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Original Article

NOISE AND SLEEP QUALITY: STUDY AMONG PHYSICAL EDUCATION INSTRUCTORS

RUÍDO E QUALIDADE DO SONO: ESTUDO ENTRE INSTRUTORES DE EDUCAÇÃO FÍSICA

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RESUMO

Este estudo investigou a associação entre ruído e qualidade prejudicada do sono em 150 instrutores de educação física, em academias de musculação. Dois questionários foram aplicados: avaliação da qualidade subjetiva do sono e sobre variáveis explanatórias. A exposição ao ruído foi avaliada. Para a análise dos dados, utilizou-se a técnica de regressão logística não-condicional, para obter os valores das Razões de Chances (RC) das variáveis significativas. Dois modelos finais se destacaram. O primeiro apresentou as variáveis significativas: realização incorreta das refeições (RC = 2,58, IC 95% 1,08 a 6,02); cor da pele – preta ou parda (RC = 0,53; IC 95% 0,25 a 1,12) e exposição ao ruído acima ou igual a 80 dB(A) (RC = 1,90; IC95% 0,87 a 4,12). O segundo modelo apresentou as variáveis significativas: realização incorreta das refeições (RC = 2,35, IC 95% 0,1 a 5,56); nível de exposição padronizado acima ou igual a 80 dB (A) (RC = 2,03, IC 95% 0,92 a 4,47) e uso de medicamentos para depressão/ansiedade (RC = 0,26; IC95% 0,53 a 1,33). Esta pesquisa identificou as variáveis que se associaram significativamente com a qualidade do sono prejudicada, como a exposição ao ruído, contribuindo para a adoção de medidas preventivas.

Palavras-chave: Ruído. Epidemiologia ocupacional. Educação física.

ABSTRACT

This study investigated the association between noise and impaired sleep quality in 150 physical education instructors, in bodybuilding gyms. Two questionnaires were applied: evaluation of subjective sleep quality and analysis of explanatory variables. Noise exposure was analyzed. For the data analysis, was used the technique of non-conditional logistic regression, to obtain the values of the adjusted odds ratios (OR) of the significant variables. Two proper adjustment models stood out. The first model presented the significant variables: incorrect performance of the meals (OR = 2.58, 95% CI 1.08 to 6.02); skin color – black ou brown (OR = 0.53, 95% CI 0.25 to 1.12) and exposure to noise level above or equal to 80 dB(A) (OR = 1.90; 95% CI 0.87 to 4.12). The second model presented the significant variables: incorrect performance of the meals (OR = 2.35, 95% CI 0.1 to 5.56); exposure level standardized above or equal to 80 dB(A) (OR = 2.03, 95% CI 0.92 to 4.47) and use 0of drugs for depression/anxiety (OR = 0.26; 95% CI 0.53 to 1.33). This research identified the variables that were significantly associated with impaired sleep quality, as exposure to noise, contributing to the adoption of preventive measures.

Keywords: Noise. Occupational Epidemiology. Physical Education.

Introduction

Noise is present in the various spaces and situations of daily life, and can reach limits that pose risks to the health and quality of life of people, being considered one of the biggest environmental problems in the world, and a public health issue[1].

Implications for sleep are one of the major adverse health effects of noise[2], not only the exposure that occurs during sleep but also that which occurs during the day[3,4]. Changes caused by noise in the body during the waking state will negatively affect the state of sleep, causing stress and alteration of the biological rhythm, and may disturb sleep even after hours of exposure[5].

Noise, as a stressor, causes exciting short-term physiological responses. High levels of adrenaline, noradrenaline and cortisol are found in the body of individuals exposed to high levels of noise, which can alter sleep[6].

In workplaces such as gymnasiums, noise can impose on Physical Education instructors a daily life with different types and levels of noise, which are pointed out by several studies as a factor that negatively affects the performance, health and quality of these professionals[7].

This study is justified by the negative potential of noise in the triggering of diseases and injuries to workers' health, aiming to evaluate the association between noise and sleep quality in Physical Education professionals who act as bodybuilding instructors in gymnasiums in the microregion of Itajubá, Brazil.

