años, el 88,7% utiliza sus teléfonos celulares como estéreos personales entre 1 y 5 horas al día (52,4%), preferentemente en casa (75,8%), conscientes del volumen máximo del dispositivo (57,9%), usándolos a un volumen más alto (48,6%), con una prevalencia de uso de auriculares de inserción (67,7%), en entornos tranquilos y ruidosos (53,6%), pasando la mayor parte del día en la escuela (58,7%) y considerando este entorno como moderadamente ruidoso (32,2%). En general, las respuestas indican actitudes neutrales hacia el sonido, lo que indica la necesidad de acciones de concienciación dirigidas a

los jóvenes. **Conclusión:** Por lo tanto, se puede observar que la mayoría de los participantes tienen hábitos de escucha nocivos, así como quejas auditivas relacionadas con la necesidad de solicitar repeticiones del habla y la incomodidad cuando se exponen a sonidos muy fuertes. Los estudiantes presentan un comportamiento neutral al tomar decisiones para cambiar hábitos y entornos.

**Palabras clave:** Pérdida Auditiva Provocada por Ruido; Ciencias del lenguaje y la audición; Conductas Relacionadas con la Salud; Estudiantes

## Introduction

Hearing is extremely important for human communication and exposure to high levels of sound intensity can cause hearing loss[1]. Sound can be characterized as a vibrational disturbance in an elastic medium, capable of producing an auditory sensation. Noise, on the other hand, is an aperiodic acoustic signal that originates from the superposition of several vibration movements with different frequencies that are unrelated to each other[2]. The majority of young people have hearing habits that are characteristic of their age group, such as attending concert halls, noisy parties, nightclubs, and sporting events, and these places are generally constantly exposed to high levels of noise, which can be above 100 dB(A)[3]. Another habit of this population is the indiscriminate use of their personal stereos at high intensities, especially with headphones, which leads to irreversible damage to hearing health[4]. Headphones are generally used as an attempt to compete with external ambient noise. The masking effect is influenced by the type of headphones used, since earphones do not effectively isolate external noise[5]. According to Regulatory Standard 15 (NR15)[6] of the Ministry of Labor, a maximum period of eight hours per day is stipulated for occupational exposure to levels of 85 dB. When noise exceeds this intensity for more than eight hours, structural changes may occur, and, because of such exposure, the development of Noise-Induced Hearing Loss (NIHL) may occur.

NIHL has been one of the main causes of sensorineural hearing loss and occurs when there is continuous exposure to high levels of sound pressure, that is, noises equal to or greater than 85 dB in intensity can cause hearing changes. These changes may occur initially through temporary threshold changes and subsequently the noise may cause irreversible, bilateral, progressive and sensorineural loss, with a gradual decrease in hearing acuity, becoming disabling at different levels, although susceptible to preventive interventions[5]. The association between intensity and exposure time used in mobile devices makes the sound even more harmful to hearing[7]. The consequences of hearing loss include, mainly, communication difficulties, tinnitus, difficulty in discriminating sounds, ear fullness and lower academic performance[1]. In addition, there is an increased risk of developing depression and anxiety, as well as a reduction in the individual's quality of life, cognitive decline and social isolation[8].

The incidence of NIHL can be reduced by implementing educational measures to raise awareness of hearing habits and prevent possible losses[3]. Therefore, in order to prevent hearing loss, as well as to change risky hearing behaviors, health actions are necessary to raise awareness among the young population about the dangers of exposure to high sound intensities and the importance of using hearing protection[9]. Basic information about hearing health and its conservation is still scarce in the school environment[10].

School is a suitable environment for such actions, as it is a space intended for sharing information, education and socialization, and because it is a place where young people spend a good deal of their time every day. Some authors suggest that these actions should encourage reflection on hearing risks, also addressing issues related to noise exposure and its consequences, so that these young people become knowledge multipliers[11]. Educating children and adolescents before they develop undesirable hearing habits and behaviors is one of the most effective solutions, when compared to rehabilitating or reversing a habit that has already been established. These actions can be carried out in a school environment, primarily to ensure greater adherence and facilitate the dissemination of information among this population[12].

This study aims to describe the behavioral profile related to noise exposure of students in public schools in the Federal District, analyzing their habits, behaviors and complaints, to develop

prevention and hearing awareness strategies for this population.

## Material and Method

This is a prospective descriptive study, linked to the Audiology in Schools Extension Program: Hearing Health and Continuing Education, developed in public schools in the Federal District, having been approved by the Research Ethics Committee, under opinion No. 1,698,476/2015. The guardians of the minors involved, and adult students signed the Informed Consent Form (ICF) and the minor participants signed the Assent Form (TALE), attesting their permission.

