







TEMPORAL TREND IN THE PREVALENCE OF RISK AND PROTECTION FACTORS FOR CHRONIC NON-TRANSMISSIBLE DISEASES IN BELO HORIZONTE, MG

TENDÊNCIA TEMPORAL DA PREVALÊNCIA DOS FATORES DE RISCO E DE PROTEÇÃO PARA DOENÇAS CRÔNICAS NÃO TRANSMISSÍVEIS EM BELO HORIZONTE, MG

TENDENCIA TEMPORAL DE PREVALENCIA DE FACTORES DE RIESGO Y DE PROTECCIÓN PARA ENFERMEDADES CRÓNICAS NO TRANSMISIBLES EN BELO HORIZONTE, MG

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Funding: Fundo Nacional de Saúde. Secretaria de Vigilância em Saúde - TED 66/2018.

Submitted on: 2019/06/26

Approved on: 2020/02/28

ABSTRACT

Introduction: chronic non-communicable diseases (NCDs) are the biggest global health problem and are the main cause of death in the world, together with their known, preventable, and amenable risk factors. **Objective:** to analyze the temporal trends in the prevalence of risk and protective factors for NCDs in the city of *Belo Horizonte*. **Methods:** trend study of indicators of risk and protective factors for NCDs from the *Vigitel* survey for the city of *Belo Horizonte* between 2006 and 2016, stratified according to gender, age, and education. We used the simple linear regression model to estimate the trend, considering $\alpha = 0.05$. **Results:** the time series analysis showed positive aspects, such as increased trends in protective factors - the practice of leisure-time physical activity and the recommended consumption of fruits and vegetables. There was also a reduction in risk factors: smoking, consumption of soft drinks and meat and milk with fat, in the period from 2006 to 2016. **Conclusion:** the surveillance of risk and protective factors for NCDs allows the identification of social, economic and environmental conditions, and the analysis of data by capital can support the planning of programs and local actions for the prevention of chronic diseases and their risk factors, both individual and collective.

Keywords: Health Surveys; Chronic Disease; Surveillance.

RESUMO

Introdução: as doenças crônicas não transmissíveis (DCNT) constituem o maior problema global de saúde e são a principal causa de morte no mundo, juntamente com seus fatores de risco conhecidos, evitáveis e passíveis de intervenção. **Objetivo:** analisar as tendências temporais da prevalência dos fatores de risco e proteção para as DCNTs no município de *Belo Horizonte*. **Métodos:** estudo de tendência de indicadores de fatores de risco e de proteção para DCNT do inquérito *Vigitel* para a cidade de *Belo Horizonte* entre 2006 e 2016, estratificados segundo sexo, idade e escolaridade. Para estimar a tendência, foi utilizado o modelo de regressão linear simples, considerando $\alpha=0,05$. **Resultados:** a análise de série temporal mostrou aspectos positivos, como aumento das tendências de fatores de proteção - a prática de atividade física no lazer e o consumo recomendado de frutas e legumes. Houve também redução de fatores de risco: o tabagismo, o consumo de refrigerantes e de carne e leite com gordura, no período de 2006 a 2016. **Conclusão:** a vigilância dos fatores de risco e de proteção para DCNT permite identificar condicionantes sociais, econômicos e ambientais, e a análise dos dados por capitais pode subsidiar o planejamento de programas e ações locais de prevenção de doenças crônicas e seus fatores de risco, tanto individuais quanto coletivas.

Palavras-chave: Inquéritos Epidemiológicos; Doença Crônica; Vigilância.

