Food consumption, overweight, obesity, and sociodemographic profile in a Brazilian capital: a time trend analysis between 2006 and 2018

Consumo alimentar, excesso de peso, obesidade e perfil sociodemográfico em uma capital brasileira: uma análise de tendência temporal entre 2006 e 2018

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A B S T R A C T

Objective

To analyze the time trend of sociodemographic characteristics and the prevalence of food consumption, overweight, and obesity variables among adults in the city of *Belo Horizonte*, Brazil, between 2006 and 2018.

Methods

A time series study involving data from the *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Vigitel, Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey), between 2006 and 2018 in *Belo Horizonte* (n=25,443). The annual prevalence of the population's sociodemographic characteristics (sex, age groups, and years of schooling), and risk and protective factors for chronic

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diseases related to food consumption and nutritional status were estimated. Prais-Winsten regression models were used to investigate the temporal variation of each variable.

Results

From 2006 to 2018, there was a significant increase in the age and educational level of the adult population of *Belo Horizonte*. In the same period, the prevalence of recommended consumption of fruits and vegetables increased (from 23.0% to 29.2%), while that of consumption of fat-rich meat and regular consumption of soft drinks decreased (respectively, from 41.9% to 38.0%; from 35.3% to 15.2%). In parallel, the prevalence of overweight and obesity increased (respectively, from 38.5% to 53.3%; from 9.8% to 17.2%).

Conclusion

An important change in the population's sociodemographic profile was noted. There are also favorable changes regarding the investigated aspects of food consumption, without these being sufficient to prevent the significant increase in the prevalence of overweight and obesity in the population.

Keywords: Food Consumption. Health surveys. Obesity. Public health.

R E S U M O

Objetivo

Este estudo objetivou analisar a tendência temporal de características sociodemográficas e da prevalência de variáveis de consumo alimentar, excesso de peso e obesidade entre adultos em Belo Horizonte entre 2006 e 2018.

Métodos

Este foi um estudo de série temporal envolvendo dados do Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico (Vigitel), entre 2006 e 2018, em Belo Horizonte (n=25.443). Estimou-se a prevalência anual de características sociodemográficas da população (sexo, faixa etária e anos de escolaridade) e de fatores de risco e proteção para doenças crônicas relacionados a alimentação e estado nutricional. Modelos de regressão de Prais-Winsten foram utilizados para investigar a variação temporal de cada variável.

Resultados

De 2006 a 2018, verificou-se aumento significativo da idade e da escolaridade da população adulta de Belo Horizonte. Nesse mesmo período, a prevalência de consumo recomendado de frutas e hortaliças aumentou (de 23,0% para 29,2%), enquanto aquela de consumo de carnes com excesso de gordura e de consumo regular de refrigerantes diminuiu (respectivamente, de 41,9% para 38,0% e de 35,3% para 15,2%). Em paralelo, a prevalência de excesso de peso e obesidade aumentou (respectivamente, de 38,5% para 53,3% e de 9,8% para 17,2%).

Conclusão

Importante mudança no perfil sociodemográfico da população foi constatada. Destacam-se também mudanças favoráveis quanto aos aspectos investigados do consumo alimentar, sem que estas fossem suficientes para impedir o aumento significativo na prevalência de excesso de peso e obesidade na população.

Palavras-chave: *Consumo de alimentos. Inquéritos epidemiológicos. Obesidade. Saúde pública.*

I N T R O D U C T I O N

In Brazil, Noncommunicable Diseases (NCD) stand as one of the main public health crises. In 2016 alone, these diseases accounted for about 74% of the causes of mortality in the country [1]. Evidence indicates that NCD-related morbidity and mortality can be reduced through public policies to control the main behavioral risk factors, such as unhealthy diets, physical inactivity, smoking, alcohol abuse, and overweight [2].

In this perspective, it is essential to identify the frequency and distribution of these factors among the population, since continuous monitoring allows the direction of appropriate public policies and actions [3]. Given this scenario, the Brazilian Ministry of Health (MH), through the *Secretaria de Vigilância em Saúde* (Health Surveillance Secretariat) and with the objective of contributing to the planning and assessment of

actions, structured a national surveillance strategy for the main risk and protection factors for NCDs in the Brazilian population, involving surveys (such as the *Pesquisa Nacional de Saúde* [PNS, National Health Survey]) and their articulation with data from official Surveillance Systems (such as the *Sistema de Informação sobre Mortalidade* [SIM, Mortality Information System]) [3-6]. The general results of this strategy are routinely published by the MH for the population as a whole, without any deeper approaches to geographic regions being carried out.

