

# EXCESS WEIGHT PREVALENCE AND ASSOCIATED FACTORS IN AN URBAN POPULATION FROM THE AMAZONAS COUNTRYSIDE, BRAZIL

*Prevalência e fatores associados ao excesso de peso em uma população urbana do interior do Amazonas, Brasil*

*Prevalencia y factores asociados con el exceso de peso de una población urbana del interior de Amazonas, Brasil*

Original Article

## ABSTRACT

**Objective:** To describe the prevalence of overweight in the adult population from the municipality of Tefê, Amazonas, according to sociodemographic, lifestyle and health-related characteristics. **Methods:** Descriptive cross-sectional population-based study that assessed 451 individuals aged  $\geq 18$  years in 2015 using a household survey. A questionnaire was used to assess sociodemographic descriptors (gender, age, marital status, education, household income), lifestyle (smoking, drinking, physical inactivity) and health (nutritional profile, obesity, diabetes mellitus, hypertension) and risk for overweight and obesity, with  $\alpha=0.05$ . **Results:** It was found that 22.7% ( $n=102$ ) of the population of Tefê is overweight (95%CI: 20.1-24.6). However, the prevalence of overweight is 1.42 times higher in individuals aged  $\geq 36$  years compared to those aged 18-35 years (95%CI: 1.00-2.02). Higher prevalence rates were observed among hypertensive individuals (1.58; 95%CI: 1.11-2.25), those who do not eat fish frequently (8.98; 95%CI: 6.37-12.68) and those with increased abdominal circumference (3.5; 95%CI: 2.41-5.07). The analysis demonstrated an association between increased BMI by gender and abdominal circumference. In the analysis adjusted for age, fish consumption and hypertension, the risk for overweight was 10.07 for individuals with increased abdominal circumference (95%CI: 5.01-20.26,  $p=0.00$ ) and 3.94 for men (95%CI: 2.04-7.61;  $p=0.00$ ). **Conclusion:** The results show that the prevalence of overweight in the population of Tefê is higher among men with increased abdominal fat.

**Descriptors:** Risk Factor; Epidemiology; Overweight.

## RESUMO

**Objetivo:** Descrever a prevalência do sobrepeso na população adulta residente no município de Tefê, Amazonas, segundo características sociodemográficas, de estilo de vida e de saúde. **Métodos:** Estudo descritivo, transversal, de base populacional, avaliou, por meio de inquérito domiciliar, 451 indivíduos com idade  $\geq 18$  anos, em 2015. Utilizou-se questionário para descritores sociodemográficos (gênero, idade, estado civil, escolaridade, renda familiar), estilo de vida (tabagismo, etilismo, sedentarismo), saúde (perfil nutricional, obesidade, diabetes mellitus, hipertensão), e risco para sobrepeso e obesidade, com  $\alpha=0,05$ . **Resultados:** Encontrou-se 22,7% ( $n=102$ ) da população de Tefê com sobrepeso (IC95%: 20,1-24,6). Contudo, a prevalência do sobrepeso é 1,42 vezes maior nos indivíduos com idade  $\geq 36$  anos quando comparada à faixa de 18 a 35 anos (IC95%: 1,00-2,02). Prevalência maior observada entre hipertensos (1,58; IC95%: 1,11-2,25), os que não consomem pescado com regularidade (8,98; IC95%: 6,37-12,68) e naqueles com circunferência abdominal alterada (3,5; IC95%: 2,41-5,07). A análise mostrou associação do aumento do IMC em função do gênero e da circunferência abdominal. Na análise ajustada para a idade, consumo de pescado e hipertensão, o risco para o sobrepeso foi de 10,07 para indivíduos com circunferência abdominal aumentada (IC95%: 5,01-20,26;  $p=0,00$ ) e de 3,94 para os homens (IC95%: 2,04-7,61;  $p=0,00$ ). **Conclusão:** Os resultados apontam que na população adulta de Tefê, a prevalência do sobrepeso é maior entre os homens com acentuado índice de gordura abdominal.

