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# Weight gain in public hospital workers: a retrospective cohort study

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**Abstract** *This study assessed changes in the nutrition profile of public hospital workers over a period of three decades and the association between nutritional status and occupational factors. A retrospective cohort study was conducted with staff taken on in 1980, 1990, and 2000 still working in the hospital in 2013. The following data was obtained from staff records: sociodemographic characteristics; and body weight and height, recorded during pre-employment and periodic medical examinations. The latter was used to calculate body mass index (BMI).The final sample consisted of 386 workers (76.4% women and 88.1% white) with a mean age of 29.3 ± 7.3 years. Mean body weight and BMI at admission were highest in the 2000 cohort (W = 66.3 ± 12.5kg; BMI = 21.3 ± 2.5 kg/m²), compared to 1980 (W = 56.7 ± 10.2 kg; BMI = 21.3 ± 2.5 kg/m²)and 1990 (W = 62.2 ± 11.5 kg; BMI = 22.9 ± 3.3 kg/m²) cohorts. Variation in weight and BMI between the pre-employment examination and final periodic examination was highest in the 2000 cohort. When stratified by sex, this difference in variation was observed only in men. No association was found between variation in body weight and BMI and work shift and occupation. The increase in weight and BMI reflects the nutritional transition in Brazil, underscoring the need for nutritional surveillance and the implementation of health education programs directed at staff.*

**Key words** *Cohort study, Weight gain, Nutritional status, Occupational health*

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## Introduction

Obesity and overweight has grown at an alarming rate in recent decades around the world across all population groups, regardless of ethnicity, age, and socioeconomic status, and currently present a major public health problem of epidemic proportions[1]. Excess weight significantly increases the risk of developing debilitating diseases with high social cost, such as type 2 diabetes[2], hypertension, and cardiovascular diseases[3].

Global epidemiological data shows that the worldwide prevalence of obesity nearly tripled between 1975 and 2016. More than 1.9 billion adults aged 18 years and older were overweight in 2016. Of these, 650 million were obese[4]. It is estimated that 38% of the world's adult population will be overweight and 20% obese by the year 2030[5].

According to Brazil's 2008-2009 Family Budget Survey (*Pesquisa de Orçamentos Familiares* - POF) involving over 188,000 people, around 50% of the adult population are overweight, while 12.5% of men and 16.9% of women were obese. In the last 34 years, the prevalence of overweight among adults had increased from18.5% to 50.1% in men, and from 28.7% to 48% in women[6]. Data from the 2015 VIGITEL survey showed that the national prevalence of overweight was 53.9% and that it was higher among men (57.6%,compared to 50.8% in women). The findings also showed a positive relationship between age and overweight and an inverse relationship between level of education and overweight among women[7].

This picture is no different in the workplace, with one study involving workers from various countries reporting a prevalence of overweight of 28%[8]. Studies conducted in Brazil have reported prevalence rates ranging from 36% among public employees at a University[9] to 53% among industrial workers[10], 45.4% in bank workers[11], and 44.4% among local government staff[12].

Although the relationship between work characteristics and weight gain is well-known[10,12], further research and new approaches are required to identify occupational vulnerabilities in specific groups of workers. Occupational health surveillance should be continuous and capable of describing the health profile of different occupations, encompassing health situation analysis and the characterization of work and of socioeconomic and environmental profiles[13]. In view of the above, the present study assessed changes over the last three decades in the nutrition profile of workers from a public hospital in Porto Alegre, Brazil and the association between nutritional status and occupation and work shift.

## Methods

A retrospective cohort study was conducted with workers from a public hospital in Porto Alegre, Brazil with 5,070 staff. The sample consisted of all staff taken on in 1980, 1990, and 2000 (229, 474, and 329, respectively) and still working in the hospital in 2013.At the time of data collection, the number and percentage of staff taken on in 1980, 1990, 2000 and still working in the hospital in 2013was 86 (37.6%), 212 (44.7%), and 164 (49.4%), respectively.

The following data was taken from staff records: sociodemographic characteristics (skin color, gender, age, occupation, and work shift) and body weight and height, measured and recorded by the occupational physician during the pre-employment and periodic medical examinations. Workers whose staff records were incomplete and did not show all body weight and height measurements from the pre-employment medical examination and/or periodic medical examinations were excluded. The final sample consisted of 386 workers (68 from 1980, 175 from 1990, and 143 from 2000).

