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SOUND EMISSION LEVEL IN SPINNING CLSSES AND THE INFLUENCE IN THE HEALTH OF TEACHERS

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ABSTRACT

Noise presents itself today as the most frequent physical agent in the workplace and its harmfulness is already proven by the literature. Among its main consequences are noise-induced hearing loss that can be caused by any type of excessive sound emission, including those used in Spinning classes. The objective of the present study was to evaluate the sound pressure levels in Spinning classes in Brasília-DF academies, as well as to identify the teacher's perception of their auditory condition. The Bruel & Kjaer 2250 sound pressure gauge was used to ensure the reliability of measurements. 43 teachers participated and the sound pressure levels were measured at 20 academies. The results indicate that 100% of the academies are working with values above the limits allowed by the current legislation (85dBA). Thus, the higher the weekly workload, the higher the maximum sound pressure level and the equivalent to which the teachers are exposed. Concerning the auditory perception of the teachers, (69.8%) they stated that they did not feel bothered by the loud sound. It is suggested that academies, teachers and students be guided to prevent possible hearing damage and to try to control the noise level in the classroom.

INTRODUCTION

Performing daily physical activity is important for a healthy life, which leads to a large number of people attending the academy environment in search of health and aesthetics. In this way, the image of the Physical Education professional emerges as an example of health and beauty aimed at the public of the academies, being in this professional that the students trust and look up to reach their goals (DA SILVA et al., 2009).

For the discussion about the physical and auditory health of the worker, especially the physical education teacher, it is necessary to understand the methodology of work that surrounds it. This is because, the injuries and damages caused to the health can be the realistic expression of the historical-social conflicts (LAURELL, 1981).

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However, how come we discuss health when as professional often exposes it in the workplace. Often the professional is under to a contract that guide him or sometimes attached to the common usage of a certain sports modality such as Spinning, where the music generates an intense sound volume and it is used as motivation for the practitioners (DA SILVA, et al., 2009).

This indicates that this kind of work from physical education teachers leads to a great physical exhaustion in consequence of the high noise in classes (MILANO, PALMA, ASSIS, 2007).

Music, however, is considered an indispensable part of the Spinning mode and very little has been discussed about it, is not uncommon for teachers in the area that believes that high sound improves student achievement in class.

In this context, in order to keep students motivated, several professionals use sound in high intensity, resulting in an unnecessary competition between them and the music itself, because to communicate properly with the students, they have to straining theirs vocal cords, potentially damaging themselves and also harming the health of the students.

In the research conducted by Deus and Duarte (1997), sound pressure levels in gymnastics classes in 14 academies in the city of Florianopolis where analyzed, it was verified that 86% of the academies were above the allowed limit. A questionnaire was applied to identify possible vocal and auditory complaints. The most apparent vocal complaint was voice loss after class. However, it was verified that the majority of teachers were young and practiced for less than 5 years, and the general audiometer profile suggests the beginning of an induced hearing loss process (HLP).

The period of exposure to noise is one of the determining causes for risks to health and hearing integrity. was established on June 8, 1978, through the Ordinance 3.214 of NR15 the Brazilian Occupational Safety standard, which determines the limits of tolerance for daily exposure to occupational noise according to the table below.

Table 1. Tolerance limits for continuous or intermittent noise

NOISE LEVEL dB(A)	MAXIMUM DAILY EXPOSURE PERMISSIBLE
85	8 hours
86	7 hours
87	6 hours
88	5 hours
89	4 hours and 30 minutes
90	4 hours
91	3 hours and 30 minutes
92	3 hours
93	2 hours and 40 minutes
94	2 hours and 15 minutes
95	2 hours
96	1 hours and 45 minutes
98	1 hours and 15 minutes
100	1 hours
102	45 minutes
104	35 minutes
105	30 minutes
106	25 minutes
108	20 minutes
110	15 minutes
112	10 minutes
114	8 minutes
115	7 minutes

Source: Adapted from ordinance 3214 of 08 June 1978- Ministry of Labor

According to the Pan American Health Organization (OPAS, 1983), it defined that noise above 85 dBA is harmful to the health of individuals.

The effects of noise range from transient changes to irreversible hearing loss. This variability depends on different factors such as: individual susceptibility, time of exposure to noise (the longer the exposure time, the greater the possibility of the individual, developing hearing impairment), the individual's age, heredity and factors such as tension, medication and smoke.