Methods

Material and Methods

Study design and ethical aspects

It is a cross-sectional prevalence study, with a quantitative approach, carried out in the Itajubá-MG microregion. Regarding ethical procedures, this project observed standards and guidelines established in Resolution 466/2012 of the National Health Council[8], submitted to the Brazil Platform and sent to the Research Ethics Committee of the Medical School of Itajubá, having been approved on 04/15/2015 under the Number of Opinion: 1,025,019.

The main risk factor analyzed was chronic exposure to noise and the attribute of interest, or outcome, was sleep quality.

Characterization of the study area

The Itajubá microregion is a set of thirteen municipalities belonging to the South and Southwest mesoregion of Minas Gerais. The microregion has a total area of approximately 2,979,130 km² and a population of 189,193 inhabitants, and is composed of the following municipalities: Brazópolis 14,661 (7.7%), Consolação 1,727 (0.9%), Cristina 10,210 (5.4%), Delfim Moreira 7,971 (4.2%), Dom Viçoso 2,994 (1.6%), Itajubá 90,658 (47.9%), Maria da Fé 14,216 (7.5%), Marmelópolis 2,968 (1,6%), Paraisópolis 19,379 (10.2%), Piranguçu 5,217 (2.7%), Piranguinho 8,016 (4.2%), Virginia 8,623 (4.6%) and Wenceslau Braz, 2.553 (1.4%)[9].

Sampling

As reported by the Federal Council of Physical Education (CONFEF), there are 344 Physical Education professionals working in the micro-region of Itajubá, who represent the population of this study. The sample size was calculated considering that the maximum estimated prevalence of sleep disorders in Brazil is 10% among the adult population[10]. The calculation of the sample admitted a margin of error of 5% and a confidence level of 95%[11].

Thus, the sample size was 139 instructors. The value obtained was also increased by 10% for losses or refusals and 20% for confounding variables, resulting in a total of 184 instructors.

Noise exposure assessment

The evaluation procedure was performed using a sampling basis established by specialized literature and the sample size for the evaluation of the exposure to noise resulted in 29 procedures[12,13]. Instructors were selected randomly. The procedures adopted in the evaluations were based on the principles established by the Norms that regulate them[14,15].

A dosimeter, of the brand Instrutemp, model DOS-500 was used. The dosimetry was performed for a period of three hours, during the class time. The data collected in the field were analyzed to obtain the following quantities[15]: Dose (%), Exposure Level (EL), Normalized Exposure Level (NEL) and Weekly Exposure Level (WEL) represented by the Equations 1, 2, 3 and 4, respectively.

$$Dose = \left(\frac{T_e}{T_p}\right) \times 100[\%] \quad (1)$$

Where:
T_e = Noise exposure time;
T_p = Permitted noise exposure time.

$$EL = 10 \times log\left(\frac{480}{T_e} \times \frac{Dose}{100}\right) + 85\ dB(A) \quad (2)$$

Where:
EL = Exposure level, in dB(A);
Dose = Noise daily dose in %;
T_e = Exposure time, in minutes.

$$NEL = EL + 10 \times log\left(\frac{T_e}{480}\right)\ dB(A) \quad (2)$$

Where:
NEL = Normalized Exposure Level, in dB(A);
EL = Exposure level, in dB(A);
T_e= Noise exposure time, in minutes.

Data collection

The data collection procedure, which took place between May and August of 2015, was carried out through the application of two questionnaires, carried out by three people duly trained by the researcher, and by signing the Free and Informed Consent Form interviewed, in the work environment of the research participants.

180 questionnaires (each containing two separate sections) were applied to the sample. The first section included a structured questionnaire: Pittsburgh Sleep Quality Index - IQSP[16].

The validated version of this instrument was used in Portuguese[17]. The reliability of the IQSP was indicated by the Kappa-Weighted Coefficient (K = 0.81), whose value is considered a high intra-examiner agreement[18]. The second questionnaire was developed based on the bibliographical review, seeking to collect sociodemographic, health and work data, on occupational exposure to noise and on risk factors for sleep quality.