The target population of this study was young students, regardless of gender and age, from elementary and high schools in the Federal District, whether they used personal stereos or not. First, the schools were selected according to availability, after prior contact with the project team, followed by the establishment of a partnership. After contact and approval of the study in the schools, dates and times were set for the lectures. The third stage was for the researcher, together with the team of extension workers, to visit the schools to administer the questionnaires and attend the educational workshop on hearing health. The objectives of the research and how to fill out the questionnaires were explained prior to the educational workshop.

Two questionnaires were used as research instruments for the study, with the aim of mapping the students' perceptions about themselves and the environments around them. The first was structured by the authors themselves and called the "Questionnaire for users of personal stereos" and the second was the "Youth Attitude to Noise Scale" (YANS), adapted to Portuguese[13]. The "Questionnaire for Personal Stereo Users" was divided into five sections, the first containing data to identify the data collected. The second section included the identification of the type of personal stereo used, frequency of use in hours and years, the places where this device is most used, as well as the sound environment, preferred musical styles, level of awareness of the volume used on the device, and types of headphones. Only in this section was it possible to select more than one answer alternative. The third section contained questions about hearing complaints and self-perception. The fourth section asked about the listening environment, and the fifth section requested identification of the participant's age and education level.

The YANS[13] was developed with 19 questions divided into 4 factors related to young people's attitudes towards noise: aspects of youth culture (F1); attitudes towards daily noise (F2); attitudes towards noise and concentration (F3); and attitudes to influence the sound environment (F4). The responses were obtained using a Likert scale, divided into five levels, where they were asked to mark only one value according to their level of agreement with the question: 1 is equivalent to "completely disagree" (DT), being the lowest level of agreement; 2 is "disagree" (D), 3 is "undecided (I)", 4 is "agree" (C) and 5 is "completely agree" (CT), being the highest level of agreement. The final score is the arithmetic mean of the responses, with a minimum of 1 and a maximum of 5, organized by factor and as a total score. The closer the score is to 1, the less aware and more negative the attitudes are towards noise.

After completing the questionnaires, a noise awareness workshop was given to the students participating in the study by the extension workers, who had been previously instructed by the teacher supervising the Audiology in Schools Program: hearing health and continuing education, which was the last stage. This workshop covered topics related to sound and noise, anatomy and physiology of the auditory system, types of hearing loss caused by noise exposure, damage caused by amplified music, and important precautions to prevent hearing damage.

To analyze the questionnaires, a database was created in Microsoft Office Excel (2010) using quantitative measures to obtain the results. The statistical analysis used the SPSS (Statistical Package for the Social Sciences) version 20.0 program and metric or parametric statistical tests, based on the study of the variables, considering a p-value $<0.05$ to characterize the significance of the study.

## Results

The study included 257 students from public schools in the Federal District, aged between 12 and 18 years. Table 1 shows the sociodemographic data of the study participants.

**Table 1.** Participant's sociodemographic data.

| Variables | | N (257) | % |
|---|---|---|---|
| Gender | Female | 121 | 47.1% |
| | Male | 123 | 47.85% |
| | N/A | 13 | 5.05% |
| Age | 12 to 15 years | 118 | 45.92% |
| | 16 to 18 years old | 93 | 36.19% |
| | N/A | 46 | 17.89% |
| Schooling | Middle school | 62 | 24.13% |
| | High school | 185 | 71.98% |
| | N/A | 10 | 3.89% |

Note: N/A = No Answer.

Regarding the questionnaire for personal stereo users and the listening habits of this population, Table 2 presents the results of the variables according to each section. It was observed that most participants use their cell phone as a personal stereo (88.7%), between 1 and 5 hours a day (52.4%), preferably at home (75.8%), aware of the maximum volume of the device (57.9%). Even aware, the majority preferred to use it at a higher volume (48.6%), with a prevalence of using insert headphones (67.7%), both in quiet and noisy environments (53.6%). The sample reported spending most of the day at school (58.7%) and considered this environment to be moderately noisy (32.2%). Given the responses, it was found that "Sometimes" most students can concentrate with other sounds around them (51.7%), maintain attention and concentration during school activities with the help of music (38.1%) and are able to easily ignore surrounding noises (37.3%). Approximately 48.6% indicated that they "never/almost never" turn the TV or radio volume up higher than their family usually uses.