They can be of three types of induce hearing loss:

a. Temporary change of threshold;
b. Noise-induced hearing loss;
c. Acoustic trauma;

Temporary threshold change is a term that refers to a change in auditory sensitivity that is gradually restored after exposure and may or may not be accompanied by tinnitus and a plugged ear sensation.

Exposure to interrupted noise will produce less temporary change in threshold than exposure to continuous noise with lower sound pressure level (WARD, 1973). To produce temporary threshold change the continuous noise exposure should exceed 60 to 80 dBA.

HLP is associated with the destruction of the sensorial elements of hearing, being irreversible. HLP is progressive and at the beginning changes only the higher frequencies above 2000 HZ. This impairment occurs mainly in the frequency bands between 3000 and 6000 Hz (GALLO and GLORIC, 1964 et al., 1994).

HLP occurs when the subject is exposed to high intensity noise, over 85 dBA, for long periods of time, leading in most individuals to irreversible acoustic changes or commonly called permanent threshold changes.

Acoustic trauma occurs when the individual has sudden hearing loss after exposure to high-intensity noise, such as impact, explosions and shots (ASTETE, 1979).

Thus, the objective of the present study was to evaluate the sound pressure levels in Spinning classes in Brasília-DF academies, as well as to identify the teacher's perception of his / her auditory condition.

MATERIALS AND METHODS

Sample

Population

To enable volunteers to participate, the study was sent to the Ethics Committee - CEP - Centro Universitário de Brasília – UNICEUB and approved under the number CAAE: 67257917.40000.0023.

The sample was obtained in a randomized way and from the sample calculation with 95% confidence interval (CI), the academies located in the Plano Piloto, Brasília-DF. The classes were always chosen at night, 20 academies were analyzed, wich is considered the minimum necessary to provide a statistical power of 95% with a 5% alpha for analysis. After approval of the owners of the 20 chosen academies and teachers, the free and informed consent form was given to be signed by the 43 teachers. The teachers who accepted to participate in the research answered a questionnaire for Quality of Life Assessment of Workers Exposed to High Sound Pressure Level, the application of the questionnaire occurred in the Spinning room, and was applied by the researchers.

Data collection

Data collection was divided into two stages. First, the Sound Pressure Level was measured. In the second stage, a questionnaire was used to evaluate the Quality of Life of Workers Exposed to High Sound Pressure Level (AVILA, 2007).

Measurement Protocol

A team of 7 evaluators was trained for 30 days in a pilot study to collect data to ensure reproducibility and consistency of the data obtained.

This study adhered to to the protocols pre-established for measurement of the variables analyzed, which are described next.

Procedures and Instruments

The Bruel & Kjaer 2250 sound pressure gauge, class 1 was used to guarantee the reliability of the measurements. The pressure level was measured in dBA at the equivalent energy level (Leq), which can be characterized by the average acoustic energy for a given time (JHNSON et al., 2001). The measurements were made in two points: one near the teacher's hearing zone and another in the center of the room. At each point there were three measurements, depending on the phases of the lesson: warm-up, main part and closing. In addition, background noise was measured without class.

On average the classes lasted 50 minutes and all measurements were taken in classes at night and always at the same time. All classes had the same characteristics of 60% to 80% were dedicated to the main part and 10% to warm-up and closing.

For the application of the questionnaires, 43 teachers, aged between 21 and 54, were submitted, of which 13 were female and 30 were male, with a 1 to 40 years of experience, and a working up to sixty hours a week, with no previous history of auditory pathologies.

All evaluated teachers work in gymnasiums, of the Federal District, teaching Spinning classes, and all used songs during the class.

STATISTICAL ANALYSIS

Data was analyzed using SPSS software version 21 (SPSS Inc., Chicago, IL, USA). The descriptive analysis of the data was performed and expressed in mean and standard deviation. The normality of the data of each group was verified by the Shapiro-Wilk test.

The differences between men and women in age, working time, hours, and minimum, maximum and equivalent sound pressure were analyzed using the independent T test. The relationships between sound noise (maximum, minimum and equivalent sound pressure level) and age, working time, and weekly workload were investigated using the Pearson correlation test.

The median maximum sound pressure level was calculated through descriptive analysis and used as cutoff point in the determination of low (below median) and high (above median) exposure to noise.