It is known that most of the proposed actions for surveillance, prevention, and control, specifically on obesity and nutrition, were articulated at different levels of government, mainly with the aid of important legal frameworks supported by the *Sistema Nacional de Segurança Alimentar e Nutricional* (Sisan, National Food and Nutrition Security System) [7]. One of the main documents, "*Estratégia Intersetorial de Prevenção e Controle da Obesidade*: *orientando sobre modos de vida e alimentação adequada e saudável para a população brasileira*" ("Intersectoral Strategy for Prevention and Control of Obesity: advising on ways of life, and adequate and healthy nutrition for the Brazilian population"), gathers guidelines for intersectoral actions and strategies, which involve access to adequate food, as well as education and promotion of healthy lifestyles and surveillance in an integrated effort, marking its position as one of the actions to face NCD in the country [8].

It is noted, however, that the trend in the variation of the prevalence of risk and protective factors may differ between different regions of the country, as they are intensely affected by environmental conditions, such as the level of economic development and the population's educational composition. In this scenario, the realization of studies focused on specific locations is highly relevant for the establishment of more effective actions towards health promotion and disease prevention.

Belo Horizonte is the capital of the state of *Minas Gerais*, located in Southeastern Region of Brazil, being the sixth most populous urban concentration in the country, with approximately 2.4 million people and with a Human Development Index (HDI) of 0.810 (the fourth highest among the country's capitals) [9]. From the 1990s until the beginning of the 2000s, the city stood out as one of the scenarios for structuring programs and actions for food and nutritional health and security that would later gain national prominence, such as the *Programa Academias da Cidade* (City Gyms Program) – aiming at promoting healthy lifestyles – and setting up grocery stores through public-private partnerships with the obligation of selling fruits and vegetables at reduced prices [10-12].

However, little progress has been made regarding the analysis of risk and protective factors for NCD in the population of the municipality, as well as regarding to changes in their sociodemographic profile. The literature available explores specific populations, gathering information on these behaviors in users of Primary Health Care services and some sanitary districts in the capital [13-15].

In this context, monitoring the evolution of factors related to NCD in this population is important to identify relevant aspects of their health profile that will enable the adoption of more effective health promotion and disease prevention policies. The aim of this study was to analyze the time trend of sociodemographic characteristics and the prevalence of food consumption, overweight, and obesity variables among adults in the city of *Belo Horizonte* between 2006 and 2018.

M E T H O D S

The study presents a time series involving secondary data from the adult population (≥18 years old) from *Belo Horizonte* who participated in the *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Vigitel, Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey), between 2006 and 2018 (n=25,443).

The Vigitel survey annually conducts interviews in a simple random sample of adults living in residences that have at least one landline in the 26 Brazilian capitals and the Federal District. The sampling

used establishes about 2,000 interviews per year in each city, allowing the estimation of all the factors surveyed with a maximum error of two percentage points and a 95% confidence interval [16].

In each year, the sampling method was initiated by drawing 5,000 landlines per city, using the landline telephone lists made available annually by the main telephone companies in Brazil [16]. From this initial draw, this sample was divided into 200 sets of landlines that reproduce the same proportion of numbers, per city, from the initial record, aiming at making calls throughout the collection period (January to December). Finally, the identification of eligible landlines was performed (being ineligible: Non-residential numbers, out-of-service numbers, and numbers that do not answer to any attempt of contact after six alternate days and times, including Saturdays, Sundays, and holidays), with an adult resident of the household answering the survey [16].

Since this is a telephone survey, a weighting strategy was applied to the data to make it representative of the entire population. A weight was assigned to each individual in order to correct the unequal probability of selection (when the residence has more than one adult or landline) and also to match the sociodemographic distribution of the population served by landlines to that of the cities' total adult population in each year of the survey (based on Census data and official projections for the population). More information on Vigitel's methodology can be found in a specific report [16].