Skin color was self-reported as either "white" or "non-white" and work shift was classified as "day shift" (those who work in the morning and/or afternoon) or "night shift" (those who work at night and on-call shift staff). Occupation was classified as "care staff", for staff whose work involved patient contact, and "administrative staff", for other staff.

Nutritional status was assessed using the body mass index (BMI),based on weight in kilograms divided by height in meters squared and classified according to the following cut-off points proposed by the World Health Organization[2]: $< 18.5$ kg/m², underweight; between 18.5 and 24.9 kg/m², healthy weight; between 25 and 29.9 kg/m², overweight; and $\geq 30$ Kg/m², obese. Weight gain per decade was also calculated for each sample member.

The study protocol was approved by the Ethics Committee of the Grupo Hospitalar Conceição.

### Statistical analysis

A descriptive analysis of the distribution of the variables was conducted using the Kolmog-

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orov-Smirnov normality test. The comparison of the continuous variables was conducted using ANOVA or the Kruska-Wallis test, depending on the distribution of the variables. Post hoc analyses were carried out using Tukey's or Dunn's test. The categorical variables were compared using the Chi-squared test. BMI and body weight at each pre-employment and periodic examination was compared using the general linear models for repeated measures. Post hoc analyses were carried out using Tukey's test. Levene's test was used to test for homoscedasticity (the equality of variances).

Student's t-test and the Mann-Whitney test were used for the comparison of the study variables according to gender, work shift, and occupation, respecting the normality of the continuous variables. The categorical variables were compared using the Chi-squared test.

The results were expressed as mean ± standard deviation for parametric quantitative variables, median and interquartile range (P25-P75) for non-parametric quantitative variables, and absolute and relative frequency for categorical variables. Statistical analysis was carried out using the software package SPSS 18.0®. A significance level of 0.05 was adopted.

## Results

### General sample characteristics

The results show that 76.4% of the workers were women and 88.1% white. The mean age of the workers when they started working at the hospital was 29.31 ± 7.31 years, while mean weight and BMI were 62.76 ± 12.13 kg 23.08 ± 3.45 kg/m², respectively.

Table 1 shows the general characteristics of the workers by year of entry. The results show that body weight and BMI upon entry is significantly higher in each successive cohort No statistically significant difference was found between thecohortsin relation to gender, skin color, and occupation no one difference between groups was observed.

### Variation in body weight and BMI between the pre-employment medical examination and last periodic medical examination of 2010

The 1980,1990, and 2000 cohorts underwent six, four, and two periodic medical examinations, respectively, besides the pre-employment examination. Table 2 shows that there was significant difference in variation in body weight and BMI between the pre-employment examination and last periodic examination between the three cohorts.

The 1980 cohort gained a mean of 12.5 (6.3 - 18.5) kg between the pre-employment examination and the last periodic examination (equivalent to 4.2 kg/10 years), while the 1990 cohort gained 7.0 (-5.9 - 19.0) kg (equivalent to 3.5 kg/10 years), and the2000 cohort gained 7.0 (2.5 - 12.0) kg ($p < 0.001$). BMI varied 4.63 (2.47 - 6.89) kg/m² between the pre-employment examination and the last periodic examination inthe1980 cohort, 2.41 (-1.89 - 8.29) kg/m² in 1990 cohort, and 2.59 (0.92 - 4.44) kg/m² in the 2000 cohort ($p < 0.001$).

Prevalence of underweight at entry was significantly higher in the 1980 cohort (14.7%), compared to in the 1990 (5.1%) and 2000 (1.4%) cohorts ($p < 0.001$). There was no significant difference in prevalence of healthy weight at entry between the 1980 (73.5%) and 1990 (70.9%) cohorts. However, prevalence was significantly higher in the 2000 cohort (58.7%) ($p < 0.001$). Prevalence of obesity at entry was zero in the 1980 cohort, compared to 4% and 5.6% in the 1990 and 2000 cohorts, respectively ($p = 0.143$). Prevalence of overweight at entry was significantly higher in the 2000 cohort (33.6%), compared to 1980 (11.8%) and 1990 (18.9%) cohorts($p < 0.001$).