How to cite this article:

Reis BSMT, Machado IE, Freitas MIF, Jorge AO, Silva AG, Malta DC. Temporal trend in the prevalence of risk and protective factors for chronic non-communicable diseases in *Belo Horizonte*, MG. REME - Rev Min Enferm. 2020[cited _____];24:e-1307. Available from: _____ DOI: 10.5935/1415-2762.20200044

RESUMEN

Introducción: las enfermedades crónicas no transmisibles (ENT) son el mayor problema global de salud y la causa principal de muerte en el mundo, junto con sus factores de riesgo conocidos, prevenibles y susceptibles a intervención. Objetivo: analizar las tendencias temporales en la prevalencia de factores de riesgo y protección para las ENT en la ciudad de Belo Horizonte. Métodos: estudio de tendencias de los indicadores de riesgo y factores de protección para las ENT a partir de la encuesta Vigitel para la ciudad de Belo Horizonte entre 2006 y 2016, estratificados según el sexo, la edad y la escolaridad. Para estimar la tendencia se utilizó el modelo de regresión lineal simple, considerando $\alpha = 0.05$. Resultados: el análisis de series temporales mostró aspectos positivos, como aumento de las tendencias en los factores de protección: la práctica de actividad física en el tiempo libre y el consumo recomendado de frutas y verduras. También hubo reducción en los factores de riesgo: tabaquismo, consumo de bebidas gaseosas y carne y leche con grasa en el período de 2006 a 2016. Conclusión: la vigilancia de los factores de riesgo y protección para las ENT permite identificar condicionantes sociales, económicos y ambientales; el análisis de datos por capitales puede ayudar a planificar programas y acciones locales para la prevención de enfermedades crónicas y sus factores de riesgo, tanto individuales como colectivos.

Palabras clave: Encuestas Epidemiológicas; Enfermedad Crónica; Vigilancia.

INTRODUCTION

Chronic non-communicable diseases (NCDs) are multifactorial, long-lasting, and develop throughout life. They are the biggest global health problem and are responsible for about 70% of deaths in the world, with emphasis on diseases of the circulatory system, diabetes, cancer and chronic respiratory disease.¹

In Brazil, NCDs follow the global trend with the largest problem in the country, and proportional mortality from 59.6% in 1990, which increased to 75.8% in 2015.² In *Belo Horizonte*, NCDs were responsible for 71.3% of deaths from 2012 to In 2014, with death as the main group of causes with emphasis on diseases of the circulatory system, 23.8%, and neoplasms, 20.2%.³

NCDs have modifiable and preventable risk factors. They are: physical inactivity, unhealthy eating, harmful alcohol consumption, and smoking.⁴ Monitoring, control, and prevention of these risk factors are essential since they contribute to the emergence and worsening of these diseases, affecting the quality of life of the population and causing a representative number of premature deaths and economically affecting society and the Brazilian health system.⁵

The NCD risk factors monitoring is important in the definition of public policies, leading to the implementation of the Risk and Protection Factors Surveillance System for Chronic Diseases by Telephone Survey (*Vigitel*) in 2006, in all Brazilian capitals and the Federal District, by the Health Surveillance Secretariat (SVS), of the Ministry of Health (MS). *Vigitel* aims at annually monitoring the

frequency and distribution of risk and protective factors for NCDs in adults (≥ 18 years old) living in Brazilian capitals and the Federal District.^{6,7} The system's advantages consist in quickly and low-cost checking of the frequencies of the main risk factors for NCDs in the adult population.⁶

It is possible to analyze all Brazilian capitals and each of the capitals separately through *Vigitel*. Studies have been published especially about Brazil, but there are still few studies with regional or local range. *Belo Horizonte* analyzed risk factors in 2008⁸ and inequalities between health districts⁹, the consumption of fruits, vegetables and the geographical availability of places that sell these foods.¹⁰

Considering the importance of NCDs and 11 years of the collection in *Vigitel's*, the analysis of trends in the set of risk factors in the city of *Belo Horizonte* is useful to support prevention and health promotion policies. Thus, this article aims at analyzing the trend of the prevalence of risk and protective factors for chronic non-communicable diseases between 2006 and 2016 in the city of *Belo Horizonte*, using data from *Vigitel*.

METHODOLOGY

We analyzed *Vigitel* data of the city of *Belo Horizonte*, capital of the state of *Minas Gerais*, from 2006 to 2016. Through the system, there were approximately 2,000 thousand telephone interviews annually with adults aged 18 years old or over, who have landlines in each of the 26 capitals of the Brazilian states and the Federal District, totaling approximately 54 thousand interviews.