The differences in age, working time and weekly workload among teachers in high and low noise exposure were analyzed using the independent T test. Frequency analysis was used to describe the results of the 11 questions contained in the questionnaire. To analyze the differences in working time and the weekly workload for each answer given to the questionnaire, using the Variance Analysis of a factor for questions 01, 03, 04, 05, 06, 07, 08, 09 and 10; and the independent T test for questions 02 and 11. To determine possible significant differences between each response analyzed through the anova of one factor, the post-hoc LSD was applied. The level of statistical significance adopted was $p < 0.05$.

Regarding the sound pressure levels, it was observed that the lower value was 64.5 dBA and the highest was 105.4 dBA. The mean values found were: 1- warm-up (mean = 69.4dBA); 2- main part (mean = 99.9 dBA); 3 part closing (average 67.2 dBA). The background noise averaged 64.8 dBA)). Statistical analysis showed significant differences ($p < 0.001$between mean background noise levels and class phases. Comparison between the mean values of each class stage also revealed significant differences: main part and background noise: $p < 0.001$, main part and warm-up: $p < 0.001$, main part and closing: $p < 0.001$, and warm-up and closing: $p < 0.05$.

Table 3 presents the data on the distribution of the number of academies according to the values of sound pressure. It is noticed that in any situation the average values are distributed in greater number in bands considered unhealthy.

Table. 4 presents the characterization of the sample with the mean values and standard deviations of the variables (sex, age, professional performance time and sound pressure levels), 43 individuals participated, of which 13 were women and 30 were men. Data on age, working time and workload of each gender are shown in table 3. There were no significant differences between men and women in age, working time or weekly workload ($p > 0.05$). Regarding the noise, the men had a maximum sound pressure level ($p = 0.016$) and equivalent ($p = 0.048$) significantly higher than the women.

VALUE ANALYSIS

A result of the present study was that 25% of the academies work with minimum values of 75 to 85 dBA, which is the limit value allowed by the Ministry of Labor standards (Table 1). It is noted that the sound pressure level of most of the academies was above the limits of acoustic comfort for indoor environments, according to the established by Standard NBR 10152/1987 (Brazilian Association of Technical Standards - ABNT) and above the limit of 85 dBA for 8 hours of daily exposure, established by Portaria 3214 of 1978 and Portaria n ° 19 of 09/04/98 (Brazilian Ministry of Labor).

Table 2. Sound Pressure Levels in Academies

Academy	**Maximum sound pressure level (Lmax) in dB**	**Minimum sound pressure level (L'Min) in dB**	**Equivalent sound pressure level (Leq) in dB**
1	96.5	72.51	86.83
2	100.74	67.2	92.06
3	97.06	65.41	85.66
4	93.34	70.52	84.98
5	100.9	66.36	86.43
6	99.26	64.58	84.12
7	92.01	68.59	80.68
8	104.48	64.21	92.28
9	103.17	63.95	91.39
10	105.48	65.21	93.28
11	98	74.01	88.33
12	102.24	68.7	93.56
13	98.56	66.91	87.16
14	94.84	72.02	86.48
15	102.4	67.86	87.93
16	100.76	66.08	85.62
17	95.01	71.59	83.68
18	98.71	75.29	87.38
19	93.42	70.87	82.95
20	100.81	77.9	89.38

Table 3. It was also observed that 100% of the academies worked with levels of 85 to 95 dBA, maximum values of the sound pressure levels that are above the limits established by the current legislation.

Table 3. Distribution of the number of academies studied according to sound pressure values.

Sound pressure values (dBA)	**Academy**	
	n	**%**
Average sound pressure value of the entire class		
≤80	0	0
80,1-85	5	25
85,1-90	10	50
90,1-95	5	25
≥95	0	0
Higher sound pressure values during class		
≤80	0	0
80,1-85	0	0
85,1-90	0	0
90,1-95	4	20
≥95	16	80
Lower sound pressure values during class		
≤80	20	100
80,1-85	0	0
85,1-90	0	0
90,1-95	0	0
≥95	0	0

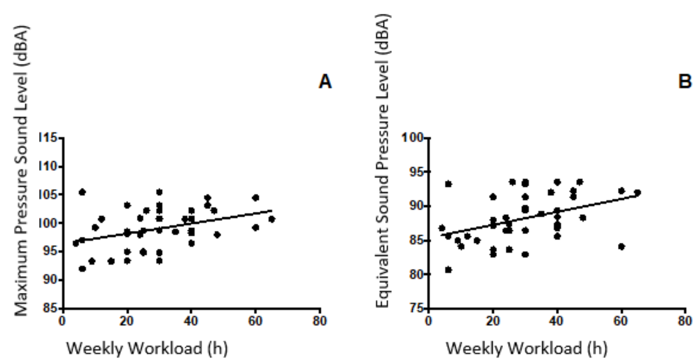
When the characteristics of the sample can be observed the data regarding the age, working time and time of each gender. There were no significant differences between men and women in age, working time or weekly workload ($p > 0.05$). Regarding the noise, the men had a maximum sound pressure level ($p = 0.016$) and equivalent ($p = 0.048$) significantly higher than the women.