**Descritores:** Fator de Risco; Epidemiologia; Sobrepeso.

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Received on: 06/24/2016  
Revised on: 08/17/2016  
Accepted on: 10/31/2016

## RESUMEN

**Objetivo:** Describir la prevalencia de sobrepeso de la población adulta del municipio de Tefé/Amazonas, según las características sociodemográficas, de estilo de vida y de salud. **Métodos:** Estudio descriptivo, transversal, de base poblacional que evaluó a través de una encuesta domiciliaria 451 individuos con edad  $\geq 18$  años, en 2015. Se utilizó un cuestionario para los descriptores sociodemográficos (género, edad, estado civil, escolaridad, renta familiar), el estilo de vida (tabaquismo, etilismo, sedentarismo), la salud (perfil nutricional, obesidad, diabetes mellitus, hipertensión) y el riesgo para el sobrepeso y la obesidad, con  $\alpha=0,05$ . **Resultados:** Se encontró el 22,7% ( $n=102$ ) de la población de Tefé con sobrepeso (IC95%: 20,1-24,6). Sin embargo, la prevalencia del sobrepeso es 1,42 veces mayor en los individuos con edad  $\geq 36$  años al comparar a la franja de edad entre 18 y 35 años (IC95%: 1,00-2,02). Se observó mayor prevalencia entre los hipertensos (1,58; IC95%: 1,11-2,25), los que no consumen pescado con regularidad (8,98; IC95%: 6,37-12,68) y aquellos con alteración de la circunferencia abdominal (3,5; IC95%: 2,41-5,07). El análisis mostró la asociación entre el aumento del IMC en función del género y de la circunferencia abdominal. En el análisis ajustado para la edad, el consumo del pescado e hipertensión, el riesgo para el sobrepeso fue de 10,07 para los individuos con la circunferencia abdominal aumentada (IC95%: 5,01-20,26;  $p=0,00$ ) y de 3,94 para los hombres (IC95%:  $sxc2,04-7,61$ ;  $p=0,00$ ). **Conclusión:** Los resultados señalan que en la población adulta de Tefé la prevalencia del sobrepeso es mayor para los hombres con elevado índice de grasa abdominal.

**Descriptores:** Factores de Riesgo; Epidemiología; Sobrepeso.

## INTRODUCTION

Excessive weight (or overweight) is a nutritional status level characterized by increased body weight resulting from the accumulation of fat in relation to height, which can pose a high risk for the development of various diseases<sup>(1)</sup>. The main cause of excessive weight is the imbalance between caloric intake and energy expenditure due to the increasingly emergence of the nutritional transition and urbanization<sup>(1)</sup>. Obesity is the most serious condition of excessive weight, characterized as one of the diseases that are part of the group of noncommunicable diseases and harms<sup>(2)</sup>. Over the last decades, obesity has become one of the major health problems as it is associated with several health problems, such as diabetes mellitus, heart diseases, dyslipidemias, psychosocial disorders, sleep apnea, osteoarthritis, and hypertension<sup>(2,3)</sup>.

In Brazil, there is a trend of an increasing prevalence of overweight and obesity as a consequence of the nutritional transition process. According to data from the

Health Surveillance Secretariat of the Ministry of Health (*Secretaria de Vigilância em Saúde do Ministério da Saúde*), in 2006 the percentage of overweight adult individuals was 43%, while the obese population represented 13% of the population<sup>(4)</sup>. Like Brazil, studies in Europe<sup>(5)</sup>, the United States of America<sup>(6)</sup> and emerging countries in Latin America<sup>(7)</sup> also point to a linear and gradual increase in the number of overweight or obese individuals.

Currently, these rates reach 52.5%, and 18% of the population is considered obese<sup>(8)</sup>. This trend of increasing prevalence of overweight and obesity is verified in all Brazilian regions<sup>(8)</sup>.

The Amazon Region presents a special situation in the Brazilian reality: while a large part of its population lives alone and keeps riverine habits, the region also has urban centers where the problems of the big cities predominate<sup>(9)</sup>.

National population-based studies point to a trend towards an increase in the number of cases of overweight and obesity in the capital cities of the Amazon Region<sup>(10)</sup>. Recent studies have associated these results with changes in lifestyle due to infrastructure projects<sup>(11)</sup>, migratory processes<sup>(12)</sup> and changes in dietary behavior<sup>(13)</sup>. Therefore, socio-environmental impacts of these factors on lifestyle may be important enough to change the morbidity and mortality profile of populations living in the Amazon Region<sup>(11,12)</sup>.

Even with these specificities, it is recognized that overweight/obesity is a chronic noncommunicable disease that has affected several population groups<sup>(14)</sup>. Therefore, systematic studies on the health status of the Amazonian populations and its main determinants will allow comparisons with future assessments and the possible detection of health system failures in addition to improving the understanding of the magnitude and historical trends of morbidity and mortality risks in these population groups<sup>(11,12)</sup>.