The *Vigitel* system establishes this minimum sample size of telephone interviews in each city so that with 95% confidence and a sampling error of three percentage points, the frequency of any risk factor in the adult population is possible to estimate.⁶ The selection is through probabilistic sampling in two stages: a) systematic and stratified drawing by ZIP code (CEP) of 5,000 telephone lines in each city, followed by a new drawing and organization of replicas (subsamples) of 200 lines; b) a drawing of an adult resident (≥ 18 years old) from the house to answer the interview.⁶

Since 2012, *Vigitel* uses the rake method to calculate the post-stratification weight of the sample, aimed at correcting the number of telephone lines and the number of individuals in the house, besides matching the sociodemographic composition of the total population and the population with landline telephones, such as gender, age group, and education.¹¹ Thus, all estimates before 2012 were reviewed by the new method.

We performed time trend analyses for the indicators related to smoking, food, physical activity, alcohol, obesity, and self-reported diabetes mellitus diagnosis, available at *Vigitel* of the city of *Belo Horizonte*. Due to modifications made in the questionnaire applied by *Vigitel*, some indicators were not evaluated throughout the study period, as there was no collection of the necessary

information. The indicators analyzed were: a) **smokers**: individuals who reported current smoking - collected from 2006 to 2016; b) **obesity** (body mass index ≥ 30 Kg/m² - calculated from weight in kilos divided by the square meters heights, both self-reported by the individual - collected from 2006 to 2016); c) **food consumption**: recommended consumption of fruits and vegetables (five or more servings daily, on five or more days of the week) - collected from 2008 to 2016, consumption of meat with visible fat (red meat with visible fat or chicken with skin) - collected from 2007 to 2016, regular consumption of soft drinks (soda or soft drink/artificial juice on five or more days a week) - collected from 2007 to 2016; d) **enough physical activity during leisure time**: at least 150 minutes per week of light or moderate intensity physical activity or at least 75 minutes per week of vigorous physical activity, regardless of the number of days practicing physical activity per week - collected from 2009 to 2016; e) **alcohol intake abuse**: four or more doses for the women and five or more doses for the men, on the same occasion in the last 30 days, considering a dose of distilled drink, a can of beer or a glass of wine as a dose of alcoholic beverage - collected from 2006 to 2016; f) **driving after alcohol intake abuse**: number of adults who reported driving a motor vehicle after alcohol intake abuse - collected from 2007 to 2016; g) **diabetes mellitus**: medical diagnosis report of diabetes mellitus - collected from 2006 to 2016.

We calculated the indicators using the total number of adults interviewed as the denominator, except for those referring to specific age and gender. For the trend analysis of the time series, the selected indicators were stratified according to gender, age, and education level in each year of the interview. The simple linear regression model was the technique used to estimate the trend, with the response variable (Y_i) as the prevalence of each indicator and the explanatory variable (X_i) as the time variable (year of the survey). The positive value of the slope (β) of the line indicated the average annual increase in the prevalence of the indicator for each unit of time. When negative, it represents the average annual drop in prevalence. The prevalence in the studied period and the trend expressed by the slope of the line and the level of significance of the trend were shown. We adopted a value of $\alpha = 0.05$ for a significant trend and the Stata program (Stata Corp., College Station, United States) for data processing and statistical analysis.

The National Commission for Ethics in Research for Human Beings of the Ministry of Health approved the *Vigitel* project and we replaced the free and informed consent form by verbal consent obtained at the time of telephone contact with the interviewees.⁶

RESULTS

This study analyzed data from the city of *Belo Horizonte* with 1,500 to 2,000 interviews being collected annually. The frequency of interviews in the capital from 2006 to 2016 ranged from 1,519 in 2014 to 2,016 in 2006 and 2008 (Table 1).

Table 1 - Interviews conducted in *Belo Horizonte, Vigitel, 2006-2016*

Year	Men	Women	Total
2006	782	1234	2016
2007	803	1207	2010
2008	799	1217	2016
2009	817	1194	2011
2010	789	1218	2007
2011	836	1170	2006
2012	689	1122	1811
2013	757	1199	1956
2014	527	992	1519
2015	779	1228	2007
2016	747	1257	2004

Source: *Vigitel* 2006-2016.