Table 4. Sample characteristics expressed as mean ± standard deviation, and difference between genders.

Characteristics of the sample.	**Men (30)**	**women (13)**	p
Age (years)	35.67 ± 9.13	35.15 ± 6.88	0.857
Working Time (years)	10.93 ± 6.51	13.85 ± 10.07	0.271
Weekly Load (hours / week)	29.80 ± 15.30	30.46 ± 14.82	0.896
Maximum Sound Pressure Level (dB)	99.92 ± 3.49	97.15 ± 2.88	0.016
Minimum Sound Pressure Level (dB)	69.48 ± 5.30	72.8 ± 4.59	0.094
Equivalent Sound Pressure Level (dB)	88.93 ± 3.61	86.68 ± 2.69	0.048

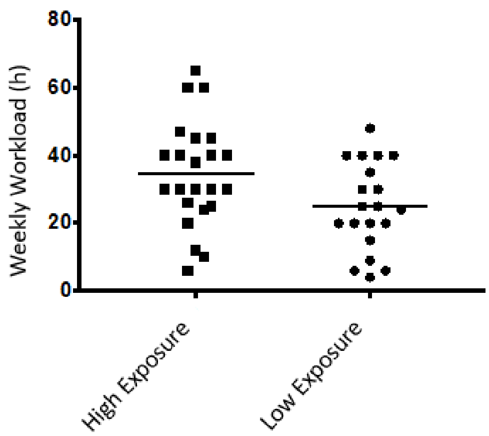
No significant correlations were found between maximum and minimum sound pressure levels, age and working time ($p > 0.05$). However, there was a significant correlation between the maximum sound pressure level and the weekly hourly load ($r = 0.375$; $p = 0.013$). There was also a significant correlation between the equivalent sound pressure level and the weekly workload ($r = 0.408$, $p = 0.007$). In general, the higher the week time load, the higher the maximum sound pressure level and the equivalent to which the teachers are exposed, as shown in Figure 1.

Figure 1. Relation between the weekly hourly load and the maximum and equivalent sound pressure levels.



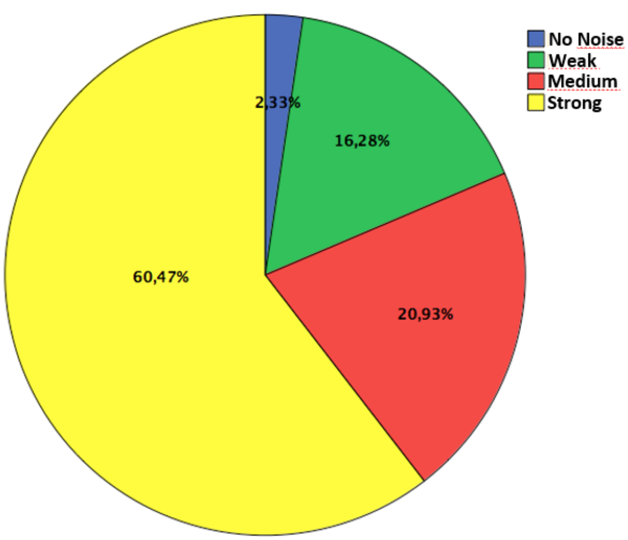
Twenty subjects had low exposure to noise (<98.71 dB), while 23 subjects had high exposure to noise (≥ 98.71 dB). There was no difference between the individuals who suffere d low and high exposure to noise at age ($p = 0.406$) and in working time ($p = 0.548$). However, individuals who were highly exposed to noise presented higher weekly workload compared to individuals who had low noise exposure (p = 0.034), as shown in Figure 2.

Figure 2 Weekly workload in groups that had low and high exposure to noise (p =0.034).



