Agricultural Pilot's Audiological Profile

Perfil Audiológico de Pilotos Agrícolas

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SUMMARY

Introduction: The agricultural airplane pilot are daily exposed to intense noises, being susceptible to the noise-induced hearing loss (NIHL) and its auditory and extra auditory effects.

Objective: To analyze the audiological profile of this population, verifying the work's influence on its hearing.

Method: It was realized a retrospective, individual, observational, and cross-sectional study through the data obtained by means of a questionnaire and audiometric thresholds of 41 agricultural pilots. To the statistical analysis were utilized the chi-square, Spearman, and Wilcoxon tests with significance level of 5%.

Results: It was verified that 95,1% of the pilots use PPE (personal protective equipment) during flight and 58,5% have contact with pesticides. More than half of individuals referred to feel auditory and extra auditory symptoms, being the buzz the more frequent (29,1%). It has the occurrence of 29,3% of NIHL suggestive hearing loss and 68,3% of normality, taking this presence of unilateral notch in 24,4% and bilateral notch in 31,7%. It was found correlation statistically significant in the associations between time of service and the average of the acute frequencies in the right ear (p=0038), and in the left ear (p=0,010). It has a statistical tendency in the association between audiometric configuration and contact with pesticides (p=0,088).

Conclusion: The hearing loss prevalence in this study was showed high. More than half of the sample has normal audiometric thresholds with notch configuration. Such data lead to the conclusion that the agricultural pilots, even with PPE use, they still suffer with the damages caused by noise, needing best proposals of hearing loss prevention.

Keywords: noise-induced hearing loss, aviation, agriculture, occupational noise, worker health.

RESUMO

Introdução: Os pilotos de aviões agrícolas estão diariamente expostos a ruídos intensos, estando suscetíveis à Perda Auditiva Induzida pelo Ruído (PAIR) e seus efeitos auditivos e extra-auditivos.

Objetivo: Analisar o perfil audiológico desta população, verificando a influência do trabalho sobre sua audição.

Método: Foi realizado um estudo retrospectivo, de corte transversal, individual e observacional, através de dados obtidos por meio de questionário e audiometria tonal liminar de 41 pilotos agrícolas. Para a análise estatística foram utilizados os testes Qui-quadrado, Spearman e Wilcoxon, com nível de significância de 5%.

Resultados: Verificou-se que 95,1% dos pilotos usam EPI durante os vôos e 58,5% possuem contato com agrotóxicos. Mais da metade dos indivíduos referiram ter sintomas auditivos e extra-auditivos, sendo o zumbido o mais frequente (29,1%). Houve a ocorrência de 29,3% de perda auditiva sugestiva de PAIR e 68,3% de normalidade, tendo, esta, presença de entalhe unilateral em 24,4% e entalhe bilateral em 31,7%. Foi encontrada correlação estatisticamente significativa nas associações entre tempo de serviço e a média das frequências agudas na orelha direita (p=0038) e na orelha esquerda (p=0,010). Houve tendência estatística na associação entre configuração audiométrica e contato com agrotóxicos (p=0,088).

Conclusão: A prevalência da perda auditiva neste estudo se mostrou elevada. Mais da metade da amostra possui limiares auditivos normais com configuração de entalhe. Tais dados levam a conclusão de que os pilotos agrícolas, mesmo com o uso de EPI, ainda sofrem com os danos provocados pelo ruído, carecendo de melhores propostas de prevenção da perda auditiva.

Palavras-chave: perda auditiva provocada por ruído, aviação, agricultura, ruído ocupacional, saúde do trabalhador.

Introduction

The agricultural aviation arrived in Brazil by the need to control pests in large areas of monoculture, as the mechanized systems of application of agricultural land were too slow and could not effectively control the whole plantation. Currently, agricultural aviation activities are to the application of fertilizers, pesticides, planting, stand water, fire fighting and vectors (1).

The agricultural aircraft have the characteristic of being, mostly single-engine, and the location of the engine in front and can accommodate only one crewman. Thus, the noise produced by the engine is near the cockpit, even to the *cockpit* at high intensities.