**Table 2.** Responses to the questionnaire for personal stereo users.

| Variables | | N (257) | % |
|---|---|---|---|
| Most used device for listening to music | MP3/MP4 | 2 | 0.77% |
| | Discman | 0 | - |
| | iPod | 3 | 1.16% |
| | Cell phone | 228 | 88.74% |
| | Others | 14 | 5.44% |
| | N/A | 10 | 3.89% |
| Daily exposure time (hours/day) | Less than 1 | 38 | 14.79% |
| | Between 1 and 3 | 78 | 30.36% |
| | Between 3 and 5 | 57 | 22.18% |
| | Between 5 and 8 | 28 | 10.89% |
| | More than 8 | 15 | 5.83% |
| Exposure time/years | Between 1 and 3 | 52 | 20.24% |
| | Between 3 and 5 | 59 | 22.96% |
| | Between 5 and 8 | 63 | 24.52% |
| | More than 8 | 55 | 21.4% |
| | N/A | 13 | 5.05% |
| Place of use | School | 23 | 8.95% |
| | Work | 17 | 6.62% |
| | Home | 195 | 75.9% |
| | In transit | 9 | 3.50% |
| | Gym | 2 | 0.77% |
| | N/A | 11 | 4.26% |
| Do you know the maximum volume? | Yes | 149 | 57.98% |
| | No | 88 | 34.24% |
| | N/A | 20 | 7.78% |
| Usual volume | Lower than the maximum | 17 | 6.61% |
| | Equal to the maximum | 97 | 37.74% |
| | Higher than the maximum | 125 | 48.65% |
| | N/A | 18 | 7.00% |
| Type of headphones | Do not use headphones | 21 | 8.17% |
| | In-ear | 174 | 67.7% |
| | Circumaural (over-ear) | 44 | 17.1% |
| | N/A | 18 | 7.00% |
| Listening environment | Quiet | 83 | 32.2% |
| | Noisy | 18 | 7.00% |
| | Both | 138 | 53.6% |
| | N/A | 18 | 7.00% |
| Can concentrate with surrounding noise? | Never | 25 | 9.72% |
| | Almost never | 28 | 10.9% |
| | Sometimes | 133 | 51.77% |
| | Almost always | 40 | 15.56% |
| | Always | 27 | 10.5% |
| | N/A | 4 | 1.55% |
| Does listening to music help maintain attention and concentration? | Never | 29 | 11.28% |
| | Almost never | 35 | 13.61% |
| | Sometimes | 98 | 38.16% |
| | Almost always | 52 | 20.23% |
| | Always | 39 | 15.17% |
| | N/A | 4 | 1.55% |

| Variables | | N (257) | % |
|---|---|---|---|
| Ease in ignoring surrounding noise? | Never | 39 | 15.17% |
| | Almost never | 45 | 17.5% |
| | Sometimes | 96 | 37.38% |
| | Almost always | 41 | 15.95% |
| | Always | 28 | 10.89% |
| | N/A | 8 | 3.11% |
| Do you turn up the TV or radio volume higher than your family? | Never | 80 | 31.12% |
| | Almost never | 45 | 17.5% |
| | Sometimes | 63 | 24.51% |
| | Almost always | 30 | 11.67% |
| | Always | 35 | 13.65% |
| | N/A | 4 | 1.55% |
| Onde passa a maior parte do dia? | School | 151 | 58.77% |
| | Home | 76 | 29.57% |
| | Work | 7 | 2.72% |
| | Others | 16 | 6.22% |
| | N/A | 7 | 2.72% |
| Volume desse ambiente | Quiet | 14 | 5.44% |
| | Slightly noisy | 71 | 27.62% |
| | Moderately noisy | 83 | 32.30% |
| | Very noisy | 59 | 22.97% |
| | Extremely noisy | 21 | 8.17% |
| | N/A | 9 | 3.50% |

Note: N/A = No Answer.

Table 3 presents the responses regarding hearing complaints and symptoms. The chi-square test showed an association between the responses regarding habits and hearing complaints. There was a statistically significant association between the type of headphones and the hearing complaint of tinnitus (p=0.048), with 43.3% of the young people who reported using earphones saying they heard tinnitus. Regarding the frequency of use of personal stereos, there was also a statistically significant association (p=0.007) between the amount of daily use and the hearing complaint of tinnitus. Among the participants, 18.55% reported using between three and more than eight hours a day, and tinnitus.

