Full length article

# Excess weight in regular aviation pilots associated with work and sleep characteristics☆

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## ARTICLE INFO

## ABSTRACT

*Objective:* To identify the prevalence and associated factors of overweight and obesity in Brazilian commercial airline pilots.

Methods

An observational, cross-sectional study involving 1198 Brazilian commercial airline pilots with a sampling power > 80% (ß=20%) and confidence level of 95% (α=5%) was carried out. The pilots completed an on-line questionnaire collecting data on sociodemographics, work, health, lifestyle and sleep. Poisson regression, with robust variance (stepwise forward technique), was employed to analyze the factors associated with excess weight (overweight and obesity). The models were adjusted for the variables age, marital status and education. The data were analyzed using the STATA 12.0 program.

*Results:* The prevalence of overweight among the pilots was 53.7% and of obesity was 14.6%. The probability of being overweight was highest among pilots working night shifts for 6–10 years and that had difficulty relaxing after work, where perceived morningness was a protective factor. Risk factors for obesity included working night-shifts for 6–10 years, having difficulty relaxing after work, sleeping < 6 h on days off, having other diagnosed diseases, and practicing < 150 min/week of physical exercise.

*Conclusion:* It was concluded that the prevalence of overweight and obesity among the commercial airline pilots was high and represents a public health problem in this population. Excess weight was associated with time working night-shifts, difficulty relaxing after work, inadequate sleep on days off, having other chronic diseases, and physical inactivity. In this context, nutritional status can be regarded as the result of dynamic and complex interactions promoted by occupational, sleep and health factors.

## 1. Introduction

Obesity is a public health problem, given the elevated risk of morbi-mortality [1]. It constitutes a global problem that has reached epidemic proportions worldwide [2]. Besides the numerous consequences for physical and mental health, obesity represents a financial burden for public expenditure [3]. Among the known causes leading to overweight, such as changes in lifestyle (irregular meal times and physical inactivity) and food standard (food easy to prepare and highly caloric, i.e. fast-food), organizational factors also have it has been recognized as an important cause of obesity among workers [4,5]. Generally, pilots are subject to a host of adverse working conditions such as irregular and long work shifts and transmeridian flights. These adversities faced by pilots have a significant impact on rest and sleep, factors that can have deleterious effects on their health, including metabolic problems such as excess weight [2,6,7].

Circadian disruption, a consequence of shift work, has significant effects on regulation of body weight and on the ratio of leptin/ghrelin, hormones controlling appetite, and is thus a factor causing an imbalance in eating behavior. In summary, the disturbances caused by changes in sleep and rest times influence appetite, satiety and consequently food intake, promoting weight gain irrespective of physical activity [2,5,8,9,10].

A number of studies to determine which occupational characteristics are risk factors for excess weight and the deleterious effects of work organization on workers´ health have been proposed [3,4]. Given the current dearth of data on excess weight in Brazilian commercial airline pilots, as well as on associated risk factors, the objective of the present study was to identify the prevalence and associated factors of overweight and obesity.

## 2. Methods

An observational, cross-sectional investigation based on data derived from the study called "Assessment of chronic fatigue in Brazilian pilots" [11], was carried out. The study population comprised 2350 airline pilots, members of the Brazilian Association of Civil Aviation Pilots (ABRAPAC). Of this total, 1234 agreed to take part in the present investigation, representing 52.5% of the original study cohort. Executive, cargo and air-taxi aviation pilots were excluded, as were female pilots, owing to their small number and the biological difference in the study outcome, giving a final study sample of 1198 pilots. Initially the sample size was calculated to meet the objectives of the research "Chronic fatigue, working conditions and health of Brazilian pilots" (MARQUEZE et al., 2014[1]). For the present study, the statistical power of the sample was calculated a posteriori. The sample power of the present study was superior to 80% (ß =20%) and 95% confidence level (α=5%), having as parameter the prevalence of obesity of the sample analyzed (14.6%). Sample power was calculated using the G*Power 3.1.4 program.

Data collection was performed by means of an on-line questionnaire applied between October 2013 and March 2014. The dependent variables were overweight and obesity, where these were obtained by calculating Body Mass Index (BMI) based on self-reported body mass and height of the pilots, measures which, according to Dekkers et al. [12], are valid for cross-sectional, epidemiological studies. BMI was calculated as proposed by the World Health Organization [13]. The scores obtained were categorized into: Normal (18.50–24.99 kg m [2]), Overweight (25.00–29.99 kg m [2]) and Obesity (≥30.00 kgm$^2$) [14]. According Santos and Sichieri [15], BMI represents a good indicator of nutritional status.