The environment of airports and air clubs have multiple sources of noise, both on land and in air. Noise is produced by virtue of aircraft equipment, transmission systems, propellers, rotors, hydraulic and electric actuators, air conditioning and cabin pressurization systems, alert systems and communications equipment. Noise can also be generated by the aerodynamic interaction between the air (boundary layer) and the surface of aircraft such as fuselage, wings, control surfaces and landing gear. These sounds do not only make the work environment more stressful, but over time can cause hearing loss (2).

Gerostergiou et al (3) conducted a study involving 15 pilots a flying club, audiological evaluations being made and the level of noise of small planes and ultra-lightweight. The findings showed that 30% of pilots had hearing impairment suggestive of Noise Induced Hearing Loss (NIHL) and the noise level peaked at 100-110dB, with an average of 75dB in both models.

Changes or effects that noise leads to hearing and health in general are influenced by the sound pressure level (SPL), the type of noise, the frequency, and the total exposure time and also by individual susceptibility. Thus, the noise may affect the subjects exposed in different ways for the same period of time (4).

Several studies focused on PAIR, showed a correlation between threshold and the years of occupation (5,6,7).

The acoustic trauma, the temporary threshold shift (MTLA) and PAIR are characterized as hearing impairment resulting from noise exposure. The acoustic trauma is characterized by single exposure to very high SPL, resulting in an immediate and permanent injury and may be unilateral or bilateral. The MTLA refers to a hearing impairment caused by short exposure to high SPL, and may be accompanied by tinnitus. After a relaxing acoustic thresholds return to its initial default. PAIR is now defined as the permanent hearing loss preceded by prolonged and repeated exposure to intense noise levels (8).

Ordinance No 19 of Ministry of Labor (9) provides that the PAIR is determined by changes in sensorineural hearing thresholds, resulting from occupational exposure to systematic NPS high. The characteristics are defined by irreversibility, gradual progression over time of risk exposure, falling predominantly in the frequencies of 3000Hz, 4000Hz and 6000Hz, and interruption of progression of hearing reduction with cessation of exposure. Such characteristics are due to the destruction of the sensory cells of the organ of Corti, producing a slow deterioration in hearing, generally symmetric, and taking on its clinical settings (10,11).

According to the American College of Occupational and Environmental Medicine (11), the first sign of hearing loss due to noise exposure is a notch in the audiogram in 3000, 4000 and /or 6000Hz, 8000Hz with recovery. The Regulatory Standard 7 of the Ministry of Labor (12) requires that cases suggestive of onset of NIHL can be checked by comparing the examination of reference and sequentially through the difference in 10dBNA the average of the frequencies 3000, 4000 and 6000Hz or worsening on a frequency mentioned in 15dBNA.

After the lowering of the frequencies 3000, 4000 and 6000Hz, the lesion extends to frequencies of 8000, 2000, 1000, 500 and 250Hz. Insofar as the mid and bass are hit, the audiometric curve is shaped in descending order, with recovery usually 8000Hz (13,14).

Noise is the most frequent of occupational exposure, may develop extra-auditory effects and audio. These effects directly affect the concentration and skills needed for the tasks generating inattention, carelessness and masking warning signals, thereby contributing to the increase of industrial accidents (8).

Auditory effects found in workers with NIHL limit the functionality of the hearing, causing change in hearing sensitivity, changes in frequency selectivity in the temporal and spatial resolution, recruitment (increased sense of discomfort) and tinnitus. Such changes directly influence the auditory discrimination, hampering the perception, especially of speech sounds; it can also change the pattern of speech according to the degree of loss auditiva 15, 16.

Several studies address the relationship between NIHL and tinnitus, being influenced by factors such as age and length of service (6,17,18). One study showed that workers with a mean of 6.8 years of service already have tinnitus. This work also indicated the occurrence of this

symptom in 70% of individuals with normal thresholds exposed to occupational noise (18).

In relation to changes outside the hearing, these are characterized by disturbances in multiple systems. The disturbances will depend on factors such as frequency noise, intensity, duration, and rhythm, as well as the time of exposure, individual susceptibility and attitude of each individual with the sound. The main extra-auditory changes found in patients with NIHL are: communication disorders, vestibular, behavioral, digestive, neurological, sleep disorders, cardiovascular, hormonal and circulatory changes in respiratory reflexes, concentration and skill and changes in income work (19,20).