The trend analysis shows that the prevalence of smokers had an average annual reduction of 0.59 percentage points (pp) per year, varying from 15.7% in 2006 to 10.9% in 2016. In males, the reduction was higher (-0.78 pp a year) than in females (-0.44 pp a year) (Table 2). In all age groups, except 55 years old and older, there was a decrease in the frequency of smoking. The biggest tendency to decrease (1.02 pp per year) was in the age group of 45 to 54 years old (Table 3). In people with 12 or more years of study, the reduction was 0.75 pp per year, followed by people with nine to 11 years of study (-0.35 pp per year) (Table 4).

The prevalence of obesity increased by 0.68 pp per year, varying from 9.8% in 2006 to 16.6% in 2016. This increase was greater in females (0.76 pp per year) than in males (0.59 pp per year) (Table 2). All age groups had an increase, higher in the range of 35 to 44 years old (0.99 pp year) (Table 3). Concerning education, there was an increase in all age groups. People with zero to eight years of study had the largest increase, 0.97 pp per year (Table 4).

The prevalence of recommended consumption of fruits and vegetables increased 1.05 pp per year, varying from 23% in 2008 to 31.1% in 2016. Women showed a higher prevalence in this indicator and also showed greater annual growth (1.17 pp over the same period), compared to men (0.91 pp per year) (Table 2). Regarding the age group, the prevalence of recommended consumption of fruits and vegetables increased only in people from 18 to 44 years old. Regarding education, in all age groups, there was an increase, higher in people with nine to 11 years of study, 1.04 pp per year (Tables 3 and 4).

There was a reduction in the prevalence of meat consumption with visible fat of 0.38 pp per year, varying from 41.9% in 2007 to 38% in 2016, significant only in women (-0.34 pp per year) and aged 35 to 44 years old (-1.37 pp per year) (Tables 3, 4 and 5). There was a reduction in the prevalence of regular soft drink consumption (≥ 5 days/week) of 1.89 pp per year, varying from 35.3% in 2007 to 15.2%

Table 2 – Trend in the prevalence of risk and health protection factors in the population of *Belo Horizonte, MG*, according to gender, *Vigitel* 2006-2016