The literature on the social, economic, demographic and health conditions of the different population groups of the Amazon Region is restricted to the urban populations of the capital cities, such as Manaus<sup>(10)</sup>, Belém<sup>(10)</sup> and Rio Branco<sup>(10,12)</sup>. Thus, it is also necessary to investigate the factors that contribute to the increase of body weight in small and medium-sized cities, considering the discrepancies of different living conditions between Brazilian cities.

Therefore, the present study aimed to describe the prevalence of overweight in the adult population from the municipality of Tefé, Amazonas, according to sociodemographic, lifestyle and health-related characteristics.

## METHODS

This is an observational descriptive cross-sectional population-based study conducted in the period from March to November 2015 using a household survey. The methodological approach involved the use of standardized and structured questionnaires followed by anthropometric analysis carried out with a sample of adult people (age over 18 years) living in the municipality of Tefé, Amazonas, Brazil.

Tefé is located in the Médio Solimões region and occupies a territorial area of 23,704 Km<sup>2</sup>(15). According to the 2010 Census, Tefé had a population of 61,453 inhabitants: 31,492 men and 29,907 women(16). Approximately 81.48% of the population lives in the urban area of the municipality and 18.52% live in the rural area(16).

The sample size was estimated with the objective of ensuring representativeness for the event under study. The sample was determined using information from the 2010 Demographic Census of the population living in the urban area reported by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística – IBGE*)(16) for the municipality of Tefé, which reported a total of 61,453 adults, establishing 380 individuals to be studied. The statistical software Epi-Info (version 3.5.1) was used to calculate the sample with a 95% confidence interval, 50% ratio and a 5% estimation error. With a 20% allowance for possible losses and/or refusals, the total sample size was determined to be 451 adults.

The sample was selected using the IBGE(16) Demographic Expansion Areas (*Áreas de Expansão Demográfica – EAD*) as the reference unit: a total of 18 EAD in Tefé. A simple random sample was selected from each sector proportionally to the number of individuals living in each of these sectors considering the sample size. Due to the proportion considered and aiming at a better distribution for neighborhood purposes, one out of every five households was randomly chosen. In case there was no one in the household, the next house was chosen. Exclusion criteria were: pregnant women, mothers of children under six months of age, and people with physical and/or mental limitations that prevented the obtainment of data.

The epidemiological investigation of the demographic, socioeconomic, lifestyle and health descriptors was performed using a questionnaire specifically tailored for this study by the researchers. A multidisciplinary team composed of a nursing technician and a biologist (note-taker) was responsible for conducting the interviews, applying the questionnaires, and evaluating the health descriptors. The interviews, previously scheduled with one of the heads of the household according to the availability

and convenience of the interviewee, lasted on average 35 minutes and took place in the participant's house. During the interview, the biologist read the questions and wrote down the answers in a data sheet recorded in the mobile device used exclusively for the study (Philco WorkTab Q10 tablet). After that, the nursing technician evaluated the health descriptors. The interviewee remained seated during the assessment of dietary behavior, glucose measurement and blood pressure measurement, and stood up for weight, height and waist circumference measurements. During this stage, the biologist stayed together with the evaluator in order to record the results in the data sheet. At the end of the day, the information contained in the mobile device was transferred to an external HD (Sony HD-EG5).

The demographic and socioeconomic variables included were: gender, age, marital status (single, married/united, divorced/separated), education level (complete/ incomplete primary education, complete/incomplete secondary education, complete/incomplete higher education), and household income in minimum wages.

Regarding lifestyle, the variables assessed were: smoking, categorized as non-smoker or active smoker ( $\geq 1$  pack per week); consumption of alcohol in relation to the 30 days prior to the interview; and physical activity – leisure time in minutes per week.

Health variables included the assessment of dietary habits, determination of body mass index (BMI), measurement of abdominal circumference (AC), blood pressure measurement and glucose measurement.

The assessment of the dietary habits of the interviewees was based on information about consumption and consumption frequency of: meat (red meat, white meat, and fish), soft drinks and artificial juices. The habit of eating the main meals (breakfast, lunch, and dinner) at home or in bakery/restaurant was also part of the analysis of the dietary profile. The assessment of the dietary profile was based on the questionnaire of the National Health Survey(17). The parameters of the dietary assessment were categorized as: “consumer of fat meat or poultry” (intake of red or chicken meat, regardless of weekly quantity or frequency, with visible fat or skin, respectively) and “non-consumer of fat or skin” (attributed to those who reported removing and discarding red meat fat or skin from chicken); “frequent consumer of fish” (those who reported consuming fish two or more times per week) and “non-frequent consumer” (those who indicated consuming fish less than twice a week); “regular consumer of soft drinks/artificial juices” (when the intake of artificial beverages corresponded to five days or more per week) and “non-regular consumer” (attributed to those who reported less than five times a week); “meal at home” (individuals who reported eating the

main meals – breakfast, lunch and dinner – at home) and “meal outside the home” (those who reported eating main meals at commercial establishments).