Another risk factor is that the pilot farm is exposed to pesticide poisoning by inhalation. Some of chemical pesticides have neurotoxic properties, and studied their impact on several areas of health, particularly the impact hearing loss (21,22), and considered responsible for the poisoning of workers who handle and apply. The forms of poisoning can be by skin contact, inhalation and digestive tract, and airway in the form of faster absorption (22).

The chemicals most commonly used pesticides in agricultural airplanes are thrown by the organophosphates, synthetic pyrethroids, both commonly used in insecticides and carbamates, used in insecticides and herbicides (23).

Due to the knowledge of risk factors to which the pilot farm is exposed, it became necessary to analyze the audiological profile of the working class in order to provide data for future research.

Method

This research is in a cross-cohort study, individual, observational and contemporary, where the factor under study is agricultural pilots. The purpose of this study was to analyze the audiological profile of this population. The population consisted of 43 pilot agricultural attended the health inspection at the Air Force Hospital of Canoas (Haco) - Canoas / RS for renewal of Certificate of Physical Capacity (TLC) in the period from June to September 2009. This study was reviewed and approved by the Ethics in Research of Methodist University Center - IPA, with protocol number 60/2009. Was also approved by the director of Haco, by signing the Institutional Term.

We included all the riders who attended the periodic examinations and who agreed to participate in this study by signing the consent form. Exclusion criteria were disregarded pilots had conductive hearing loss. Thus, two airmen were excluded; the sample consisted of 41 agricultural pilots.

For data collection, subjects answered a questionnaire with questions relating to his work routine, and subsequently underwent otoscopy and pure tone audiometry. We examined the audiometric thresholds of the airway of frequencies from 250Hz to 8000Hz and bone 500Hz to 4000Hz. It was considered normal standard audiometric thresholds equal to or smaller than 25dBNA. For the implementation of pure tone audiometry were used two audiometers two channels, each of the Grason-Stadler, GSI 61, with calibration of 29/09/2008. To analyze the audiological data per individual, we used the audiometric classification proposed by Fiorini (24), were divided into three groups:

Group I: normal auditory thresholds. This group was subdivided into:

- Normal bilateral (levels equal to or less than 25dB).
- Normality with unilateral notch (corresponding to a reduction in the normal frequencies of 3000, 4000 and / or 6000Hz).
- Normality with bilateral notch (ditto to the above, but in both ears).

The characterization of the notch audio used in this work is determined by the same author (24), as the lowering of high frequencies (3000Hz and / or 4000 Hz and / or 6000Hz) of at least 10dB of difference with the previous frequency or later.

Group II: Amendment audiometric suggestive of NIHL (hearing loss in the frequencies of 3000Hz and / or 4000 Hz and / or 6000Hz). Subdivided into:

- PAIR unilateral (audiogram showing suggestive of NIHL in one ear and the other with normal).
- PAIR unilateral notched the other ear (audiometric configuration suggestive of NIHL in one ear and the presence of Notch within the normal range on the other).
- PAIR bilateral (both ears).

Group III: audiometric configuration suggestive of loss downward bilaterally or unilaterally.

Statistical analysis was performed on the *software Statistical Package for Social Science* (SPSS) 10.0 *for Windows.*

A descriptive analysis of data plane, use of personal protective equipment (PPE), type of PPE used, time of flight daily, contact with pesticides, pesticide product

type, home audio, presence auditory symptoms and extra-auditory types of symptoms , audiometric configuration were described through absolute and relative frequencies, the variables age and length of service were analyzed by calculating the average observation accompanied by the standard deviation, and the variables: average highs of the right ear, the middle of the treble left ear average severe right ear, mean severe left ear was performed by observing the calculation of average median and interquartile range.

The comparison of the average highs and lows between the ears was performed using the Wilcoxon test. To verify the correlation between quantitative variables with normal distribution was used chi-square for non-normal distribution was used the Spearman coefficient.

All tests were performed as two-tailed, assuming as statistically significant if P less than or equal to 0.05.

RESULTS

Results of the questionnaire

The study population comprised 41 agricultural pilots, all male, mean age 38.1, standard deviation of 10.6 and predominant age group 31-40 years (46.3%). The median length of service was 11 years, with most individuals (31.7%) are drivers who have 11-20 years of occupation. As for the daily flight time, more than half (51.2%) fly 5-8 hours a day. Data for the variables are shown in Table 1.