For this research, it was used the information referred by the interviewees regarding food consumption, nutritional status, and sociodemographic characteristics. Six food consumption variables related to NCD were analyzed, three of which were admitted as protective factors – regular (≥5 days/week) and recommended (≥5 times/day) consumption of fruits and vegetables and regular consumption of beans (≥5 days/week) – and three as risk factors – the consumption of fat-rich meat (≥1day/week) (fat-rich red meat or poultry skin), the consumption of whole milk (≥1day/week), and regular consumption of soft drinks (≥5 days/week). These variables were chosen accordingly to scientific evidence that corroborate their association with NCD [17]. The regular (≥5 days/week) or weekly (≥1 day/week) consumption variables of the different foods were defined based on questions about the weekly frequency: "How many days a week do you usually eat [name of the food group investigated]? (1 to 2 days/week | 3 to 4 days/week | 5 to 6 days/week | every day | almost never | never)". The recommended consumption of fruits and vegetables variable considered, in addition to the weekly frequency, the usual amount of consumption. Thus, the consumption of a fruit or a glass of fruit juice corresponded to one serving, keeping the maximum daily servings for fruits as three, and one for juices. For vegetables, a maximum consumption of four daily servings was established, classified when the individual reported consumption of raw and cooked vegetable salads at lunch and dinner [16].

The variables were defined according to the Vigitel classification, which considered models from other monitoring systems [18,19], essentially for the assessment of global and national targets for facing NCD [5,20]. The regular and recommended consumption of fruits and vegetables, regular consumption of beans, consumption of fat-rich meat, milk with full fat content, and regular consumption of soft drinks variables were not analyzed in each years, due to changes in the methodology that made the estimate unfeasible in the period or because they were not collected in these years.

Self-reported information about the respondent's current weight and height was used to calculate the Body Mass Index (BMI). Vigitel collected this information with the questions: "Do you know your weight (even if it is an approximate value)?" and "Do you know your height?" [16]. The BMI was obtained by dividing weight, in kilograms, by the square of height, in meters. The cutoff points recommended by the World Health Organization (WHO) were used to identify overweight (BMI ≥25kg/m^2, including overweight and obesity) and obesity (BMI ≥30kg/m^2) [21].

The studied population was described according to the proportions for the sociodemographic characteristics collected by Vigitel: sex (male and female), age group (18 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, and ≥65 years old), and years of schooling (0 to 8 years, 9 to 11 years, and ≥12 years

of study). The proportions of sociodemographic characteristics, food consumption, and nutritional status (independent variables) were correlated with the years analyzed (dependent variable), using Prais-Winsten linear regression models, allowing the identification of significant trends (increasing or decreasing) with the passage of time. The use of this model is indicated for time series analysis, as it allows correcting the autocorrelation of years [22]. Variations with p<0.05 were considered as significant. A positive variation coefficient points to an increase in the prevalence of the variable in the period; if negative, it points to a reduction; and it was considered a stationary variation when no significant differences were identified.

The Stata software, version 14.2 [23], was used to organize, process, and analyze the data. Vigitel's databases are accessible for public use on the official website of the Ministry of Health and the collection of the interviews was authorized by the *Comissão Nacional de Ética em Pesquisa em Seres Humanos do Ministério da Saúde* (Brazilian Ethics Committee for Research with Human Beings, Ministry of Health) (Protocol number: 65610017.1.0000.0008).

R E S U L T S

The study population was composed mostly of women, people under 45 years old, and with less than 11 years of schooling. It should be highlighted the decrease in the percentage of people aged between 18 and 24, from 18.0% to 12.9%, and an increase in people aged 45 or over, from 37.3% to 46.1%. There was a reduction in the percentage of people with lower educational levels, 0 to 8 years, from 44.8% to 28.9%, and an increase in the percentage of people with higher educational levels, 12 or more years of schooling, from 23.3% to 35.4% (Table 1).

There was an increase in the prevalence of recommended consumption of fruits and vegetables, from 23.0% in 2008 to 29.2% in 2018 (2.35%/year). The consumption of fat-rich meat and regular consumption of soft drinks decreased, varying from 41.9% in 2007 to 38.0% in 2016 (-1.02%/year) – for fat-rich meat consumption – and 35.3% in 2007 to 15.2% in 2018 for soft drinks (-7.85%/year) (Table 2).

Table 1 – Distribution (%) of the adult population (≥18 years old) in the city of *Belo Horizonte*, according to sociodemographic characteristics. *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico*[1], 2006-2018.