The prevalence of healthy weight (1980 = 38.2%, 1990 = 41.7%, and 2000 = 33.6%; $p = 0.411$) and obesity (1980 = 20.6%, 1990 = 24.6%, and 2000 = 23.8%; $p = 0.751$) were not different between groups at the last periodic examination. There was little difference in the frequency of overweight at the last periodic examination between the 1980 and 2000 cohorts (39.7% compared to 37.8%). However, there was a difference between these groups and the 1990 cohort, where frequency was 24.6% ($p = 0.012$). Finally, the frequency of underweight in the 1980, 1990, and2000 cohorts was 1.5%, 7.4%,and 0.7%, respectively ($p = 0.005$).

### Body weight and BMI by work shift and occupation

Table 3 shows that no statistically significant difference in body weight and BMI was found between the day shift and night shift groups and gender, skin color, and age groups.

**Table 1.** General characteristics of the workers by year of hospital admission (Porto Alegre, Brazil 2017).

| | 1980 (n = 68) | 1990 (n = 175) | 2000 (n = 143) | Valor de P |
|---|---|---|---|---|
| Age (years) | 24.76±4.36a | 28.26±6.21b | 32.81±8.07c | <0.001[1] |
| Gender (Female) | 58 (85.3%) | 125 (71.5%) | 109 (76.2%) | 0.166[2] |
| Skin color (White) | 61 (89.7%) | 153 (87.42%) | 126 (87.5%) | 0.167[2] |
| Shift (Day) | 37 (54.4%) | 123 (70.3%) | 105 (73.4%) | 0.017[1] |
| Occupation | | | | |
| Care staff | 51 (75%) | 106 (60.6%) | 92 (64.3%) | 0.187[2] |
| Administrative staff | 17 (25%) | 69 (39.4%) | 51 (35.7%) | |
| Weight (Kg) | 56.68±10.25[a] | 62.22±11.48[b] | 66.31±12.55[c] | <0.001[1] |
| BMI (Kg/m²) | 21.30±2.52[a] | 22.86±3.28[b] | 24.19±3.64[c] | <0.001[1] |

BMI = body mass index. [1] ANOVA (post hoc analysis carried out using Tukey's test with significant differences represented by superscript letters) [2] Chi-squared test (residual analysis with significant differences represented by superscript letters). Data presented as mean ± standard deviation or number and percentage of workers with the characteristic.

**Table 2.** Variation of body weight and BMI of the workers from decade to decade by year of entry (Porto Alegre, Brazil 2017).

| | 1980 n = 68 | 1990 n = 173 | 2000 n = 139 | Valor de p[1] |
|---|---|---|---|---|
| Δ weight(kg) | | | | |
| Total | 4.17 (2.08 – 6.17)[a] | 3.50 (-2.95 – 9.50)[a,b] | 7.00 (2.50 – 12.00)[c] | < 0.001 |
| Women | 3.83 (2.00 – 5.83) | 4.23 (-1.00 – 11.13) | 5.00 (2.00 – 10.00) | 0.199 |
| Men | 5.50 (2.25 – 6.33)[a] | -0.25 (-6.00 – 7.25)[a,b] | 9.00 (5.00 – 14.00)[a,c] | 0.012 |
| Δ BMI (kg/m²) | | | | |
| Total | 1.54 (0.82 – 2.30)[a] | 1.21 (.0.94 – 4.15)[a,b] | 2.60 (0.92 – 4.44)[a,c] | < 0.001 |
| Women | 1.47 (0.80– 2.34)[a] | 1.01 (-0.74 – 4.12)[a] | 2.08 (0.77 – 4.05)[a] | 0.112 |
| Men | 1.64 (0.79 – 2.10)[a] | 1.41 (-1.69 – 4.45)[a,b] | 3.09 (1.68 – 5.00)[a,c] | 0.019 |

BMI = body mass index. [1] The Kruska-Wallis test. Post-hoc analysis conducted using Dunn's test; $p < 0.05$: superscript letters indicate significant differences between groups. Data presented as median and interquartile range (P25 – P75).

Table 4 shows that the proportion of male administrative staff is greater than the proportion of male care staff. Furthermore, the body weight of administrative staff is greater than that of care staff in the pre-employment medical examination. However, this difference is not maintained in the last periodic examination.