Table 1. Frequency of age and length of service (n = 41).

Variable	n	%
Age (years)		
18 to 30	9	22
31-40 years	19	46.3
41-50 years	7	17.1
51-60 years	3	7.3
61-70 years	3	7.3
Service time		
until 6 months	1	2.4
7-11 months	2	4.9
1-5 years	11	26.8
60-10 years	5	12.2
11-20 years	13	31.7
21-30 years	6	14.6
31-40 years	3	7.3
Daily flight time		
2-4 hours	2	4.9
5-8 hours	23	51.2
9-12 hours	15	36.6
more than 12 hours	1	2.4

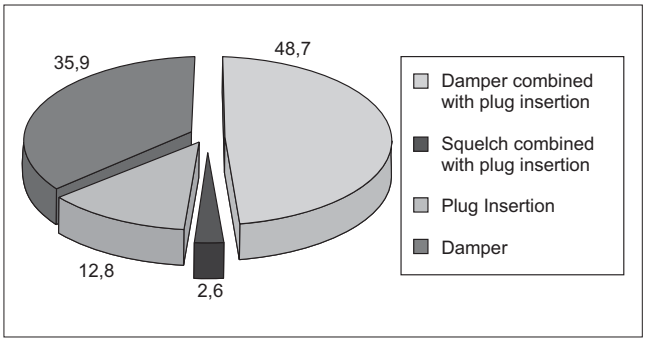

Figure 1. Distribution of the type of PPE used by aviators.

We examined the models of aircraft used in agricultural aviation, the most reported were: Embraer 202 Ipanema (43.2%), Embraer Ipanema 201-A (41.5%) and AG Cessna 188B Truck (29.3%). Models Ipanema Embraer 202-A, 201, 200 and 200-A, correspond, together, to 24.4%.

Regarding the use of PPE during the flights, the data show that 95.3% of drivers (39 individuals) using such equipment and 4.9% (two individuals) do not. Regarding the type of PPE (Figure 1), most subjects (48.7%) reported the combined use of dampers and plug insertion.

More than half of aviators (58.5%) mentioned that they have some kind of contact with pesticide products, while 41.5% have no contact. Of the riders who have contact, 41.7% (n = 10) reported contact with all types of pesticides (herbicide, insecticide, fungicide and maturing). The insecticide was the most cited by the sample, constituting 95.8% of respondents, followed by 87.5% herbicide, fungicide soon after with 83 3% and maturing with 45.9% of responses.

Most drivers (70.7%) claimed to have performed more than 14 hours of rest before the hearing audiometric, 12.2% reported having done 11-14 hours, 9.8% had 9 to 10 hours, 2.4% had 5-8 hours and 2.4% reported less than four hours of home audio.

Was searched for the presence of auditory symptoms and extra-auditory, affirmed in 53.7% of pilots (n = 22) and denied by 46.3%, and tinnitus (54.5%) the most prevalent symptom among 22 individuals, constituting 29.3% of

responses between the study sample (Table 2). Of individuals who reported tinnitus (n = 12), 50% belong to Group I and 50% in Group II.

Results of the audiological evaluation

With respect to audiological data, the average high frequencies (3000, 4000 and 6000Hz) of the right ear was 12.11 dB and 10dB median (interquartile range: 5 to 18.33) and 13.05 dB for the left ear with a median of 8.33dB (interquartile range: 5 to 22.49), the average of frequencies 500, 1000 and 2000Hz in both ears was 6.66 dB (DO: 3.33 to 10, LE: 2.50-8.33).

In the analysis of audiometric evaluation, we observed hearing within normal limits (Group I) in 28 subjects (68.3%) and 13 pilots (31.7%) with abnormal audiograms. The data are shown in Table 3.

Analyzing the 28 audiograms from Group I (100.0%), found that 17.9% of individuals have normal threshold without notch, show the presence of 35.7% and 46.4% unilateral notch with notch bilaterally.

In Group II, among the 12 audiograms evaluated (100.0%), we find that 25% of pilots hearing loss suggestive of NIHL unilateral, 25% have unilateral hearing loss with a notch within the normal in the other ear and 50% classified as bilateral hearing loss.