Regarding the use of personal stereo volume, there was a significant association between the intensity and the ease of ignoring surrounding noises (p=0.008). Among the participants, 35.01% stated that it was easy to ignore surrounding noises, as well as saying that they used their personal stereo at a louder volume than on the day of collection. When compared to the volume of the TV or radio, there was a significant association (p=0.05), where 28.79% of those who indicated that they put the volume up higher than the rest of their family, listening to their devices at a louder intensity than measured on the day of collection. Comparing the feeling of discomfort when exposed to very loud sounds, there was a statistically significant association (p=0.005) with the volume, where 26.45% of those who used the volume higher than on the day of collection felt discomfort when exposed to very loud sounds.

**Table 3.** Symptoms and complaints related to hearing.

| Variable | Frequency | | |
|---|---|---|---|
| Hearing complaints | Almost always/Always | Sometimes | Almost never/never |
| Requests repetition in conversations | 27% | 40% | 33% |
| Discomfort when exposed to loud sounds | 25% | 35% | 40% |
| Tinnitus | 13.3% | 27.7% | 59% |
| Hearing difficulties | 6.5% | 22% | 71.5% |

In the multivariate analysis, the effect of gender on the type of environment in which personal stereos are used (p=0.041) was observed, with 29.1% of girls and 21.4% of boys responding that they use them in both quiet and noisy environments. With this same statistical test, the effect of education (p=0.017) on the type of environment and education was also observed, with the majority (62.1%) of students who responded that they use their personal stereos in both types of environments are in high school, while the majority (41.9%) of elementary school students responded that they use them in quiet environments.

The results of the YANS questionnaire are presented in Figure 1. It is worth noting that the average responses were obtained based on a 5-point Likert scale, where 1 refers to the most negative and least preventive attitude of the young person towards noise and 5 refers to the most positive attitudes. Question 7 stands out as the most positive attitude for the sample of young people, in which students revealed the importance of making the sound of their environment more comfortable. Question 11, on the other hand, presented a more negative attitude, decreasing the idea that the sample was not bothered by the noise of traffic.

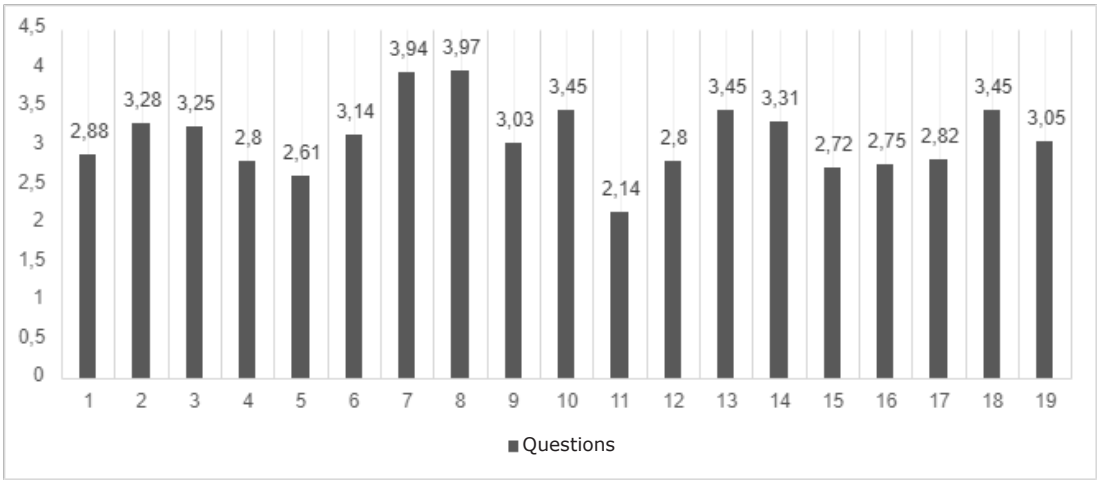


**Figure 1.** Mean response scores for the 19 YANS items.

Grouping the questions by factors according to the reference research13, the distribution of each question follows the description: Factor 1 (F1) - noise related to youth culture: 1, 4, 9, 10, 12, 15 and 18, Factor 2 (F2) - noise and concentration: 11, 14, 16, 17 and 19, Factor 3 (F3) - daily noise: 2, 5, 8 and 13, Factor 4 (F4) - ability to influence the sound environment: 3, 6 and 7. The comparison between the average responses of the questions separated by their factors is presented in Table 4. Factor 4 (ability to influence the sound environment) had a more positive attitude in relation to the others. For statistical analysis purposes, the responses Totally Agree and Agree were grouped, as were the responses Totally Disagree and Disagree.