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	p-value	Trend
	%	%	%	%	%	%	%	%	%	%	%		
Smokers													
Male	21.3	19.8	20.3	17.7	17.6	19.1	15.5	15.8	16.2	12.4	13.5	<0.001	-0.789
Female	11.0	10.9	13.2	11.5	12.9	10.8	9.9	10.3	9.2	6.0	8.7	0.0106	-0.441
Total	15.7	15.0	16.4	14.3	15.0	14.6	12.5	12.8	12.4	8.9	10.9	<0.001	-0.599
Obesity													
Male	9.7	10.7	11.0	10.5	12.0	12.9	13.3	13.7	14.9	15.7	14.9	<0.001	0.595
Female	9.9	12.5	13	14.7	13.6	15.1	15.5	15.4	17.9	18.8	18.0	<0.001	0.761
Total	9.8	11.7	12.1	12.8	12.8	14.1	14.5	14.6	16.5	17.4	16.6	<0.001	0.685
Recommended consumption of fruits and vegetable													
Male			18.0	19.2	21.3	22.2	22.5	23.3	25.9	24.7	25.0	<0.001	0.913
Female			27.1	29.8	29.6	30.8	34.7	34.8	36.5	35.3	36.2	<0.001	1.178
Total			23.0	24.9	25.8	26.9	29.1	29.6	31.7	30.4	31.1	<0.001	1.057
Consumption of meat with visible fat													
Male		55.3	47.6	50.9	52.7	52.7	48.7	49.8	46.7	48.8	50.3	0.1497	-0.426
Female		30.6	31.9	29.8	29.5	29.7	29.4	30.0	26.4	29.8	27.6	0.0253	-0.348
Total		41.9	39.1	39.5	40.1	40.2	38.2	39.1	35.7	38.5	38	0.0215	-0.384
Regular refrigerant consumption (>=5 days/ week)													
Male		41.3	33.4	32.9	30.6	33.4	28.5	24.9	22.8	21.9	17.2	<0.001	-2.242
Female		30.1	23.4	24.4	26.2	23.2	26.4	20.3	14.4	16.4	13.5	0.001	-1.593
Total		35.3	28.0	28.3	28.2	27.9	27.3	22.4	18.2	18.9	15.2	<0.001	-1.898
Practice of sufficient physical activity at leisure													
Male				41.7	40.1	44.5	45.5	42.8	44.1	45.5	45.4	0.0461	0.583
Female				27.3	25.3	27.6	28.7	30.2	36.4	33.2	36.7	0.0021	1.586
Total				33.9	32.1	35.3	36.4	35.9	39.9	38.8	40.7	0.0011	1.124
Alcohol intake abuse													
Male	27.1	29.3	30	34.1	30.6	28.1	30.6	25.5	29.5	27.5	29.2	0.5436	-0.14
Female	12.1	10.3	13.1	14.1	12.8	12.1	13.0	14.5	16	11.9	15.3	0.0593	0.292
Total	19.0	19.0	20.8	23.2	20.9	19.4	21.1	19.6	22.2	19	21.7	0.5104	0.097
Driving after alcohol intake abuse													
Male		5.7	4.1	4.9	4.5	4.1	3.2	1.9	2.7	1.5	1.7	<0.001	-0.448
Female		0.6	0.3	0.6	0.5	0.1	0.4	0.0	0.0	0.2	0.3	0.0575	-0.046
Total		2.9	2.1	2.6	2.4	1.9	1.7	0.9	1.2	0.8	0.9	<0.001	-0.235
Diabetes													
Male	3.4	5.0	5.0	5.7	6.9	4.9	5.0	7.6	6.6	7.5	9.1	0.0014	0.411
Female	4.9	6.5	6.6	6.3	6.0	7.3	7.9	7.6	8.0	7.6	11.0	0.0011	0.396
Total	4.2	5.8	5.8	6.0	6.4	6.2	6.6	7.6	7.4	7.5	10.1	<0.001	0.405

Source: *Vigitel* 2006-2016.

Table 3 – Analysis of the trend in the prevalence of risk and health protection factors in the population of *Belo Horizonte, MG* according to age group, *Vigitel* 2006-2016