## Discussion

The findings of this retrospective cohort study show that body weight and BMI at entry was lower in the1980 cohort in comparison to the 1990 and 2000 cohorts. Weight increased at a crescent rate and variation in weight and BMI between successive decades was greatest in the 2000 cohort. Work shift and occupation were not determining factors that account for differences in weight and BMI among workers. The increase in weight and BMI over the last three decades reflects the general increase in overweight and obesity in Brazil[6,7] in step with global trends[14].

Studies in Brazil have reported different prevalence rates of overweight and obesity among hospital workers, ranging from 65.6% in a pre-hospital care service in Salvador[15], to 63.9% in a university hospital in Londrina[16]and 53.3% in a private general hospital in São Paulo[17]. Another study with nursing staff working in intensive and emergency care units reported prevalence rates of overweight and obesity of 37.8% and 31.1%, respectively[18].

Differences in the variation in body weight were also found by a study involving 1,341 men and women in Florianópolis, which reported mean weight gain of 10.4 ± 9.3 kg in women and 11.1 ± 9.1 kg in men over a period of 12 years[19].

**Table 3.** Characteristics of workers by work shift (Porto Alegre, Brazil 2017).

| | Day shift (n = 265) | Night shift (n = 121) | P-value |
|---|---|---|---|
| Age (years) | 29.43 ± 7.57 | 29.04 ± 6.73 | 0,620[1] |
| Gender (Female) | 76.2% | 73.6% | 0,356[2] |
| Skin color (White) | 72.1% | 66.9% | 0,183[2] |
| Weight(kg) | | | |
| Pre-employment examination | 63.11 ± 12.07 | 61.96 ± 12.27 | 0,388[1] |
| Final periodic examination | 71.76 ± 14.99 | 71.41 ± 14.95 | 0,835[1] |
| BMI (kg/m²) | | | |
| Pre-employment examination | 23.17 ± 3.55 | 22.86 ± 3.2 | 0,411[1] |
| Final periodic examination | 26.5 ± 5.46 | 26.49 ± 5.56 | 0,985[1] |
| Classification of BMI | | | |
| Pre-employment examination | | | |
| Underweight | 5.3% | 4.1% | 0,488[2] |
| Healthy weight | 66.4% | 69.4% | |
| Overweight | 22.6% | 24% | |
| Obese | 5.7% | 2.5% | |
| Final periodic examination | | | |
| Underweight | 3.8% | 4.1% | 0,926[2] |
| Healthy weight | 37.4% | 39.7% | |
| Overweight | 31.7% | 33.1% | |
| Obese | 24.5% | 21.5% | |

BMI = body mass index. [1] Student›s t-test; [2] Chi-squared test.

Research involving staff from an energy company in São Paulo reported an increase in overweight equivalent to a variation in BMI of over 4kg/m² over the course of 20 years[20], while a study with doctors showed a 17% increase in prevalence of overweight over a 15 year period[21].

People who are overweight are more likely to be absent from work due to illness. Being overweight means that daily work activities can become more taxing, as extra weight puts additional strain and pressure on the back and influences posture. It can also influence work performance and productivity, negatively affecting quality of life at work[22]. Furthermore, overweight and obesity can lead to the increased use of health services, resulting in higher costs to businesses and society[23].

The fact that the 2000 cohort had a higher body weight at entry and greater weight gain per decade in comparison to the other cohorts may be associated with the nutrition transition and the impact of increasingly sedentary lifestyles, coupled with high intake of energy-dense foods[24]. Eating outside of the home, increased consumption of ultra-processed foods, and the replacement of meals with snacks with a high concentration of energy, sugar and salt, contribute to increased energy intake[25]. However, the higher body weight in the 2000 cohort may also be related to age (young adults aged 30 years and over). In this respect, a population-based study conducted with 2,436 adults in Denmark between 1982 and 1994 reported mean weight gain of between 0.9 and 1.2 kg/year in individuals aged between 30 and 40 years[26]. In addition, a longitudinal analysis of seven cohort studies with German adults aged between18 and 83 years initially assessed between 1994 and 2007 and followed up for a period of four to 11.9 years showed mean weight gain of 0.25 kg/year. The results showed that weight gain was associated with age at the beginning of the period and significantly greater in people aged under 45 years, corroborating the findings of the present study, which showed pronounced weight gain in young adults[27]. Another study comparing seven population-based prospective cohorts in Finland spanning different times periods (1972 – 2007) reported weight gain of 0.3kg/year in both sexes, showing that it was more pronounced in cohorts where follow-up was started later (1980 and 1990 x 1970) and in younger individuals, as in the present study[28].

