



ACADEMIC EXAMS
AT THE FACULTY OF MEDICINE OF THE UNIVERSITY OF LISBON
INSTITUTE OF ADVANCED TRAINING

Masters:

Sleep Sciences (2nd Edition)

Name of Student:

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Subject of Thesis:

Exposure to low frequency noise in an occupational environment vs. repercussions in sound quality.

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Very Good

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ABSTRACT

INTRODUCTION: Exposure to noise in occupational environment constitutes an important health risk factor for workers, being contemplated in the list of professional diseases. However this list, it is only contemplated deafness caused by audible sound, excluding the effects of noise in the lowest ranges.

The effects of long term exposure to noise of high intensity in the range of low frequencies (LFN, <500 Hz) led to the concept of "Vibroacoustic Syndrome" (J. The Guignard, 1992) characterized by the abnormal proliferation of extra-cellular matrices (collagen and elastin) in the absence of inflammatory process.

The LFN is not recognized as an agent of the disease, because it is an agent that "theoretically" does not exist. However, the excessive exposure, sometimes during years, has been causing complaints evident in some examinations that cannot be ignored, such as pericardial thickening, pulmonary fibrosis, reduced respiratory drive, nervous system disturbs, among others. These complaints are generally alterations of the behaviour, a reduction of the performance, loss of memory, gastrointestinal disturbance, difficulties of concentration, increase of irritability and sleep disturbance.

In an occupational point of view, the long permanence in the helicopters cockpit can result in the exposure to multiple professional risk factors, specifically the exposure to LFN that result from the mechanical mechanisms (rotor and propeller) of the helicopters.

OBJECTIVES: The objective of the present study was to verify if the effects of chronic exposure to LFN in an occupational environment during daytime exposure related to impulsive noise produced by the helicopters blade slap had consequences in nocturnal sleep architecture of military helicopter pilots, because of some complaints about their sleep (difficulty to fall asleep, frequently waking up, morning fatigue and headaches), since they are supposedly not exposed to this kind of noise in their homes.

MATERIAL AND METHODS: There were evaluated 15 male helicopters pilots (cases) of the Portuguese Armed Forces (AF) in active duty, males, with ages raging from 35 to 55 years, with more than 3500 hours of flight. Also from the AF were evaluated 15 individuals (controls) of the same age group and physical characteristics, not exposed in their workplace to the LFN,



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All subjects agreed to participate of free will in the study.

None of them were exposed to LFN sources or other kind of noise at their homes during the night. The subjects with audition problems, smokers, shift work, therapeutics that influences the sleep, ingestion of alcohol, obstructive sleep apnoea, cardiac, neuropsychiatry and respiratory disease were excluded. All the pilots who had flown the previous 24 hours of the sleep study and had conducted flights out of the National Air Space were also excluded.

All subjects carried out a polisomnography with capnography at the sleep laboratory, measured the respiratory drive with and without CO₂ stimulation and fulfilled the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS).

RESULTS: The pilots demonstrated a total time of sleep ($p = 0.011$) and sleep efficiency ($p=0.004$) lower than the control group, as well as a significant increase of the wakefulness time after sleep ONSET ($p=0.002$), arousals ($p=0.045$), changes of body position ($p=0.009$), changes of sleep stages ($p=0.041$) and PSQI score ($p=0.001$).

The pilots showed significant depression in their respiratory drive with CO₂ stimulation ($p=0.001$) in comparison to the controls. However there was no relation in the appearance of central respiratory events during the nocturnal period. There are no significant differences for the total recording time, total sleep period, proportion of the different stages of sleep and latencies, as well as the ESS and biometric data.

Apart from the earlier sleep complaints indicated by the pilots, they also referred in the PSQI, frequent back pain as one of the situations that disturbed their sleep, being the correlation moderately positive.

CONCLUSIONS: Helicopter pilots exposed to occupational LFN during daytime flight show significant changes in nocturnal sleep architecture and increased subjective complaints. This study aims to raise awareness to the damage caused by this kind of noise: the mechanic stress due to whole body vibration, the high frequency of low back pain and the stress associated with the high risk missions. The present study does not differentiate among the foreseen pathogenic mechanisms.

A larger study or different methodologies are required to confirm these findings.

Key words: low frequency noise, sleep architecture, helicopter pilots, pains back