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	p-value	Trend
	%	%	%	%	%	%	%	%	%	%	%		
Smokers													
18 to 24	13.4	14.0	12.0	9.3	11.5	9.8	4.1	8.6	10.7	5.4	5.2	0.0037	-0.801
25 to 34	13.1	14.2	18.2	13.2	16.5	13.5	14.7	15.2	10.2	8.6	7.2	0.0235	-0.67
35 to 44	19.5	15.9	17.7	16.5	17.6	14.2	12.2	12.2	14.4	8.6	11.8	<0.001	-0.833
45 to 54	22.0	24.2	23.9	18.5	20.4	22.9	17.9	16.9	13.1	12.5	16.5	0.0015	-1.022
55 to 64	15.6	10.2	12.8	19.5	14.8	18.7	16.1	13.9	18.4	12.4	18.1	0.3979	0.256
65 and more	8.7	7.3	9.4	6.3	4.9	7.2	7.4	6.8	8.6	5.4	7.2	0.3543	-0.127
Obesity													
18 to 24	3.7	2.8	4.7	3.4	4.5	3.9	7.6	5.3	7.2	6.2	4.7	0.032	0.3
25 to 34	5.6	11.9	11.5	9.1	10.0	8.5	11.5	11.4	14.7	13.0	13.7	0.0146	0.551
35 to 44	12.2	8.2	11.5	14.7	16.5	18.3	14.5	14.6	20.2	20.7	19.4	0.0012	0.999
45 to 54	13.4	19.5	16.0	16.7	14.4	19.8	17.7	18.8	18.3	19.9	19.1	0.0486	0.405
55 to 64	17.5	20.1	18.2	21.0	19.6	19.5	22.5	21.8	22.9	25.8	22.7	0.001	0.613
65 and more	12.0	11.7	13.6	12.2	15.6	19.0	16.7	18.9	16.7	21.1	20.9	<0.001	0.963
Recommended consumption of fruits and vegetable													
18 to 24			21.3	21.0	20.2	20.2	26.9	26.3	26.3	31.8	27.5	0.0044	1.258
25 to 34			24.8	24.0	25.6	24.3	30.8	24.6	34.5	31.6	31.3	0.0189	1.115
35 to 44			17.0	22.4	25.1	27.3	28.2	28.7	32.3	32.2	29.9	<0.001	1.613
45 to 54			24.3	23.5	27.0	27.5	25.6	32.3	34.6	25.4	30.7	0.0795	0.855
55 to 64			27.3	31.1	29.7	32.2	32.2	40.4	30.6	30.6	36.2	0.1511	0.735
65 and more			25.7	31.2	29.4	34.3	32.1	29.7	28.2	31.4	31.7	0.3984	0.293
Consumption of meat with visible fat													
18 to 24		47.7	37.4	48.7	4.05	45.8	50.8	43.0	42.1	50.3	48.8	0.4176	0.401
25 to 34		45.7	45.2	43.8	47.4	49.7	44.1	44.4	39.6	46.6	40.9	0.2175	-0.418
35 to 44		46.1	46.0	45.5	38.5	39.5	41.3	45.1	34.4	29.2	37.7	0.0145	-1.376
45 to 54		42.6	38.7	35.8	40.7	35.7	34.0	31.6	40.7	39.3	39.1	0.6385	-0.193
55 to 64		27.8	26.5	31.8	34.0	35.1	29.0	33.9	26.7	30.3	33.2	0.4909	0.262
65 and more		28.9	29.0	24.0	25.8	25.8	20.8	30.8	24.3	30.3	25.0	0.819	-0.088
Regular refrigerant consumption (>=5 days/ week)													
18 to 24		46.8	39.8	39.1	43.9	44.5	42.4	34.6	29.4	33.8	28.0	0.0039	-1.756
25 to 34		43.0	37.5	40.6	34.3	33.1	30.5	29.6	23.2	22.2	18.0	<0.001	-2.641
35 to 44		39.2	26.4	28.9	30.0	27.9	27.7	23.3	15.9	18.0	12.3	<0.001	-2.341
45 to 54		28.1	18.4	19.8	24.1	21.8	22.8	16.2	15.8	18.4	11.7	0.0138	-1.153
55 to 64		20.4	17.2	19.3	16.4	17.6	18.9	12.5	8.5	8.4	12.1	0.0029	-1.216
65 and more		17.3	16.6	12.1	7.8	14.1	16.1	10.8	12.2	8.8	8.5	0.0457	-0.741
Practice of sufficient physical activity at leisure													
18 to 24				43.2	41.0	42.4	51.3	48.1	52.0	52.1	58.4	0.0017	2.232
25 to 34				41.8	39.9	40.2	41.8	37.8	45.6	44.3	49.5	0.0579	1.049
35 to 44				24.8	27.9	31.6	37.1	31.1	37.6	38.9	37.2	0.0057	1.831
45 to 54				28.9	25.3	33.9	26.2	34.4	30.1	33.3	33.3	0.1593	0.805
55 to 64				32.8	27.8	32.5	31.6	33.9	40.0	30.7	35.6	0.2329	0.701
65 and more				32.3	24.3	26.8	24.8	28.7	32.1	29.6	25.7	0.9983	0.001

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Table 3 – Analysis of the trend in the prevalence of risk and health protection factors in the population of *Belo Horizonte*, MG according to age group, *Vigitel* 2006-2016