**Table 4.** Characteristics of workers by occupation (Porto Alegre, Brazil 2017).

| | Care staff n = 248 | Administrative staff n = 137 | P-value |
|---|---|---|---|
| Age (years) | 29.6 ± 6.44 | 28.8 ± 8.7 | 0.349[1] |
| Gender (Female) | 17.7% | 35% | **<0.001[2]** |
| Skin color (White) | 73.8% | 65% | 0.075[2] |
| WEIGHT(kg) | | | |
| Pre-employment examination | 61.79 ± 11.98 | 64.44 ± 12.28 | **0.042[1]** |
| Final periodic examination | 71.15 ± 15.22 | 72.44 ± 14.52 | 0.423[1] |
| BMI (kg/m²) | | | |
| Pre-employment examination | 22.94 ± 3.48 | 23.31 ± 3.39 | 0.303[1] |
| Final periodic examination | 26.37 ± 5.63 | 26.71 ± 5.25 | 0.567[1] |
| Classification ofBMI | | | |
| Pre-employment examination | | | |
| Underweight | 5.2% | 4.4% | |
| Healthy weight | 69.8% | 62.8% | **0.734[2]** |
| Overweight | 20.6% | 27.7% | |
| Obese | 4.4% | 5.1% | |
| Final periodic examination | | | |
| Underweight | 4% | 3.6% | |
| Healthy weight | 39.9% | 35% | **0.828[2]** |
| Overweight | 30.6% | 34.3% | |
| Obese | 22.6% | 25.5% | |

BMI = body mass index. [1] Student›s t-test; [2] Chi-squared test.

The manifestation of the nutrition transition in these workers is worrying, given that there is a direct association between the increase in prevalence and incidence of obesity and the escalating prevalence and incidence of diabetes, hypertension, and cardiovascular diseases, which are chronic diseases that have high impact on morbidity and mortality and elevated social cost[11,29]. A cohort study with 114,281 American nurses reported that the risk of developing type 2 diabetes was 1.9 times greater in those who gained between 5 and 8 kg throughout the study period (1976 – 1990), compared to nurses whose weight remained stable[4]. Evidence shows that people who are obese have a two-fold increased risk of hypertension, compared with non-obese people[16]. Furthermore, studies have shown that the risk of cardiovascular disease is greater in obese women[30] and people who work night shifts[31]. The latter have a 40% increased risk of developing cardiovascular diseases, in comparison to people who work during the day[31]. A study conducted in Brazil revealed a 67% increased risk of cardiovascular disease among people who work night shifts[32], while no association was found between working during the day and increase in weight and BMI.

The fact that the present study was retrospective and that data was collected from staff records is a potential limitation, give that this methodology makes it impossible to standardize data collection. In this respect, incomplete staff records meant that a considerable proportion of workers could not be included in the study. Furthermore, convenience sampling was used, where the proportion of workers included in the sample was less than 50% of the total number of staff taken on each period, meaning that the sample may not be representative. This may be justified by the length of time between employment start date and data collection (minimum of10 years and maximum of 30 years), meaning that data for staff who no longer work at the hospital was not available. Finally, the lack of more detailed information on the staff records prevented the assessment of complementary variables, such as

presence of comorbidities associated with overweight and obesity like diabetes, hypertension, and dyslipidemia.

On the other hand, this study offers valuable insights into the health profile of workers and provides important inputs to inform the development of health strategies for specific groups of workers. The increase in overweight observed by this study is alarming given that excessive weight gain increases the risk of morbidity, disability, and mortality, leading to increased social costs. Furthermore, the present study provides data on the nutrient profile of hospital workers from the last 30 years and is original in so far as it compares workers who joined the hospital in different decades, different occupations, and day and night shift workers.

## Final considerations

The results reveal that the increase in weight gain and BMI observed in all cohorts was more pronounced in the group of workers who joined the hospital in 2000. These findings underscore the need for nutritional surveillance, through the monitoring of the nutritional status of workers and implementation of health education programs aimed at encouraging healthy eating practices and regular physical activity, improving quality of life, and reducing preventable health problems.

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