**Table 4.** Mean YANS responses grouped and comparison of youth attitudes towards noise by Factor (F).

| Factor (F) | Mean – Current Study | Most Positive Question | Most Negative Question | Mean – Previous Study[13] |
|---|---|---|---|---|
| 1 | 2,94 –Positive | 10 and 18 | 15 | 2,36 - Neutral |
| 2 | 2,94 – Neutral | 2 | 5 | 2,76 - Neutral |
| 3 | 2,76 – Neutral | 14 | 11 | 3,38 - Neutral |
| 4 | 3,39 – Neutral | 7 | 19 | 3,13 - Neutral |

The effect of gender on the habits and behaviors identified in the application of the research instruments was studied using the multivariate analysis test. An effect of gender was observed on the perception of noise from household appliances (item 14 F3) with p=0.021, where 79 male students agreed that the sounds from household appliances do not disturb them, while 62 female students disagreed with this statement. The effect of gender on the inability to get rid of bothersome children was also observed (item 19 F4), p=0.006, where 57 female students responded that they felt helpless due to their inability, while the majority (35) of the male participants were undecided about this statement. It was also noted that gender had an effect (p=0.025) on the perception of noise in the classroom (item 13 F4), with 79 students responding that they agreed with this item, while only 63 students agreed with this statement.

The multivariate analysis test was applied to verify the effect of schooling on students' listening habits. This variable influenced the perception of volume at nightclubs, dances, rock concerts and sporting events (item 1 F1), p=0.038, in which most high school students (50.8%) considered the sound too loud, while 30.6% of elementary school students did not answer this item and 43.4% agreed that the sound was too loud. Education also influenced the perception of traffic noise (item 11 F3) with a significant effect of p<0.001, in which 69.1% of high school students and 53.1% of elementary school students considered the noise disturbing. In contrast, 33.8% of elementary school students disagreed with this perception.

The chi-square test was performed to verify possible associations between education and the attitudes presented in the young people's responses to the YANS. Education was associated (p=0.007) with the feeling of comfort regarding noise at school (item 16 F3). Only 39.4% of high school students stated that the sound is comfortable, while 53.1% of elementary school II students disagreed with this statement. Regarding the sum of the YANS factors, a significant association was obtained with education in the total of F1 – attitude towards noise related to youth culture (p=0.012), F3 – attitude towards daily noise (p<0.001) and in the sum of all factors (p=0.005). For age, the total YANS score also showed a significant association of p=0.007.

## Discussion

The participants in this study were students from public schools near the university campus of Ceilandia, in Samambaia, Taguatinga and mainly in Ceilandia, which are characterized by a large population density, with urban planning different from the administrative center of the Federal District, with commercial areas closer to residential areas. Cities with inadequate or nonexistent urban planning face greater vulnerability to noise pollution[14].

With the advancement of technology, the use of portable devices has become increasingly common. Currently, more than 90% of adolescents and young adults use these devices periodically, with cell phones being the most widely used[3,15,16]. Another study[8] showed that 85% to 95% of young people between the ages of 12 and 19 used a personal stereo device.

Research conducted by the Regional Dialogue on the Information Society[17] associates cell phones as one of the devices that are most easily accessible to young people, due to their low cost of acquisition and maintenance, compared to computers. Furthermore, cell phones are the most widely used personal devices by the general population. It is estimated that 77% of the world's population has a cell phone, which offers a wider range of technological resources compared to other devices such as tablets, iPods and notebooks. Because they are easily accessible, teenagers have become accustomed to listening to amplified music on their portable devices whenever possible[18], as music plays an important role in human life, being able to translate feelings and cultural expressions through sound.

A study conducted in India[19] demonstrated that the main reasons for listening to music include enjoying music, relieving boredom, relieving stress, helping to overcome difficult times and increasing creativity. Another study conducted in 2024[5] found that of the 44 participants in the study group, 26 used a cell phone, 17 used a computer and cell phone to listen to music and one used an iPod. The high accessibility of portable devices has made listening to music more practical regardless of time and place, leading to excessive use of these devices in the daily lives of young people and adolescents, in addition to a reduction in the auditory sensitivity of these individuals[3,15].

As for the time of use, authors[4] mentioned in their study that the advent of technology and the ease of access to portable devices such as cell phones have contributed to the acquisition of new social habits, since these devices can provide humans with an alternative reality. In recent decades, cell phone use has increased. Many people believe that cell phones are a vital element, showing their dependence on this device, and among these, children and adolescents represent a large proportion. Cell phones have played a symbolic role, helping these young people integrate into social groups and giving them a sense of belonging. In the present study, 86.3% of participants use their cell phones to play music, using headphones for 1 to 3 hours a day. In another study[10], participants reported listening to music using portable devices for more than five days a week, with 43.3% of the sample listening for between 1 and 2 hours a day.