In Group III was found only one subject with hearing loss related to other causes, which is unilateral.

Found no relationship was statistically significant in comparisons of the variables age, use of PPE, flight time and daily contact with pesticides is rated second audiometric Fiorini (24) (Table 4).

By the Wilcoxon test were compared with the average of the average bass treble in each ear, and is statistically significant difference (OD: p = 0.002; LE: p <0.001). This difference was not identified in the comparison of high frequencies between the ears (p = 0.237), indicating the same symmetry.

In Table 5 are described correlations of the variables taken long service and home audio with the average highs of right and left ear, showing a statistically significant length of service with the average acute ears.

Noting the distribution of the variables age, years of daily flight and type of PPE used, with the classification of the subgroups proposed by Fiorini (24) (Table 6), there is slight homogeneity in variable age and greater number of individuals with hearing loss suggestive PAIR who fly 5-8 hours a day. Regarding the EPIs used in all types of hearing loss is present and / or normal hearing thresholds with slot configuration.

Table 2. Frequency of extra-auditory symptoms and reported hearing.

Variable	Number of responses	%
Otologic symptoms		
No symptoms	19	46.3
Discomfort to loud sounds	4	9.8
Feeling of "ear full"	3	7.3
Decreased hearing in	4	9.8
Buzz	12	29.3
Otalgia	2	4.9
Headache	1	2.4
Difficulty to understanding words	1	2.4
Dizziness	1	2.4
Other	1	2.4

Table 3. Analysis of the audiometric evaluation, according to Fiorini (1994).

Classification group	n	%
Group I	28	68.3
Normal hearing thresholds bilaterally	5	12.2
Normal hearing thresholds with unilateral notch	10	24.4
Normal hearing thresholds bilaterally notched	13	31.7
Group II	12	29.3
Unilateral hearing loss	3	7.3
Unilateral hearing loss with a notch in the other ear	3	7.3
Bilateral hearing loss	6	14.7
Group III	1	2.4

Table 4. Analysis of pairs of variables (Chi-square).

Pairs of variables	p-value
Age x Rating audiometric	0.149
Use of PPE x Rating audiometric	0.793
Flight time daily x Classification audiometric	0.609
Contact with pesticide x Rating audiometric	0.088

* P <0.050 statistically significant.

Discussion

This study was limited to the absence of national literature and few studies related to international civil aviation, mainly in agricultural aviation, so we do most of the comparisons of findings with the literature related to NIHL within other areas of work.

According to the results of the study sample (n =41), the age ranged between 25 and 66 years, with a greater number of individuals between the ages of 31-40 years (n = 19), followed by 18-30 years (n = 9), thus constituting a young adult population in full professional activity. Other studies also report owning middle and highest concentration of workers within this age group (3, 7). Observing Table 6, we see that at all ages there is hearing loss, which is relatively homogeneous. Thus, we can infer that, in our sample, the age variable was not significant, since it correlated with the audiometric configuration there was no statistical significance (p= 0.149).

Weather Service showed that 26.8% of aviators (n=11) engaged in agricultural aviation 1 (one) to 5 years and 12.2% piloting 60-10 years, considered as a short exposure time. However, workers with 10 years of exposure can produce hearing loss installed at an early stage, but with irreversible damage (14). The largest group of individuals (31.7%) is agricultural pilots from 11 to 20 years of occupation , with a considerable time of exposure. It was possible to verify statistically significant dependence between the length of service with the average highs (OD: p = 0.030; LE: p = 0.010), indicating that pilots with greater length of employment have an average of high frequencies of greater value. This finding has also been found in studies by Lim et al (18), and consistent with the natural history of NIHL as to the aggravation of it, it kept the noise exposure (14).

An important factor in agricultural aviation is the time of daily exposure to noise, which found that 36% of pilots (n=15) fly 9-12 hours per day and 56.1% (23 individuals) work daily 5-8 hours. Although no statistically significant relationship was found between duration of daily flights audiometric configuration (p = 0.609), in Table 6 we can see that hearing losses are concentrated in the range of exposure time between 5 and 12 hours. We realized that in all groups are present, either unilateral or bilateral notch showing that noise can affect hearing even with the minimum exposure time. A curious fact is that the group you mentioned flying 5-8 hours per day is more affected by noise than the group who navigates between

Table 5. Analysis of the Spearman coefficient for pairs of variables.