After weight and height measurements, the BMI of each individual was calculated by dividing the weight (body mass in kilograms) by the square of the height (in meters). The characterization of the nutritional status of the study population was based on BMI cut-off points recommended by the World Health Organization (WHO)<sup>(18)</sup>, which classifies individuals as normal ( $< 25\text{kg/m}^2$ ) and overweight ( $\geq 25\text{kg/m}^2$ ). The interviewees measured the weight of the interviewees using a portable scale (Tanita Corp. Body Fat BF572, with a capacity of 130kg and intervals of 100g), and height was measured using a portable stadiometer graduated in millimeters. Weight was measured with individuals with bare feet and wearing light clothing.

Abdominal circumference was measured using an anthropometric tape (WISO R88) and considered the midpoint between the anterior superior iliac crest and the last rib at the end of the expiration. Based on the WHO criteria for AC normality classification<sup>(18)</sup>, men with up to 102cm and women with 88cm of abdominal circumference were considered normal. Higher values indicated abdominal obesity.

Blood pressure was measured in triplicate<sup>(19)</sup> using a semiautomatic device (OMRON HEM 711AC), considering the mean of the three measurements for the analysis. At the moment of the blood pressure measurement, the participants were requested to remain seated after a five-minute rest and abstaining from coffee and tobacco 30 minutes before each measurement. Those with systolic blood pressure (SBP)  $\geq 140$  mmHg and/or diastolic blood pressure (DBP)  $\geq 90$  mmHg<sup>(19)</sup> and those who reported using an antihypertensive medication, even if on an irregular basis<sup>(19)</sup>, were considered hypertensive.

The diagnosis of diabetes mellitus (DM) was based on the history, use of hypoglycemic drugs and serum glucose measurement above 100mg/dL<sup>(20)</sup>. Plasma levels were measured using a commercial kit (ROCHE Accu-Chek Active) at the interviewee's house.

Statistical analyses were performed using SPSS (version 20.0) and included: 1) descriptive analysis, with results described as absolute and relative frequencies, mean values and standard deviation, and prevalence ratios with their respective confidence intervals (95%CI); 2) comparative analysis of the demographic, socioeconomic, lifestyle and health parameters to determine differences and similarities between the groups of thin ( $< 25\text{kg/m}^2$ ) and overweight ( $\geq 25\text{kg/m}^2$ ) individuals using the Student's t-test for continuous variables and the Chi-squared test for qualitative variables; 3) multiple logistic regression to

estimate the effect of explanatory variables on body weight variation.

This research respected the ethical and scientific standards established by Resolution No. 466, of December 12, 2012, of the National Health Council – Ministry of Health, which provides for research involving human beings. It was approved by the Research Ethics Committee of the Amazonas State University (*Universidade do Estado do Amazonas*) under Opinion No. 407.080, of September 26, 2013. The interviewees signed the Free and Informed Consent Form prior to participation in the research.

## RESULTS

The results of the descriptive analysis are summarized in Table I. The sample of 451 adults from the population of Tefé, Amazonas, was composed of 41.7% (n=188) of men, mean age of  $38.42 \pm 14.69$  years, and 58.3% (n=263) of women, with a mean age of  $38.20 \pm 14.42$  years. Most of the interviewees (51.8%, n=231) were over 36 years of age and had higher education (42.9%, n=189). Regarding household income, 49.5% (n=218) of the respondents reported a monthly income between 3 and 5 minimum wages. Of the participants, 47% (n=211) are single and 45.4% (n=204) are married. The proportion of divorced, separated or widowed individuals accounted for 7.6% (n=34) of the sample. As for lifestyle, only 6.2% (n=28) reported being smokers. However, 34.8% (n=157) of the respondents reported consuming alcohol and 60.1% (n=268) reported not doing physical activity.

Regarding health variables, mean values were  $126.04 \pm 18.34$  mmHg for systolic blood pressure,  $79.83 \pm 13.14$  mmHg for diastolic blood pressure,  $93.77 \pm 29.31$  mg/dL for fasting glucose,  $21.89 \pm 4.19$  kg/m<sup>2</sup> for body mass index, and  $91.29 \pm 14.94$  cm of AC in women and  $91.55 \pm 15.12$  cm of AC in men.