The present findings reveal that 57.9% of the students in the sample know the maximum volume of their devices and 48.6% stated that they use the volume higher than on the day of collection. One study[7] showed that the description of the sound intensity level of devices ranges from 71 dB to 102 dB, with a maximum of 130 dB, with 130 dB being the noise produced by a jet plane. In another study[5], 63.63% of the participants in the study group reported listening to music at an intensity level of 75 to 100 dB and none of the participants reported listening below 64 dB. According to NR 156, activities with continuous or intermittent exposure to noise levels above 115 dB(A), without adequate protection, pose a serious and imminent risk to the integrity of the auditory system. In addition, it is worth noting that the maximum permissible daily exposure time for a noise level of 115 dB is 7 minutes[6]. The literature[5] indicates that continuous exposure to sounds that exceed the intensity level of 89 dB for 5 hours or more, in a period of one week, leads to hearing difficulties over time. As described in the literature[4], the intensity of music can influence adrenaline levels, as it is stimulating and pleasurable, which may be a factor that contributes to this risk being exposed to this population.

Regarding the type of earphone, both in the current study and in other studies found in the literature[3,9], most participants used insert-type earphones. These earphones are smaller, more affordable and louder than circumaural earphones, and are therefore the most popular. In addition, the sound pressure level of this type of earphone is

higher, since the sound is distributed directly into the external auditory canal, and is therefore more harmful to hearing[20]. After prolonged exposure to noise, with earphones for example, the most common symptoms are tinnitus and noise sensitivity[21]. There was a significant relationship between the amount of daily use and the auditory complaint of tinnitus in the present study, also agreeing with the findings of another author[22] who had a direct correlation between the time of exposure and the presence of tinnitus in his studies. In another study[10], more than half of the interviewees reported having experienced the auditory sensation of tinnitus at least once, and the majority reported having experienced this symptom after listening to music using their personal listening devices.

In the present sample, 53.6% stated that they use their personal stereos in both quiet and noisy environments. The major problem with using sound devices in environments with high noise levels, such as gyms, traffic, and schools, is that, in these cases, the individual feels the need to increase the volume of their device in order to block out external noise, which is more harmful to hearing health due to the increase in sound intensity[23]. This data corroborates the findings of another study[5], where 77.3% of participants increased the volume of music when they are in noisy environments. Many young people in the sample studied listen to music or other noises during school activities, and 52.4% stated that this habit helps them maintain concentration. improved directed attention. The authors indicate that the use of headphones helps with concentration and focus on situations of divided attention due to sporadic and uncontrolled noises in the environment, such as school noise. However, in another study[5], young people who frequently listen to music reported limited concentration.

Most students in the study (58.7%) stated that they spend most of the day at school and 32.2% consider this place to be moderately noisy. In another study[25], the average noise level observed in schools ranged from 59.5 to 71.3 dB(A) and according to NBR 1015226, the acceptable noise level for activities that require constant reasoning, and attention is 65 dB(A). In schools, children and adolescents are often exposed to inappropriate stimuli from the surrounding environment such as school alarms, noise from conversations in the hallway, recreational noise such as shouting and whistling, in addition to portable devices. In this environment, students may also develop learning, attention and concentration difficulties, which can lead to disciplinary problems[27,28]. Just like students, teachers may also be affected, as they must compete with constant noise and must adjust their voices to express their speech correctly and be understood, thus increasing the chance of vocal pathology.

The dangers that high noise levels pose for hearing become clearer when we consider hearing complaints and even more so when we compare them with hearing habits. In the present study, the most frequent hearing complaint was the request for speech repetitions. According to one study[4], such difficulties in understanding or hearing words are among the main symptoms of excessive noise exposure. Another frequent complaint in the current study was discomfort when exposed to very loud sounds. This data is in agreement with another study[29] , which found that, among those who reported using higher volumes, 26.45% felt discomfort when exposed to very loud sounds, and with another study[5] in which approximately 90% of respondents reported listening to music for more than five years on their personal devices and approximately 80% reported listening three or more times a week for ≥ 3 hours. Of these participants, 75% reported experiencing decreased tolerance to certain environmental sounds, in addition to a variety of auditory symptoms after listening to music, such as tinnitus, fullness in the ears, hearing loss or muffled hearing, and ear pain.