Pairs of Variables	Rs	p value
Length of service x average acute OD	0.326	0.038 *
Length of service x average acute OE	0.399	0.010 *
Home auditory average acute OD	-0.044	0.786
Home audio x average acute OE	-0.047	0.771

* P <0.050 statistically significant.

Table 6. Distribution of variables in percentage related to the classification of the subgroups proposed by Fiorini (24).

Variable	LAN Bilateral	LAN c/ Ent Uni	LAN c/ Ent Bi	PAIR Uni	PAIR Uni+ Ent	PAIR Bilateral	Not PAIR
Age							
18 to 30 years	2,4	7,3	7,3	-	2,4	2,4	-
31 to 40 years	9,8	12,2	17,1	2,4	-	4,9	-
41 to 50 years	-	2,4	4,9	2,4	2,4	2,4	2,4
51 to 60 years	-	-	2,4	2,4	-	2,4	-
61 to 70 years	-	2,4	-	-	2,4	2,4	-
Daily flight hours							
2 to 4 hours	-	2,4	2,4	-	-	-	-
5 to 8 hours	9,8	12,2	12,2	7,3	4,9	9,8	-
9 to 12 hours	2,4	9,8	14,6	-	2,4	4,9	2,4
More than 12 hours	-	-	2,4	-	-	-	-
EPI Type							
Damper	-	10,3	10,3	2,6	2,6	7,7	2,6
Plug	5,1	2,6	5,1	-	-	-	-
Damper + plug	7,7	10,3	15,4	5,1	5,1	5,1	-
Noise supressor + plug	-	-	2,6	-	-	-	-

Legend: LAN -normal hearing thresholds; Ent Uni - Nick Unilateral; Ent Bi - Nick Bilateral; PAIR - Suggestive of Noise Induced Hearing loss; PAIR Uni+ Ent - Suggestive of Noise Induced Hearing Loss Unilateral Notch with the other ear, not PAIR - Hearing loss is not suggestive of Noise Induced Hearing Loss.

9-12 hours. However, this could be explained by the fact that in times of harvest, the number of flight hours per day increases, since the deadlines for completion of the applications are short and it is this period that the pilot has increased demand for agricultural labor . Thus, we noted the importance of checking the flight hours during this period. This factor is of concern because there is no legal consensus on limits daily / monthly flying in agricultural aviation. The law that prevails over all airmen is the Law 7.183/84 (25), which states that a single crew can fly nine hours and 30 minutes per day, with a maximum of 11 hours of daily work.

As for the planes, the three most widely used models (Ipanema Embraer 202, Embraer 201 Ipanema-A and 188B Cessna AG Truck) are single-engine airplanes, with an average of 300 horsepower (HP). The Embraer 201 Ipanema-A and model before it (models 201, 200 and 200-A), have their exhaust in the front side, aimed at the cockpit. The noise turns out to directly reach the *cockpit* at high intensities. Ipanema Embraer 202 models, 202-A and 188B Cessna AG Truck have their exhaust at the bottom of the plane to avoid the noise produced by it, directly reach the cabin of the aviator (26). Kiefer et al (23), did an analysis of two planes agricultural Rockwell Thrush SR2, and single engine of 600HP. The monitoring of noise these planes showed that the noise equivalent level (L eq) was one of 103dB (A) and 104dB (A). These figures exceed the tolerance limits set by the Regulatory Norm 15 of the Ministry of Labor (27) laying 85 dB for 8 hours of work. Thus, it is clear the importance of assessing the noise level of these aircraft in order to provide actual values for each plane and, as appropriate, consider proposals for prevention.

The Brazilian Aeronautical Regulation (RBHA) 137 (28) provides that any transaction aeroagrícola not be done without the crew using breathing mask to filter against inhalation of toxic products and helmet with anti-shock devices for visors and dampers noise. The use of PPE for hearing was confirmed in 95.1% of the pilots (n = 39), while 4.9% (n = 2) do not follow the legal determination. This law mentions only the use of dampers, but more than half the population (51.2%) used a combined use of dampers and plug insertion, and a positive information about the interest of hearing loss prevention. However, even with this measure, the hearing losses are still present (Table 6). This also occurred with the isolated use of the damper, which apparently was less effective than the previous measure. In all types of PPE was seen the presence of the notch, indicating that the attenuation may not be sufficient for the level of noise and / or time of exposure may be contributing to its development. Kiefer et al (23) studied the use of helmet for flight, and the level of noise reduction (NRR) of 8.3 dB. Compared to the noise level, concluded that the helmets alone will not provide sufficient protection to exposure during flights.