The analysis of the dietary profile of Tefé residents showed that 26.9% (n=121) consumed red meat with fat/ or white meat with skin, while 71.4% (n=322) ate fish more than twice a week. Only 12% (n=52) ate the main meals in restaurants or bakeries and 15.4% (n=73) reported regularly drinking artificial juices or soft drinks.

The bivariate analysis (Table II) showed that the estimated prevalence of overweight is 22.7% (95%CI: 20.1 – 24.6) of the adult population, with no significant difference between women (20.3%) and men (26.1%). In the analysis by age group, it was verified that the prevalence of overweight is 1.42 times higher in individuals aged  $\geq 36$  years when compared to the range between 18-35 years (95%CI: 1.00 – 2.02). Marital status (single: 1.05 [95%CI: 0.48 – 2.26], married/common-law marriage: 1.48 [95%CI:

Table I - Demographic, lifestyle and health characteristics of the adult population analyzed. Tefé, Amazonas, 2015.

Variables	Descriptive analysis n (%)
<b><i>Socioeconomic Characteristics</i></b>	
<b>Gender</b>	
Women	263 (58.3%)
Men	188 (41.7%)
<b>Age, years</b>	
Up to 35 years	215 (48.2%)
From 36 years	231 (51.8%)
<b>Education level</b>	
Primary	142 (32.2%)
Secondary	110 (24.9%)
Higher	189 (42.9%)
<b>Household Income, minimum wage</b>	
Up to 2	188 (42.7%)
3 to 5	218 (49.5%)
Above 5	34 (7.7%)
<b>Marital Status</b>	
Single	211 (47.0%)
Married/Common-law marriage	204 (45.4%)
Widowed/Divorced	34 (7.6%)
<b>Lifestyle Characteristics</b>	
Smoking	28 (6.2%)
Alcohol consumption	157 (34.8%)
Sedentary lifestyle	268 (60.1%)
<b>Health Characteristics (qualitative)</b>	
Consumer of meat and poultry with fat	121 (26.9%)
Consumption of fish	322 (71.4%)
Regular consumption of soft drinks/artificial juice	73 (15.4%)
Meals outside the home	52 (12%)
<b>Health Characteristics (numeric)</b>	
	Mean ± SD
Abdominal Circumference (cm)	
Women	91.29 ± 14.94
Men	91.55 ± 15.12
Systolic Blood Pressure, mmHg	126.04 ± 18.34
Diastolic Blood Pressure, mmHg	79.83 ± 13.14
Fasting Glucose, mg/dL	93.77 ± 29.31

n: absolute value; SD: standard deviation; cm: centimeter; mmHg: millimeter of mercury; mg/dL: milligram of glucose per deciliter of blood.

0.72 – 3.06]), family income (3-5 minimum wages: 1.25 [95%CI: 0.86 – 1.80]; above 5 minimum wages: 1.32 [95%CI: 0.69 – 2.51]) and education level (secondary education: 0.94 [95%CI: 1.49 – 0.59]; primary school: 1.18 [95%CI: 0.79 – 1.76]) were not associated with overweight.

Regarding health variables (Table III), the prevalence of excessive weight is 1.58 times higher among hypertensive individuals when compared to normotensive individuals

[95%CI: 1.11 – 2.25]. Among those who do not consume fish regularly, the overweight rate increases to 8.98 [95%CI: 6.37 – 12.68]. In addition, the prevalence of abdominal obesity measured through abdominal circumference was 3.5 times higher in the group of overweight individuals (95%CI: 2.41 – 5.07). The glycemic profile (0.98 [95%CI: 1.49 – 0.65]), the dietary pattern (consumption of red or white meat with fat: 1.23 [95%CI: 0.81 – 1.87]; regular

Table II - Prevalence of overweight/obesity, prevalence ratio and confidence interval according to socioeconomic characteristics of the adult population analyzed. Tefê, Amazonas, 2015.