Considering the responses to the 19 YANS questions (Figure 1), an average of 3 points was obtained, in agreement with the findings of another study[7], which obtained 2.80 points. By grouping the questions into their respective factors, we have a sample with results similar to those found in literature[13], with the difference that, in the latter study, all students were high school students, while in the present study, 71.9% of the participants had this level of education.

Table 4 shows the comparison of the attitudes of young people toward noise by factor between the current study and a previous study[13]. In general, the attitudes of young people toward noise tended toward neutrality both in the present study and in the literature found. This behavioral characteristic may indicate a lack of knowledge about the harm that noise can cause, in addition to indifference regarding the damage caused by noise exposure to the auditory system, and therefore, this behavior

is maintained. Another explanation may be the absence of items in the data collection instrument that truly contemplated the response intention of this population, biasing the results and limiting their interpretation. However, the comparison between the two studies shows that the young people in the present study have more positive behaviors, clearly indicated in Factor 1 and Factor 3, as shown in Table 4. Although attitudes tend to be neutral, the sample in the present study presented more positive attitudes, which indicate an awareness about hearing care. One study[10] showed that most respondents were aware of the damage that headphones at high volume can cause to hearing, however, only 26% of participants had attitudes to listen safely.

Three associations were identified between gender and issues related to feelings of helplessness, exposure to loud noises, classroom volume, and noise from household appliances, in which female participants presented a more positive behavior compared to male participants. It is worth noting that in the present sample, the number of male participants was slightly higher (Table 1). On the other hand, a study[30] demonstrated that the gender of participants was not significantly associated with unsafe listening habits, as was the case in the findings of another study[4], where no significant differences were found in relation to gender, except for habits related to sports practices, in which the greatest noise exposure was among male participants.

As for education, associations were also observed in items related to the volume of sound in nightclubs, concerts, and sporting events, volume of sound at school, and traffic noise. High school students presented more positive responses in relation to the first two items mentioned. Regarding traffic noise, elementary school students had a more positive attitude. No evidence was found in the literature that could help justify these findings. However, the issues related to events linked to noise exposure were those that presented the highest number of abstentions among elementary school students, suggesting a lack of experience to establish a position on the subject.

From this, it is emphasized that educational behavior in hearing health should be objective and direct to recognize and prevent damage caused by exposure to environmental noise and leisure activities. The findings of this study reinforce the need for work of this nature in all regions of the country. It is emphasized that educational actions should be initiated in the first year of elementary school, since, during this period, students tend to respond and participate more easily in social and educational activities and suggestions proposed by third parties, making it easier to become aware of the risks to hearing health and the importance of adopting healthy habits.

As a limiting factor of this study, it is worth highlighting the impossibility, so far, of verifying changes in behavior after the educational action, since the dynamics of the school schedule make it difficult to carry out follow-up with new collections using the Noise Attitudes Questionnaire (YANS)[13] and repetition or deepening of awareness-raising actions. This study is a sample of just one evaluation, and it would be ideal to plan longitudinal studies to monitor changes in behavior of young people when faced with noise, allowing a reliable analysis of the success of the hearing loss prevention program.

## Conclusions

Despite the risks posed to hearing by exposure to high levels of noise, this study observed that there is no real concern among young people regarding these issues. There is agreement among the students that music, especially at a high intensity, brings more benefits than harm. As an example, the participants mentioned greater concentration to perform activities that require focus and pleasurable stimuli, since music at high levels stimulates the release of the adrenaline hormone. Such attitudes are factors that can lead to the maintenance of bad habits. As for hearing complaints, the most frequent ones were the need to request repetitions of speech and discomfort when exposed to very loud sounds. It was therefore found that most participants have hearing habits that are harmful to their hearing and present neutral behavior when making decisions to change these habits and environments.

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## Appendix I. Questionnaire for personal stereo users.

### Section 01 (Do Not Answer)

| | | |
|---|---|---|
| Code: | | |
| Location: | Time: | Date: |
| Sound Pressure Level dB(A): | Background Noise dB(A): | |