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	p-value	Trend
	%	%	%	%	%	%	%	%	%	%	%		
Alcohol intake abuse													
18 to 24	26.8	24.1	23.8	29.9	21.6	25.7	17.8	22.3	21.1	25.5	23.2	0.2625	-0.359
25 to 34	23.7	26	23.8	26.7	30.1	25.8	29.5	23.4	34.3	25.7	30.1	0.1293	0.501
35 to 44	23.6	22.1	25.7	25.3	23.7	18.9	22.0	21.7	20.1	20.8	23.2	0.1411	-0.299
45 to 54	16.1	15.8	19.7	25.5	21.8	19.0	24.4	22.6	22.3	17.5	24.5	0.1452	0.485
55 to 64	7.3	9.4	16.5	19.1	10.3	12.5	14.8	15.7	17.1	11.7	14.8	0.2429	0.42
65 and more	1.8	3.5	6.7	6.4	5.2	5.9	8.2	4.9	7.7	6.4	5.2	0.1001	0.287
Driving after alcohol intake abuse													
18 to 24		3.0	3.3	3.9	0.6	2.1	1.1	0.4	0.0	1.1	0.6	0.008	-0.352
25 to 34		5.5	2.6	3.9	4.4	3.8	3.6	1.4	2.3	1.4	1.4	0.0051	-0.379
35 to 44		3.0	2.0	1.5	3.7	1.8	1.1	0.9	0.4	0.9	1.2	0.0267	-0.233
45 to 54		1.9	1.0	2.3	2.8	1.7	1.6	1.7	2.2	0.1	1.1	0.229	-0.105
55 to 64		0.6	1.6	3.0	0.0	0.2	0.6	0.0	1.2	0.5	0.3	0.283	-0.115
65 and more		0.7	1.0	0.5	0.0	0.1	0.3	0.0	0.3	0.3	0.5	0.209	-0.045
Diabetes													
18 to 24	1.5	1.5	1.1	0.2	0.7	1.0	0.6	0.7	1.7	1.6	3.0	0.1956	0.096
25 to 34	1.1	0.5	0.8	1.8	1.8	0.9	1.6	0.2	0.6	1.9	1.4	0.6421	0.028
35 to 44	1.4	1.8	2.8	2.6	5.2	2.1	2.3	3.3	2.6	3.4	6.7	0.0532	0.28
45 to 54	4.6	7.8	7.9	6.8	5.5	9.6	9.3	8.6	10.6	7.2	12.7	0.0157	0.487
55 to 64	9.3	17.2	14.3	12.6	11.8	11.8	12.9	16.4	16.4	16.5	20.2	0.034	0.606
65 and more	16.0	17.8	18.4	18.9	22.3	20.6	20.7	26.7	20.1	22.2	24.7	0.0047	0.729

Source: *Vigitel* 2006-2016.

in 2016. This reduction in men was 2, 24 pp a year and in women, it was 1.59 pp a year (Table 2). In all age groups and education levels, there was a fall, being greater in the groups of 25 to 34 years (-2.64 pp per year) and with nine to 11 years of study (-2.20 pp per year) (Tables 3 and 4).

The prevalence of adults who practice enough physical activity in their free time (leisure time) showed an average annual increase of 1.12 pp, with a greater tendency in females (1.58 pp per year) than in males (0.58 pp) per year). However, the prevalence of physical activity was higher in men than in women, throughout the period (45.4% in 2016) (Table 2). Only two age groups from 18 to 24 years old and 35 to 44 years old showed a significant increase, higher in the first group (2.23 pp per year) (Table 3). The trend only increased in people with nine to 11 years of study, 1.25 pp per year. However, the prevalence of physical activity is higher in the group of people aged 12 and older in the whole period (51, 4% in 2016) (Table 4).

The prevalence of adults who had alcoholic beverages intake abuse did not show a trend regarding the gender, education, and age group (Tables 2, 3, and 4). There was a decrease of 0.23 pp per year in the prevalence of adults who usually drive after consuming alcoholic beverages, significant in men (-0.44 pp per year), between 18 and 44 years old and in all education levels, higher in the group with nine to 11 years of study (-0.31 pp per year) (Tables 2, 3 and 4).

The prevalence of self-reported diagnosis of diabetes tended to increase on average by 0.40 pp per year, varying from 4.2% in 2006 to 10.1% in 2016 in both genders: in men, from 0.41 pp per year; and in women, 0.39 pp per year (Table 2). The tendency to increase was in the age group of 45 years and older, greater from 65 years and older (0.72 pp per year) (Table 3). In people with zero to eight years of study, there was an increase of 0.98 pp per year, going from 6.7% (2006) to 19.4% (2016), followed by people with nine to 11 years of study (0.33 pp per year), from 1.8% (2006) to 6.5% (2016). In people aged 12 and older, the prevalence remained stable - 5.4% in 2016 (Table 4).