With respect to pesticides, 58.5% of drivers reported having contact with these products, a considerable number of individuals who are exposed to its harmful effects. The insecticides followed the herbicide, were the pesticides most often cited by people as similar to that found in other studies (21,22). According Monquero et al. (22), the pesticide poisoning can be acute or chronic. At first, symptoms are headaches, dizziness, diarrhea, weakness, impaired vision, stomach pains, drowsiness, salivation and / or excessive sweating and breathing difficulties. Already in the chronic effects can appear months or years after exposure. We tested the correlation between contact with the pesticide and audiometric classification, no statistically significant relationship was found. However, we found that there is a statistical trend, since the value of p (p = 0.088) was close to significance (p = 0.050). Therefore, we emphasize the need for further research about the effects of pesticide products on the hearing of this population, since exposure to ototoxic agents is disturbing.

Ordinance No. 19/98 (9) states that until the completion of audiometric, the employee must remain at rest hearing for at least 14 hours, which was followed by 70.7% of pilots (n = 29). Like 29.3% of fliers did not do due hearing rest, we found the average treble was influenced by time from home (Table 5), but no significant statistical significance (OD: p = 0.786; LE: p = 0.771) .

The buzz was the symptom of a broader reference otological searched among individuals who had those symptoms, accounting for 54.5% of the responses. Tinnitus related to the total number of pilots is equivalent to 29.3% while the value found greater than the study by Steinmetz et al. (18), which corresponded to 22%. The literature states that tinnitus is the first warning sign of exposure to sounds of high sound pressure levels and may be a symptom of the temporary threshold shift (10). To this end, the 12 airmen who reported tinnitus, half have normal hearing thresholds (four with bilateral notch setting and two with unilateral notch) and half with hearing loss suggestive of NIHL.

A statistically significant difference between average highs and lows from both ears (RE: p = 0.002; OE: p <0.001), together with the observation of symmetry of the average of such high frequencies (p = 0.237) constitute compatible with NIHL, for possessing characteristic drop in predominant frequency of 3000Hz, 4000Hz and 6000Hz and symmetrical hearing loss (9,10,20).

In the classification of hearing tests as Fiorini (24) found that 29.3% of agricultural pilots have hearing loss

suggestive of NIHL, numbering more than several studies in other occupational areas, but close to results found in pilots flying club (3) that showed 30 % of hearing loss suggestive of NIHL. Within the audiograms suggestive of NIHL (n = 12), half the subjects have bilateral hearing loss. We found normal in 68.3% of fliers, however, the most surprising is the number of audiograms slot configuration, representing 24.4% with unilateral notch and 31.7% with bilateral notch, totaling 56.1% of sample. Natural history of NIHL, it is known that these pilots tend to develop hearing loss with continued exposure (11,14).Summing the values of audiograms suggestive of NIHL with audiograms slot configuration, have a total of 85.4% of agricultural pilots who are affected by the effects of noise on hearing.This is an extremely important and should be considered in developing policies for the prevention of NIHL.

Conclusion

With this study we can conclude that agricultural aviators are actually exposed to the effects caused by noise. Such activity involves occupational contact with pesticide products, time of exposure to noise and also the level of noise itself. Although there is the use of PPE, hearing loss appeared in the sample. The proof is in the high frequency hearing loss suggestive of NIHL, and also by the appearance of setting notch in more than half the population.

We observed that age was not statistically significant when compared with the classification of audiometry, but how much longer the service, the greater the commitment of high frequencies. Tinnitus was the most prevalent symptom, affecting individuals with hearing loss and normal hearing.

This is an initial study in aviation agriculture. We hope that with this work, there is a greater orientation of health teams and work safety and health authorities of the pilot farm, either in the prevention of hearing loss and other risks that this population is exposed, whether in promoting health. For this, further studies are needed, and perhaps rethink the law itself of this type of aviation.

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