Variables	2006 n=2,013	2007 n=2,010	2008 n=2,016	2009 n=2,011	2010 n=2,007	2011 n=2,006	2012 n=1,811	2013 n=1,956	2014 n=1,519	2015 n=2,007	2016 n=2,004	2017 n=2,008	2018 n=2,072	Average annual variation (%)*
Sex														
Male	45.8	45.8	45.8	45.8	45.8	45.8	45.7	45.7	45.7	45.7	45.6	45.6	45.6	-0.05**
Female	54.2	54.2	54.2	54.2	54.2	54.2	54.3	54.3	54.3	54.3	54.4	54.4	54.4	0.04**
Age														
18 to 24	18.0	17.6	17.1	16.6	16.2	15.8	15.3	14.9	14.5	14.1	13.7	13.3	12.9	-2.76**
25 to 34	24.5	24.5	24.5	24.5	24.4	24.4	24.4	24.3	24.3	24.2	24.2	24.1	24.0	-0.16**
35 to 44	20.2	19.9	19.7	19.4	19.1	18.9	18.6	18.3	18.1	17.8	17.5	17.2	17.0	-1.44**
45 to 54	16.4	16.6	16.8	17.0	17.2	17.4	17.6	17.8	18.0	18.2	18.4	18.6	18.8	1.14**
55 to 64	10.6	10.9	11.1	11.4	11.7	11.9	12.2	12.4	12.7	13.0	13.3	13.5	13.8	2.15**
65 or more	10.3	10.6	10.8	11.1	11.3	11.6	11.9	12.1	12.4	12.7	13.0	13.2	13.5	2.24**
Educational level (years of schooling)														
0 to 8	44.8	43.8	41.1	40.4	39.7	37.2	35.4	35.4	33.9	33.4	31.0	30.5	28.9	-3.55**
9 to 11	31.9	33.9	35.5	35.9	34.8	37.1	38.0	36.8	37.8	37.4	36.3	36.0	35.7	0.80**
12 or more	23.3	22.3	23.4	23.7	25.5	25.7	26.6	27.7	28.3	29.2	32.7	33.5	35.4	3.74**

Source: Elaborated through the Vigitel databases available on the Ministry of Health website (http://svs.aids.gov.br/download/Vigitel/).
Note: *Corresponding to the Prais-Winsten regression coefficient of the variable over the survey year; **p<0.05.
[1] *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Vigitel, Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey).

Table 2 – Evolution of the prevalence (%) of food consumption variables in the adult population (≥18 years old) in the city of *Belo Horizonte*, Brazil. *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico*[1], 2006-2018.

Variables	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average annual variation (%)*
Protective factors														
Regular consumption of fruits and vegetables	–	–	40.3	41.0	40.4	40.8	42.9	45.1	47.7	45.3	45.4	44.9	44.1	1.11
Recommended consumption of fruits and vegetables	–	–	23.0	24.9	25.8	26.9	29.1	29.6	31.7	30.4	31.1	30.9	29.2	2.35**
Regular consumption of beans	–	82.9	83.1	81.0	81.4	83.1	85.6	83.4	81.3	82.1	77.4	78.4	–	3.14
Risk factors														
Consumption of fat-rich meat	–	41.9	39.1	39.5	40.1	40.2	38.2	39.1	35.7	38.5	38.0	–	–	-1.02**
Consumption of whole milk	–	53.3	55.6	55.3	54.6	54.9	54.2	54.3	50.9	50.7	53.4	–	–	-0.65
Regular consumption of soft drinks	–	35.3	28.0	28.3	28.2	27.9	27.3	22.4	18.2	18.9	15.2	14.0	15.2	-7.85**

Source: Elaborated through the Vigitel databases available on the Ministry of Health website (http://svs.aids.gov.br/download/Vigitel/).
Note: *Corresponding to the Prais-Winsten regression coefficient of the variable over the survey year; **$p<0.05$.
[1] *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Vigitel, Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey).

Despite the positive results regarding food consumption, more than half of the population was overweight in 2018, with an average increase of 2.35%/year (ranging from 38.50% in 2006 to 53.30% in 2018). The prevalence of overweight, in all years analyzed, was higher among men, however, with an annual variation almost twice as high among women (3.13%/year), when compared to men (1.61%/year). At the same time, there was an increase in the prevalence of obesity from 9.80% in 2006 to 17.20% in 2018, with a change of 4.21%/year. Regarding obesity, women presented, in most years, a higher prevalence than men did; however, men presented a greater annual variation (4.58%/year) when compared to women (4.03%/year) (Table 3).