Data analysis

The description of the association between the dependent variable (sleep quality) and the explanatory variables was performed using the non-conditional multivariate logistic regression technique with the aid of the Epi-Info 3.5.1TM software[19]. This method offers the calculation of the Odds Ratio (OR), simultaneously controlling the other variables considered explanatory to avoid their interference in the results of the study[20].

Univariate analyzes were carried out in the multivariate model construction process, with a value of $p < 0.20$ based on the likelihood ratio test as input for the modeling process. In order to define the most appropriate model, stepwise-forward was used, including the variables in descending order of significance and excluding those non-significant ones that could interfere with the good fit of the model, analyzing the OR variations, confidence interval (95% CI), and significance levels of the models. The significance of the variables in

the final model was also verified by the same test, allowing the variables to remain with a value of $p \leq 0.05$[21].

The dependent variable analyzed in this study was of the dichotomous type, represented by sleep quality (good or bad). By means of this model, the dependent variable will be the probability of the affirmative or positive answer in the model, or the log of the odds (chance) of occurrence of the answers.

Categorical variables, which have more than two options of answers, were transformed into dummy variables for the analysis.

Results

Descriptive analysis of the sample

Of the 180 questionnaires applied, 30 (16.7%) were classified as losses and refusals. Thus, 150 questionnaires were answered correctly. A total of 92 men (61.3%) and 58 women (38.7%) participated in the study. The mean age was 29.0 ± 7.7 years, with a minimum age of 18 and a maximum of 59 years. They were declared black 13 (8.6%) of the participants, while married, 45 (30.0%). With regard to schooling, 53 (35.3%) of the participants did not have a college degree. Concerning smoking, only three (2.0%) of the participants were smokers, while 15 (10.0%) said they frequently or always drink alcohol.

The use of medication for depression or anxiety was reported by seven (4.7%) of those investigated. Drug users for hypertension and diabetes were only four (2.7%) and five (3.3%) of the participants, respectively.

Of the 150 instructors, 73 (48.7%) presented a Body Mass Index (BMI) above recommended, 63 (48.0%) in overweight and 10 (6.6%) entering the obesity index. Of the sample, 42 (28.0%) do irregular daily meals. The great majority, 134 (89.3%) of the participants, practice exercises often or always and the main practice time is the night shift, reported by 60 (40.0%) of the interviewees.

Food supplements are used by 61 (40.7%) instructors. Another 53 (35.3%) indicated that they frequently or always drink stimulant drinks such as coffee or tea. Satisfaction with the professional situation is present in 121 (80.7%) of the instructors. No extra occupational exposure to noise was recorded. All work only in the field of Physical Education, with bodybuilding as the main modality as they work. Regarding the seniority in the function, 79 (52.7%) instructors work between 1 and 5 years in the area.

The number of hours worked per day, which also corresponds to the time of exposure of professionals to occupational noise, indicated that 15 (10.0%) of the participants work up to a maximum of 4 hours per day, 83 (55.3%) of the participants work within the range of 4 to 8 hours per day and 52 (34.7%) work more than 8 hours per day. The vast majority of participants in this study reported never or rarely bothering about noise in the occupational environment, 56 (37.3%) and 54 (36.0%) respectively. The main reactions to noise in the work environment, related to stress symptoms, are distributed among irritation 41 (27.3%), low concentration 20 (13.3%), agitation 17 (11.4%) and headache 16 (10.7%).

Financial problems disturb the sleep of 67 (44.7%) of the instructors. Watching TV and browsing the internet disturb sleep of 50 (33.3%) and noise negatively interferes in sleep of 42 (28.0%). The subjective sleep quality assessment provided by the IQSP indicated that only 48 (32.0%) instructors had good sleep quality, of which 32 (66.7%) were men and 16 (33.3%) were women. The majority of the instructors (61.3%) presented poor sleep quality, 55 (59.8%) men and 37 (40.2%) women. The presence of sleep disturbances was indicated in 10 cases (6.7%), five (50.0%) men and five (50.0%) women. Thus, the study reveals a prevalence of 68.0% for poor sleep quality (bad - 61.3% and presence of sleep disturbances -

6.7%) among instructors, Physical Education professionals who work in the academies of the micro-region of Itajubá.