The independent variables were sociodemographic characteristics (age, marital status and education); work characteristics (flight route, work shift: day or irregular, time working as pilot, time working night-shifts, average monthly flying hours, maximum number of consecutive work days, maximum number of consecutive work nights, start time of morning shift, perceived level of fatigue); health and lifestyle characteristics (smoking – this variable was assessed by a single question – consumption of alcoholic beverages or otherwise with yes/no options, physical activity – assessed by a single question on weekly physical activity time, categorized as ≥150 min/week or < 150 min/week). Level of physical activity was categorized based on the recommendations established by the Centers for Disease Control and Prevention (CDCP) and the American College of Sports Medicine (ACSM) [16], and subsequently by the World Health Organization (WHO) [17]; diagnosed diseases - this question was taken from the Work Ability Index (WAI) [18] and dichotomized into yes or no, being classified as yes for those reporting a clinically-diagnosed disease; sleep characteristics – quality of sleep indexes (good or poor), problems awaking (yes or no) and of drowsiness/sleepiness (yes or no). These indexes were obtained using the Karolinska Sleep Questionnaire – KSQ [19]. Perceived adequate sleep was also assessed by a single question adapted from the KSQ [19] and dichotomized as yes or no, sleep duration after night and day shifts in hours, categorized into > 8 h, 6–8 h and < 6 h, sleep duration during days off in hours, categorized into > 8 h, 6–8 h and < 6 h, perceived sleepiness/drowsiness – assessed by a single question and categorized into never or rarely, sometimes, often or always, difficulty relaxing after work – assessed by a single question dichotomized as yes or no, need for recovery after work – using the scale of Veldhoven and Broersen [20] with scores ranging from 0 to 100 points proportional to the need for recovery. The score obtained was categorized based on the tercile and classified into less, moderate or

greater need for recovery after work, perceived chronotype – assessed by a single question adapted from the KSQ [19], categorized into intermediate, morningness or extreme morningness, eveningness or extreme eveningness.

The Chi-squared and Fisher's exact hypotheses tests were used for comparing proportions. Poisson regression with robust variance was employed to analyze the factors associated with excess weight (overweight and obesity), allowing identification of both risk and protective factors in qualitative variables having a high prevalence ( > 10%) with lower bias in prevalence ratios [21].

Based on the results of the hypotheses tests, independent variables with p < 0.20 were tested on the multiple Poisson regression model in increasing order of statistical significance (stepwise forward technique). The models were adjusted for the variables age, marital status and education. For all tests, a "p" value of < 0.05 was considered significant. Data were analyzed using the STATA 12.0 program (Stata corp, Texas, USA).

The ethical issues related to research in human beings were duly respected, and the project was approved by the Research Ethics Committee of the Federal Institute of Education, Science and Technology of São Paulo (protocol number 625158).

## 3. Results

The pilots that participated in the study were all male and had a mean age of 39.2 years (SD=9.8 years), range 21–67 years. Mean time working in the profession was 15.3 years (SD=10.1) and in the present company was 5.9 years (SD=4.8 years). The mean monthly flying hours reported was 65.4 h (SD=9.6 h) and mean time off was 9.2 days (SD=1.4 days). The mean work day duration was 8.8 h (SD=1.4 h) for the morning shift, 8.0 h (SD=1.7 h) for the evening shift and 7.6 h (SD=6.5 h) for the night shift.

Regarding Body Mass Index (BMI) of the pilots, the prevalence of overweight was 53.7% and of obesity was 14.6%.

A large proportion of pilots who had a partner (88.5%) (p < 0.01), were aged ≥39 years (52.2%) (p < 0.01), had worked in the profession for ≥11 years (63.9%) (p < 0.01), worked night-shifts in the profession for ≥6 years (29.6%) (p=0.02), had diagnosed diseases (48.5%) (p < 0.01) and difficulty relaxing after work (50.3%) (p=0.04) were overweight.

On the bivariate model, having diagnosed diseases, sleeping < 6 h on days off, working as a pilot for > 10 years, working the night-shift for ≥16 years, having sleepiness often or always and difficulty relaxing, were associated with overweight (Table 1).

On the adjusted multiple model, working night shifts for 6–10 years and having difficulty relaxing continued to be associated with overweight, where perceived morningness was a protective factor based on the inter-relationship of the above-cited independent variables (Table 1).

The majority of obese pilots were aged ≥39 years (p < 0.01), had a partner (a) (p < 0.01), secondary education or below (p=0.04), worked in the profession for ≥21 years (p < 0.01) and on night-shifts for ≥6 years (p=0.01), practiced ≤150 min of weekly physical activity (p < 0.01), had diagnosed diseases (p < 0.01), ≤6 h of sleep during days off (p=0.01) and difficulty relaxing after work (p < 0.01). There was also a tendency for a greater proportion of pilots with sleepiness to be obese than eutrophic (p=0.06).

On bivariate analysis, sleepiness, < 150 min of weekly physical exercise, diagnosed diseases, sleeping < 6 h on days off, working ≥21 years as a pilot, working for 6–10 years and ≥16 years on night-shifts, and difficulty relaxing after work, were associated with obesity (Table 2).

On the adjusted multiple model, < 150 min of weekly physical activity, diagnosed diseases, inadequate sleep during days off, working 6–10 years on night-shifts, and difficulty relaxing after work were associated with obesity (Table 2).

[1] Marqueze EC, Diniz DHMD, Nicola AC. Fadiga crônica, condições de trabalho e saúde em pilotos brasileiros. Associação Brasileira de Pilotos da Aviação Civil - ABRAPAC, 2014. Disponível em: http://www.pilotos.org.br/safety/2287-pesquisa-de-fadiga-veja-o-relatorio-final.