Variables	Groups		Prevalence	PR [95%CI]
	BMI<25	BMI≥25		
<b>Gender</b>				
Women	204	52	20.3%	1.00
Men	136	48	26.1%	1.28 [0.91-1.81]
<b>Age (years)</b>				
Up to 35 years	170	39	18.7%	1.00
From 36 years	166	60	26.5%	1.42 [1.00-2.02]
<b>Education Level</b>				
Higher	145	40	21.6%	1.00
Secondary	86	22	20.3%	0.94 [1.49-0.59]
Primary	102	35	25.5%	1.18 [0.79-1.76]
<b>Household income</b>				
Up to 2	147	37	20.1%	1.00
3 to 5	158	53	25.1%	1.25 [0.86-1.80]
Above 5	25	09	26.4%	1.32 [0.69-2.51]
<b>Marital Status</b>				
Single	166	39	19.0%	1.05 [0.48-2.26]
Married/Other	146	54	27.0%	1.48 [0.72-3.06]
Widowed/Divorced	27	06	18.1%	1.00

PR: Prevalence Ratio; 95%CI: Confidence Interval; BMI<25: Body Mass Index below 25 kg/m<sup>2</sup>; BMI≥25: Body Mass Index equal to or above 25kg/m<sup>2</sup>.

consumption of soft drinks or artificial juices: 1.37 [95%CI: 0.90 – 2.08]; eating in commercial establishments: 1.01 [95%CI: 0.58 – 1.77]) and lifestyle variables: smoking (0.97 [95%CI: 2.00 – 0.47]), sedentary lifestyle (1.35 [95% CI: 0.96 - 1.91]) and alcohol consumption (1.12 [95%CI: 0.79 – 1.60]) were not associated with the prevalence of overweight in the present study.

The multiple logistic regression analysis showed an association of the increase in BMI according to gender and waist circumference. The multivariate analysis of excessive weight adjusted for age, fish consumption, hypertension, and diabetes also determined a prevalence of 10.07 among individuals with increased abdominal circumference (95%CI: 5.01 – 20.26; p=0.00) and of 3.94 among men (95%CI: 2.04 – 7.61, p=0.00).

## DISCUSSION

This study aimed to describe the prevalence of excessive weight according to sociodemographic, lifestyle and health descriptors in a representative sample of the adult population of Tefê, Amazonas. The identification of

risk descriptors for excessive weight allows public health actions, according to different living conditions of the studied region, aimed at reducing morbidity and mortality and improving the quality of life of the population.

Over the last decades, excessive weight and obesity have become one of the greatest health problems in mankind due to the increase in their prevalence worldwide<sup>(3,5-7)</sup>. Excessive weight has increased gradually in all age groups, from childhood<sup>(21)</sup> to adulthood<sup>(14)</sup> and its occurrence is associated with a number of chronic-degenerative diseases<sup>(14)</sup>. Therefore, it is necessary to systematically carry out epidemiological investigations in order to check for associations between factors that influence the development of excessive weight/obesity in the Brazilian population, especially in cities in the countryside not included in the VIGITEL survey<sup>(10)</sup>.

The results of the present descriptive research showed that 22.7% of Tefê residents are overweight. Compared to other Brazilian cities, the prevalence of body mass index ( $\geq 25\text{kg/m}^2$ ) in Tefê is considered low. In all regions of the country, significant portions of the adult population are overweight and/or obese<sup>(8)</sup>, even in the capitals of the

Table III - Prevalence of overweight/obesity, prevalence ratio and confidence interval according to health and lifestyle characteristics of the adult population analyzed. Tefê, Amazonas, 2015.

Variables	Samples		Prevalence	PR [95%CI]
	BMI<25	BMI≥25		
<b>Consumption of meat/poultry with fat</b>				
No	251	77	23.5%	1.00
Yes	98	23	19.0%	1.23 [0.81-1.87]
<b>Frequent consumption of fish</b>				
Yes	300	22	6.8%	1.00
No	49	78	61.4%	8.98 [6.37-12.68]
<b>Regular consumption of soft drinks or artificial juices</b>				
No	298	80	21.2%	1.00
Yes	49	20	29.0%	1.37 [0.90-2.08]
<b>Meals</b>				
At home	300	82	21.5%	1.00
Outside the home	41	11	21.1%	1.01 [0.58-1.77]
<b>Blood pressure profile</b>				
Normotensive	200	56	21.8%	1.00
Hypertensive	140	44	23.9%	1.58 [1.11-2.25]
<b>Glycemic profile</b>				
Up to 100mg/dL	216	62	22.3%	1.00
≥100mg/dL	85	24	22.2%	0.98 [1.49-0.65]
<b>AC (cm)</b>				
Normal <sup>1</sup>	218	26	10.6%	1.00
Increased <sup>2</sup>	121	72	37.3%	3.50 [2.41-5.07]
<b>Sedentary lifestyle</b>				
Active	128	48	27.7%	1.35 [0.96-1.91]
Sedentary	207	52	20.0%	1.00
<b>Smoking</b>				
Non-smoker	317	94	21.3%	1.00
Smoker	21	06	22.2%	0.97 [2.00-0.47]
<b>Drinking</b>				
No	223	62	21.7%	1.00
Yes	117	38	24.5%	1.12 [0.79-1.60]