Noise exposure assessment

Regarding the analysis of the individual exposure to noise, the measurement procedures were carried out during the class hours and in the students' presence. The mean and the confidence interval of the samples were 80.0 ± 1.7 dB (A). This means that the sample size was sufficient, since the value found in the interval was less than the instrument error which is ± 2.0 dB (A).

30 measurement procedures were performed. The Exposure Level (NE) exceeded the limit of 85 dB(A) in four (13.3%) of the procedures performed. From the calculated mean of 80 dB(A), the NE during four hours of work reached 77 dB(A) and in eight hours, 80 dB(A) and finally at 12 hours, 82 dB(A) , considered acceptable for a working day equivalent to 8 hours. The explanatory variable "hours / working day", which can be translated into the Normalized Exposure Level (NEL), was significant for the occurrence of poor sleep quality.

Analysis of the variables

In the univariate analysis, the significant explanatory variables were: consumption of stimulant beverages - coffee / tea (p = 0.18); NEL (p = 0.17); skin color (p = 0.18); sleep disturbed by noise (p = 0.17); use of medication for depression / anxiety (p = 0.16); irregular meals (p = 0.08) - Table 1.

Table 1. Univariate (crude) analysis for explanatory variables that interfere with sleep quality

Variable	OR	CI 95%	*P*
Skin color: brown / black	0.61	0.29 – 1.25	0.18
Normalized exposure level (NEL) ≥ 80 dB(A)	1.67	0.79 – 3.53	0.17
Drug use for depression or anxiety	0.33	0.07 – 1.55	0.16
Irregular daily meals	2.07	0.90 – 4.78	0.08
Coffee or tea consumption	0.61	0.31 – 1.24	0.18
Considers that noise does not impair sleep	0.59	0.28 – 1.25	0.17

Source: Author

Considering that the average found for NE for the homogeneous group of instructors was 80 dB (A), the values calculated for the NEL value were categorized into two strata: below 80 dB (A), not exposed, and equal or higher than this value, exposed.

Regarding the multivariate analysis, one of the models that offered the best adjustment, although not strictly adequate to the established criteria, presented a p = 0.10, in which the explanatory variables remained: correct meals (p = 0.03) , skin color (p = 0.09) and normalized exposure level (p = 0.11) - Table 2.

Table 2. Multivariate (adjusted) analysis for explanatory variables that interfere with sleep quality, concerning the first model

Variable	OR	CI95%	*P*
Skin color: brown or black	0.53	0.25 – 1.20	0.09
NEN - Exposed	1.90	0.87 – 4.12	0.11
Irregular daily meals	2.58	1.08 – 6.20	0.03

Source: Author

The second adjustment model presented a value of p = 0.10, in which explanatory variables remained: Irregular daily meals (p = 0.05), normalized exposure level (p = 0.08), and medications for depression / anxiety (p = 0.10) - Table 3.

Table 3. Multivariate (adjusted) analysis for explanatory variables that interfere with sleep quality, concerning the second model

Variable	OR	CI95%	*P*
NEL – Exposed	2.03	0.92 – 4.47	0.08
Drug use for depression or anxiety	0.26	0.05 – 1.33	0.10
Irregular daily meals	2.35	0.10 – 5.56	0.05

Source: Author

Discussion

The daily irregularity of meals appears as a risk factor for the occurrence of poor sleep quality and represents a odds ratio of 2.58 times in relation to those who present regularity in the daily meals. It should be mentioned that in this study it was considered as a correct food routine, that which is based on the balance between quantity and variation of what is eaten, the quality of what is eaten, in observing the principles of food safety, and in the distribution of these meals over of the day[22].