### Section 02

| Question 01 | MP3/MP4 | Discman | iPod | Cellphone | Outhers |
|---|---|---|---|---|---|
| Most used device for listening to music. | 1 | 2 | 3 | 4 | 5 |
| Question 02 | Less than 1 | Between 1 and 3 | Between 3 and 5 | Between 5 and 8 | More than 8 |
| On average, how many hours per day do you use it? | 1 | 2 | 3 | 4 | 5 |
| Question 03 | Less than 1 | Between 1 and 3 | Between 3 and 5 | Between 5 and 8 | More than 8 |
| How many years have you been using these devices? | 1 | 2 | 3 | 4 | 5 |
| Question 04 | School | Work | Home | In transit | Gym |
| Where do you usually use the device? | 1 | 2 | 3 | 4 | 5 |
| Question 05 (You may select more than one) | Jazz/ Classical | Rock | Samba /Pagode | Sertaneja (Brazilian country) | MPB (Brazilian Popular Music) |
| Question 06 | | | Yes | No | |
| Do you know your device's maximum volume? | | | 1 | 2 | |
| Question 07 | | | Lower than the current one | Equal to the current one | Higher than the current one |
| Do you usually listen at a volume? | | | 1 | 2 | 3 |
| Question 08 | | | Without headphones | In-ear headphones (inside the ear canal) | Circumaural headphones (over the ear) |
| What type of headphones do you usually use to listen to music? | | | 1 | 2 | 3 |
| Questão 09 | | | Quiet | Noisy | Both |
| What kind of environment do you use your personal stereo in? | | | 1 | 2 | 3 |

**Section 03**

| | Never | Almost never | Sometimes | Almost always | Always |
|---|---|---|---|---|---|
| 1. Are you able to concentrate even with other sounds around you? | 1 | 2 | 3 | 4 | 5 |
| 2. Does listening to music help you maintain attention and concentration? | 1 | 2 | 3 | 4 | 5 |
| 3. Is it easy for you to ignore surrounding noise? | 1 | 2 | 3 | 4 | 5 |
| 4. Do you often hear ringing in your ears (tinnitus)? | 1 | 2 | 3 | 4 | 5 |
| 5. Do you feel you have difficulty hearing? | 1 | 2 | 3 | 4 | 5 |
| 6. Do you turn the TV or radio volume up higher than your family? | 1 | 2 | 3 | 4 | 5 |
| 7. Do you ask people to repeat what they said? | 1 | 2 | 3 | 4 | 5 |
| 8. Do you feel discomfort when exposed to very loud sounds? | 1 | 2 | 3 | 4 | 5 |

**Section 04**

| Question 01 | | School | Home | Work | Others |
|---|---|---|---|---|---|
| Where do you spend most of your day? | | 1 | 2 | 3 | 4 |
| Question 02 | Quiet | Slightly noisy | Moderately noisy | Very noisy | Extremely noisy |
| How would you describe the environment of this place? | 1 | 2 | 3 | 4 | 5 |

**Section 05**

| Gênero | 1. Female | 2. Male | Age: |
|---|---|---|---|
| Educational level | 1. Incomplete elementary school | 3. Incomplete high school | 5. Incomplete higher education |
| | 2. Complete elementary school | 4. Complete high school | 6. Complete higher education |

## Appendix II. Youth Attitude to Noise Scale (YANS-BRAZILIAN)[13]

| | DT | D | I | C | CT |
|---|---|---|---|---|---|
| 1. I think the sound volume at discos, dances, rock concerts, and sporting events, in general, is too loud. | | | | | |
| 2. Listening to music while doing schoolwork helps me concentrate. | | | | | |
| 3. I am willing to do something to make the school environment quieter. | | | | | |
| 4. When the sound level is very high, I consider leaving a disco, rock concert, dance, or sporting event. | | | | | |
| 5. I can concentrate even if there are many different sounds around me. | | | | | |
| 6. I think it is unnecessary to use hearing protection when I am at a disco, rock concert, dance, or sporting event. | | | | | |
| 7. It is important to me to make the sound in my environment more comfortable. | | | | | |
| 8. I don't like it when it is quiet around me. | | | | | |
| 9. The sound volume at discos, dances, rock concerts, or sporting events is not a problem. | | | | | |
| 10. Loud noises and sounds are natural aspects of our society. | | | | | |
| 11. Traffic noise is not disturbing. | | | | | |
| 12. The sound level should be reduced at discos, rock concerts, dances, or sporting events. | | | | | |
| 13. I think the classroom should be quiet and calm. | | | | | |
| 14. Sounds from fans, refrigerators, computers, etc., do not bother me. | | | | | |
| 15. I am willing to give up activities where the sound volume is too high. | | | | | |
| 16. The sound volume at my school is comfortable. | | | | | |
| 17. It is easy for me to ignore traffic noise. | | | | | |
| 18. D There should be more rules or regulations about sound volume in society. | | | | | |
| 19. When I cannot get rid of annoying sounds, I feel helpless. | | | | | |

**Note:** DT = Strongly disagree; D = Disagree; I = Indifferent (or Neutral); C = Agree; CT = Strongly agree.