PR: Prevalence Ratio; 95%CI: Confidence Interval; BMI<25: Body Mass Index below 25 kg/m<sup>2</sup>; BMI≥25: Body Mass Index equal to or above 25kg/m<sup>2</sup>; AC: abdominal circumference; 1. Women <88cm and Men<102cm; 2. Women ≥ 88cm and Men ≥102cm.

North Region<sup>(10)</sup>. According to data from VIGITEL Brasil 2006-2012<sup>(10)</sup>, conducted through telephone interviews, the prevalence of overweight in Rio Branco, Acre, reached 31% of the adult population, while in Manaus, Amazonas, and Belém, Pará, the problem affected 42.2% and 46.4% of the population, respectively. Prevalence studies in the main world capitals also showed high rates (over 35%) of cases of overweight and obesity<sup>(22)</sup>. The increased prevalence of obesity occurs in both developed<sup>(5-6)</sup> and developing countries<sup>(7)</sup>. Excessive weight and obesity are important

predictors of risk for chronic diseases as the accumulation of body fat leads to a series of endocrine and metabolic dysfunctions<sup>(1)</sup>. In addition, weight gain contributes to approximately 58% of diabetes cases, 21% of ischemic heart diseases and 8% to 42% of certain types of cancer<sup>(23)</sup>.

When investigating the reasons for the low rate of overweight individuals in the present study, it was verified that the diet of the population of Tefê still counts on important participation of foods recognized as markers of healthy eating. Most study participants reported regular consumption

of fish, while a minority reported consuming red or white meat with fat. There was also a low consumption of soft drinks and/or artificial juices. The high frequency of healthy eating indicators presented in this study is in line with data from the National Health Survey Data (*Pesquisa Nacional de Saúde - PNS*)<sup>(24)</sup>. According to the 2013 PNS, 77.2% of the Amazonians consumed fish daily; additionally, the regular consumption of fish in the households of Amazonas was ten times superior when compared to the other Brazilian regions<sup>(24)</sup>. It is also important to note that during the period from 12 pm to 2 pm, 90% of the commercial establishments of the municipality analyzed in the current study are closed for lunch (personal communication). This regional culture allows workers to return to their homes, where they eat their meals. Therefore, the dietary pattern resulting from the consumption of natural<sup>(9)</sup> and minimally processed food contributes positively to the maintenance of body mass index within the limits of normality<sup>(22,25)</sup>. As observed in Tefé, Amazonas, some Asian populations have overweight and obesity rates below 25%<sup>(22)</sup>. This phenomenon was associated with a diet rich in fish and whole grains<sup>(22)</sup>.

Adequate food and nutrition are basic requirements for health promotion and protection<sup>(26)</sup>. The World Health Organization points to the need to improve global food standards to prevent – particularly – non-communicable diseases<sup>(26)</sup>. In Brazil, inadequate diet, high blood pressure and high alcohol consumption make up the three risk factors that most contribute to the burden of diseases in the country<sup>(26)</sup>. For the prevention of cardiovascular diseases, the WHO recommends eating fish once to twice a week<sup>(22,26)</sup>, as verified in the current research in the population of Tefé.

Age was the second leading predictor of overweight among the Tefé residents analyzed. The results of the present study showed a significant linear trend ( $p < 0.05$ ), with an increase in the prevalence of overweight with increasing aging in both genders. Among young people aged between 18 and 35 years, the prevalence of overweight reached 48.2%, while among those over the age of 35 the prevalence of overweight increased to 51.8%. Similar results regarding the association of overweight with age were also observed in other studies using the same methodological design with Brazilian populations<sup>(12,27)</sup> and worldwide<sup>(28)</sup>. In fact, obesity rates tend to increase with age, resulting from a reduction in physical activity levels and a decrease in resting metabolism<sup>(23)</sup>. These factors contribute to the reduction of energy expenditure, thus favoring body weight gain<sup>(23)</sup>.