The troubled work routine makes instructors opt for improvised diets, usually unhealthy or nutrient-poor. Some examples of foods that favor sleep quality are: milk and derivatives, where the amino acid tryptophan is active in the production of seretonin, a neurotransmitter responsible for relaxation and sleep inducer; complex carbohydrates, which promote increased levels of GABA (gamma-aminobutyric acid), an inhibitory neurotransmitter that reduces stress and helps the brain to better prepare for sleep[23].

Often, thanks to the high workload, the last meals are neglected or even performed in inadequate amounts or compositions. Excessive ingestion of food and liquids in the period before sleep can impair it[24].

There is, however, a shortage of studies that directly address the relationship of diet performed by workers during the day and their influence on sleep quality.

Multivariate analysis revealed that skin color (black or brown) is a protective factor. The odds of occurrence of poor sleep quality for instructors, who have declared themselves with this skin color, is only 0.53 times in relation to those who have delighted skin color as white.

There is not yet a consensus in the literature about the influence of skin color on sleep quality. The results of this study converge or diverge from some of the more recent research on the subject[25]. White individuals have a greater chance of having inadequate sleep patterns[26]. On the other hand, being black or brown appears as a determining factor for poor sleep[27,28].

What is observed in agreement in the literature is that the sleep / wake cycle suffers influences that go beyond the biological factors, also considering social, clinical and cultural

aspects that can interfere in the quantity and / or quality of the sleep, causing alterations of several organic functions and implications for human health[29].

Based on the results of the multivariate analysis, considering that the daily working hours are translated as exposure to noise, expressed by the normalized level in reference to eight hours, working exposed at a level greater than or equal to 80 dB (A) represents a odds ratio of 2.03 times for the occurrence of poor sleep quality when compared to the chance of subjects having an exposure with a lower value.

This result is in agreement with other studies which point out that exposure to noise during the day can cause stress and alteration of the biological rhythm and may impair sleep even after hours of exposure[3,4].

However, when studying the occurrence of this association in the literature, it is noted that even in the studies in which some association between these variables can be established, there are still questions about the late effects of noise on sleep.

Among the complaints related to exposure to occupational noise in gymnasiums, insomnia appears significantly In fact, there is a potential rationale for confirming the hypothesis that daytime noise acts as a stressor and disturbing potential of nighttime sleep[3, 6].

Taking medication for depression or anxiety appears as a protective factor for the occurrence of poor sleep quality and represents a odds ratio of 0.26 times for those who do not. According to the literature, the presence of mental disorders, such as anxiety, is accompanied by changes in sleep patterns, such as insomnia[30]. Antidepressants act on the central nervous system, interfering with the sleep-wake cycle and influencing on sleep architecture, which may improve the sleep quality [31,32].

Considering that an epidemiological study is affected by bias, it is interesting to discuss the present limitations[20].

Since sleep quality has been defined through subjective and retrospective analysis, therefore, information or memory bias should be valued. The results generated by the noise exposure assessment may have been influenced by the period in which it was performed (in winter there are fewer students). In addition, the actual level of sound exposure, represented by ambient music, may have been different from daily life during measurement, due to fears of legal action.

The explanatory variables for sleep quality were collected from questionnaires and from self-report, so the bias of the assessment should be considered.

Conclusions

This study investigated the association between noise exposure and sleep quality among Physical Education instructors. The average daily exposure to noise levels are below the recommended limits. However, exposure to noise behaved as a significant variable in sleep quality interference.

In addition to exposure to noise, irregularity of meals behave as a risk for the sleep quality, while the skin color declared as black or brown behave as a protection factor. In another model, irregular meals and exposure to noise remain as risk variables and the use of medication for depression or anxiety acts as a protective factor for poor sleep quality.

It is an initial approach that can be explored in greater depth the value of the sound exposure in the work environment and its association with sleep quality. It is recommended to conduct other studies that overcome the limitations found here, in order to generate more knowledge in the area of worker health epidemiology.

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