Table 3 – Evolution of the prevalence (%) of overweight and obesity in the adult population (≥18 years old) in the city of *Belo Horizonte*, according to sex. *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico*[1], 2006-2018.

Variables	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average annual variation (%)*
Overweight	38.5	41.2	42.7	44.4	44.1	45.6	48.1	47.3	48.5	50.4	49.6	51.1	53.3	2.35**
Male	44.8	47.2	46.6	48.4	48.8	49.9	52.0	48.4	49.7	55.4	52.7	53.1	56.6	1.61**
Female	33.2	36.1	39.4	41.0	40.1	42.1	44.7	46.3	47.5	46.2	46.9	49.5	50.5	3.13**
Obesity	9.8	11.7	12.1	12.8	12.8	14.1	14.5	14.6	16.5	17.4	16.6	16.4	17.2	4.21**
Male	9.7	10.7	11.0	10.5	12.0	12.9	13.3	13.7	14.9	15.7	14.9	17.2	15.8	4.58**
Female	9.9	12.5	13.0	14.7	13.6	15.1	15.5	15.4	17.9	18.8	18.0	15.8	18.5	4.03**

Source: Elaborated through the Vigitel databases available on the Ministry of Health website (http://svs.aids.gov.br/download/Vigitel/).
Note: *Corresponding to the Prais-Winsten regression coefficient of the variable over the survey year; **$p<0.05$.
[1] *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Vigitel, Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey).

DISCUSSION

For the first time, the evolution of the prevalence of food consumption variables and overweight and obesity in the population of *Belo Horizonte* was analyzed. Throughout the study period, the prevalence of both regular and recommended consumption of fruits and vegetables was higher than those observed in the set of Brazilian capitals [16,24]. In fact, the percentage of adults in *Belo Horizonte* who consumed fruits and vegetables as recommended in 2018 (29.2%) already reached a percentage higher than the goal proposed for Brazil until 2022, in the *Plano de Ações Estratégicas para o Enfrentamento das Doenças Crônicas não Transmissíveis* (Strategic Action Plan to Tackle Noncommunicable Diseases), of 24.3% [5].

Further details that indicate the increase in the proportion of overweight and obese people is also available for the total of the country's capitals [16]. In 2006, 42.6% of adults in Brazilian capitals were overweight, reaching 55.7% in 2018, and those with obesity went from 11.8% in 2006 to 19.8% in 2018 [16]. In such a way, the proportion of overweight and obesity observed in *Belo Horizonte* only positions the city as the one with the 19th highest frequency of overweight and the 22nd highest prevalence of obesity among the country's 26 capitals and the *Distrito Federal* in 2018, with frequencies of overweight and obesity, respectively, 7.4 and 5.8 percentage points lower than the cities with the highest values observed: *Cuiabá* (60.7% overweight) and *Manaus* (23.0% with obesity) [16].

The increase in the prevalence of overweight and obesity follows an alarming trend not only in high-income countries, but also in those of low- and middle-income countries [25,26]. The prevalence of obesity worldwide increased from 3% in 1975 to 11% in 2016, for men, and from 6% to 15%, for women [25]. Differences in prevalence between men and women are also found in the literature and have sociocultural, economic, behavioral, and biological reasons [25-27].

Regarding the increase in the recommended consumption of fruits and vegetables and reduction in the consumption of fat-rich meat or soft drinks, similar results can be found in other studies [24,28,29]. Although the objective of the present study is not to investigate the causes of the observed trends, the implementation of programs and public policies in line with national plans to fight NCD and to prevent and control obesity may contribute to the trend towards improvement in the food consumption of the population of *Belo Horizonte* [5,8]. Nutrition actions have been strengthened in the last decade, with the inclusion of Nutritionists in the Primary Health Care teams [30]. A series of actions and programs developed in the municipality (some for more than a decade) act both in increasing the supply of food, such as fruits and vegetables – the *Direto da Roça, Feiras Livres, Hortas urbanas, Programa de Sacolões ABasteCer*, and the *Restaurantes Populares* (Straight from the Country, Street fairs, Urban gardens, and the *ABasteCer* Program government-backed grocery stores, and Popular Restaurants) – as well as representing important spaces for the promotion of healthy eating [12]. Since these programs act on price reduction and expand access to these foods, these strategies can favor the consumption of healthy foods [31]. The maintenance of these actions, in partnership with a robust set of food and nutrition education practices – carried out especially with schoolchildren and the population with greater social vulnerability – has possibly been contributing to a favorable evolution of the nutritional pattern in the municipality [32].