In the present study, it was found that 37.5% of individuals with increased abdominal circumference had a BMI  $\geq 25$  kg/m<sup>2</sup>. Population-based studies conducted in Brazil<sup>(27)</sup>, in Europe<sup>(5)</sup>, and in the United States of America<sup>(6)</sup> presented similar prevalence rates of 28.1%, 24.9% and

33%, respectively. Nowadays, it is known that adipose tissue has multiple important functions in the balance regulation, both energetic and metabolic. The greatest negative impact of visceral fat has been attributed to the distinct biological properties of this deposit compared to the deposits in other tissues<sup>(1,23)</sup>. The functional activity of the adipocytes located in the visceral fat seems to be conditioned to the regulation of the Renin-Angiotensin-Aldosterone System, demonstrating a clear association between overweight and blood pressure<sup>(1,23)</sup>. Although abdominal circumference cannot discriminate between visceral fat and subcutaneous fat, research supports the idea that individuals with increased waist circumference are more likely to have hypertension, diabetes, dyslipidemia or metabolic syndrome, complementing information to that provided by the BMI<sup>(1,23)</sup>. Studies using more accurate measures of fat have demonstrated that the associations between intra-abdominal fat and various metabolic disorders begin to occur in childhood<sup>(23)</sup>.

Of the health indicators assessed in the present study, arterial hypertension and the low consumption of fish contribute to the increase in body weight. According to the results of the present study, the prevalence of overweight was 1.58 times higher in those with blood pressure above 140/90 mmHg. The increased frequency of hypertensive individuals among overweight individuals suggests the risk of comorbidity and is in line with findings in the literature<sup>(6,13,21,22,29)</sup>. It is a fact that obesity and overweight are important risk indicators for chronic non-communicable diseases, especially cardiovascular diseases<sup>(1)</sup>, showing the importance of investing in actions to promote healthy eating and physical activity<sup>(4)</sup>.

Regarding the effect of fish consumption on body weight variation, it was observed that the low consumption of fish favors the increase in the prevalence of overweight up to 8.98 times. Therefore, fish consumption two or more times a week contributes to the maintenance of body mass index within the limits of normality<sup>(22)</sup>. These effects are attributed to the nutritional properties of the fish, which is rich in sulfur-containing amino acids and unsaturated fatty acids, which makes it an important protective factor against the accumulation of calories and other degenerative processes associated with toxic oxidizing substances present in the environment<sup>(9)</sup>.

The multivariate model of factors associated with overweight showed, in the present research, an association between increased BMI according to gender and abdominal circumference. In the analysis adjusted for age and hypertension, the risk for overweight was 10.07 individuals with increased abdominal circumference, and 3.94 in men. National studies in Brazil<sup>(10)</sup>, the United States of

America<sup>(6)</sup>, and Australia<sup>(22)</sup> have shown an increase in body weight in relation to abdominal circumference variation and male gender. The relationship between gender, increase in abdominal circumference and overweight results from differentiated behavioral patterns verified between men and women<sup>(10)</sup>. Behavioral habits, such as the consumption of alcohol, smoking, and the consumption of meat with fat are some of the factors most frequently reported by men and which favor an increase in body weight<sup>(1,3,4,7,22)</sup>.

The methodological design of the present study presents limitations that must be considered in the interpretation of the results: (1) the study population is the one that is more available to be found at home, for example, retirees and homemakers, and (2) the cross-sectional design limits the possibility of interpreting the associations found as deriving from cause-effect relationships. However, the demographic census reduced the possibility of bias in this study<sup>(8)</sup>.

The present study reported the increased prevalence of overweight among men with increased abdominal fat in the municipality of Tefê, in the state of Amazonas. The population of Tefê, located 674 km from the capital Manaus<sup>(16)</sup>, lives in a rich biodiversity characterized by fruit trees, medicinal plants and various groups of wild animals, and presents eating habits based on the consumption of fish<sup>(16)</sup>. A total of 71.4% of the adult population in this region consumes fish more than twice a week and has relatively limited access to sugar and other items with greater caloric power. Despite the identification of healthy eating indicators<sup>(9,26)</sup>, 26.1% of men are overweight. The risk of weight gain among men associated with increased waist circumference signals a gradual change in the morbidity and mortality profile, particularly with regard to metabolic and cardiovascular diseases<sup>(11)</sup>. This study represents an additional contribution to the knowledge of the risk factors for overweight and obesity in Brazil's countryside and may contribute to the formulation of health strategies by the local and regional health secretariats.

## CONCLUSION

In the adult population of Tefê, Amazonas, the estimated prevalence of overweight is 22.7% and is higher in older people, hypertensive individuals and among men with increased abdominal fat.

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