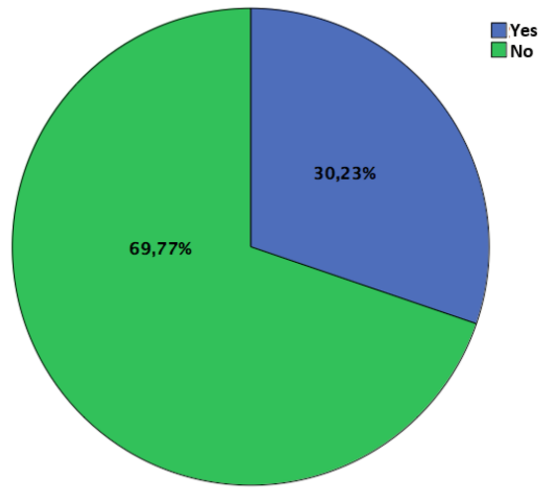
One individual (2.3%) stated that there was no noise in the workplace, 7 individuals (16.3%) reported having a weak noise in the workplace, 9 individuals (20.9%) stated that there was an average noise in the workplace of work, and 26 individuals (60.5%) reported a strong noise in the workplace (Figure 3). There was no significant difference in age (p = 0.904), working time (p = 0.685) and weekly hours (p = 0.995) among subjects who reported no noise or medium, workplace.

Figure 3. What is the intensity of noise in your workplace?



Thirteen individuals (30.2%) reported feeling uncomfortable with loud sound, while 30 individuals (69.8%) reported not feeling bothered by loud sound (Figure 4). There was no significant difference in age (p = 0.466), working time (p = 0.252), and weekly hours (p = 0.263) among individuals who reported feeling or not being bothered by loud sound.

Figure 4. Does the loud sound bother you?



DISCUSSION

The results of the present study point out that the sound levels generated in the amplified apparatuses of gymnastics gyms are much higher than those recommended by standards for acoustic comfort. Within this context, it was also possible to conclude that the sound pressure levels found are extremely high, exceeding those established by the Ministry of Labor Standards, since 100% of the academies worked with values ranging from 85 to 95 dBA, values above the allowable limit.

These data are similar to those obtained by Fusco (1989), who also observed values similar to these in 7 health centers in the city of São Paulo, and considered that these levels can lead not only to hearing injuries, but also to fatigue, malaise, irritation, intolerance and insomnia.

However, it must be taken into account that the professional can act in more than one class per day, which in each class is exposed around 30 to 40 minutes in the main part with an average value of 95 dBA, the time maximum daily exposure should be two hours, it is possible to assume that the physical education teacher is working in an unhealthy environment. Likewise, Lacerda et al. (2001) corroborates findings equivalent to the present study.

In another research on the sound pressure level, performed in 14 gymnasiums, Deus and Duarte (1997) found a variation of 75 to 104 dBA. Most teachers (35.7%) worked at levels higher than 85 dBA, considered above the tolerance limits established by the legislation in force. The authors also verified that the mean exposure to noise was 16.4 hours per week. In the study by Palma et al. (2009), it was observed that professionals were exposed, on average, to 10.7 hours of indoor cycling classes per week and 23.3 hours per week, adding all classes that require the use of music (indoor cycling, gymnastics, step, running class). However, in the present study it was observed that spinning class professionals are on average 30 hours a week adding all the classes that require the use of music.

On the other hand, Palma et al (2009) found, the research of gymnasiums, the value of 88 dBA for the warm-up phase. In the main part of the lesson the sound pressure levels were between 95 dBA. In the final phase of the class (closing) the noise decreased to 85 dBA. These findings, except for the warming phase and the final phase of the class, are similar to the present study.

Another important factor is the auditory perception, in which it was observed that 30.23% affirmed that there was a strong noise in the workplace and 69.77% stated they did not feel uncomfortable with the loud sound, the teachers showed to be accustomed to high levels of sound pressure, not caring about the damage that these levels can cause the body. The disregard or ignorance of the seriousness of the effects that prolonged exposure to high levels of sound brings to health, together with the inadequacy of the acoustic aspects of the gymnasium, cause an unhealthy environment for these professionals.

The consequences of noise are well reported in the literature Deus and Duarte (1997) observed that 21.4% of physical education teachers investigated had auditory discomfort after class; 78.6% auditory discomfort when subjected to intense sounds and 14.2% reported headache.

CONCLUSION

This research revealed that the great majority of the evaluated teachers already suffer from great hearing loss, since the high noise levels to which they are exposed do not cause any discomfort.

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