It is noteworthy, however, that only about a third of the adults in *Belo Horizonte* reported consuming fruits and vegetables adequately in 2018, and more than 15% of adults consumed soft drinks regularly. This means that the trends observed here are not yet to be celebrated. Furthermore, considering the increasing participation of ultra-processed foods in the Brazilian diet, such as snacks, drinks, and ready meals, future studies for specific research in this city should be prioritized, since the consumption of these foods is associated with weight gain, as a result of their high energy content and high amounts of sodium, free sugars, and fats [33]. A set of intersectoral actions to regulate the environment, such as the taxation

of ultra-processed foods, proper food labeling bringing clear information on the content of ingredients, in addition to restricting the entry of these foods into the school environment and to the high exposure to advertising, are currently the most favorable and effective proposals for tackling obesity [34-36]. In Brazil, some of the discussions on these actions were initiated by the Brazilian government, but are taking slow steps. Nevertheless, they contrast with the scientific evidence, even those that have already had some progress, due to the strong interest of the food industry in the decision-making process.

Still, a greater effectiveness of the actions presented is conditioned to the expansion of the program's coverage. Some studies have pointed out that establishments offering healthy food are scarce in areas of greater social vulnerability in *Belo Horizonte* [37,38]. The *Programa Academias da Saúde* (Health Gyms Program), designed mainly to change the levels of physical activity for the entire population, do not reach all population strata [39]. Thus, the expansion of programs must keep in mind, for example, that the annual variation in obesity presented here (4.21%/year) translates into about 30 thousand new cases each year in the city (data not shown).

Finally, the increase in the number of a population's NCD may reflect changes in the sociodemographic profile as well as changes in behaviors [40]. The analysis carried out in the present study showed an increase in the population's age and educational level, which is possibly related to the changes observed regarding food consumption and nutritional status. Many studies have already proposed to investigate these associations, finding a direct relationship between healthy diet, as well as obesity, and age and educational level [27,41,42]. These sociodemographic characteristics (age and educational level), as well as other genetic and socio-environmental factors (such as sex, race/ethnicity, socioeconomic and psychosocial position, and the social and structural environment) are defined as distal health determinants in the multi-causal context associated with weight gain, and, when compared to proximal determinants (diet and physical activity), they can directly interfere in the occurrence of this outcome [43]. Although it was not analyzed based on the available data, it is suggested for the next studies that this multi-causal context be also investigated.

Understanding the changes experienced, the Brazilian government has made many efforts in recent decades to overcome the challenges of the transition process, especially in nutritional matters [44]. Conversely, in the last 5 years, the country has experienced a serious economic and political crisis, marked by the disruption of important social and health policies and the postponement of important discussions for tackling obesity. In this scenario, the continuous monitoring of factors related to NCD should be encouraged, with the potential to portray the results of these changes and support decision-making to face these conditions in the country.

It is necessary, however, to acknowledge some limitations when analyzing the results of this study. It is important to consider that the information presented in this study is self-reported, which could undermine its accuracy. Despite this, information based on the condition mentioned by the interviewees is encouraged for the investigation and monitoring of risk factors between countries and is widely used by other internationally consolidated surveys [18-19]. In addition, most of the variables used in this study, had their validity tested, confirming the accuracy of the estimates [45,46]. Finally, even if Vigitel is restricted to interviewing households with a landline, the use of statistical adjustment, using weighting factors, aims to match the estimated sociodemographic percentage for the population of adults living in households with a landline in each location to the total sociodemographic percentage of the adult population in the same location [16].

CONCLUSION

An important change in the socio-demographic profile of the adult population of *Belo Horizonte* was observed between the years 2006 and 2018. It is noteworthy that there have been favorable changes in the

investigated aspects of food consumption; despite that, these changes have not yet been enough to prevent an increase in the overweight and obesity indice. In this sense, new studies should be carried out seeking possible explanations for the increase in the frequency of these conditions, in addition to the continuation of health promotion actions, which have been carried out in the city, and the expansion of public policies that promote healthy environments.

A C K N O W L E D G M E N T S

C O N T R I B U T O R S

LES SILVA and RM CLARO contributed to the conception, planning, analysis and interpretation of data, and preparation of the article. TCM CALDEIRA contributed to the conception, planning, and critical review of the content of the article. All authors approved the final version to be published.

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