DISCUSSION

The analysis of time series of the risk and protection factors for NCDs for *Belo Horizonte* city showed positive aspects, with tendencies of increase in protective factors (physical activity in leisure time and recommended consumption of fruits and vegetables) and a reduction in risk factors (smoking, regular consumption of soft drinks and meat with fat). There was also a tendency to reduce in adults who usually drive after consuming alcohol, but the prevalence increased in obesity and diabetes.

The smoking trend in *Belo Horizonte* as in Brazil has been decreasing in recent decades, showing the success of measures

Table 4 – Analysis of the trend in the prevalence of risk and health protection factors in the population of *Belo Horizonte, MG* according to education level, *Vigitel* 2006-2016

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	p-value	Trend
	%	%	%	%	%	%	%	%	%	%	%		
Smokers													
0 to 8	19.3	17.6	21.3	18.9	19.2	20.1	16.9	19.9	19	11.3	14.5	0.0547	-0.513
9 to 11	13.6	11.5	13.8	12.1	13.7	10.8	11.8	10.3	10.7	9.8	10.2	0.004	-0.351
12 and +	11.6	15.2	11.9	9.9	10.4	12.1	7.5	6.9	6.7	5.1	8.1	0.0017	-0.749
Obesity													
0 to 8	13.2	15.3	17.6	16.6	17.2	19.8	19.8	20.1	24.8	23	22.3	<0.001	0.977
9 to 11	8.3	9.3	7.9	11.4	12	11.4	13	11.6	14.1	16.1	16.2	<0.001	0.788
12 and +	5.4	8.1	8.7	8.5	7.2	9.7	9.7	11.6	9.9	12.6	11.5	<0.001	0.553
Recommended consumption of fruits and vegetable													
0 to 8			18	18.9	21.5	21.8	21	27.9	21	24	24.8	0.0314	0.793
9 to 11			23.6	25.5	24.5	26.8	29.5	28.5	34	29.7	30.9	0.0033	1.042
12 and +			30.7	34.3	34.2	34.4	39.5	33.1	41.3	38.7	37.3	0.0368	0.875
Consumption of meat with visible fat													
0 to 8		43.2	42.4	43.5	45	40.1	36.8	41	37.8	42.4	38.9	0.0869	-0.5
9 to 11		45.9	41.7	39.3	41.8	44.1	41	41.9	38.2	40	40.2	0.0796	-0.433
12 and +		33.2	29.4	32.9	30.4	34.6	36.1	32.9	29.7	32.1	34.7	0.5631	0.154
Regular refrigerant consumption (>=5 days/ week)													
0 to 8		30.6	26.2	25.2	25.1	26.1	26.8	14	15.5	17.1	12.2	<0.001	-1.881
9 to 11		41.8	32.4	33.9	34.8	31.8	27.5	29.4	19.9	21.9	19.6	<0.001	-2.205
12 and +		34.6	24.4	25.2	23.9	24.9	27.9	23.8	19.2	17.1	13.2	0.0022	-1.642
Practice of sufficient physical activity at leisure													
0 to 8				22.7	21.2	25.4	26	25.7	26.9	25.5	24.9	0.0903	0.489
9 to 11				36.6	35.5	37.9	39.9	39.4	42.3	43.1	44.4	<0.001	1.254
12 and +				48.8	44.4	46	45.1	44.5	52.2	48.5	51.4	0.1705	0.675
Alcohol intake abuse													
0 to 8	16	13.6	17.4	19.3	14.5	13	17.3	14.3	16.4	14.8	12	0.2869	-0.231
9 to 11	17.9	22.3	23.7	23.2	20.8	20.3	21.8	21.9	23.2	18.8	20.7	0.8823	-0.028
12 and +	26.2	24.6	22.6	29.9	31.1	27.5	25.1	23.2	27.7	24.2	31.9	0.5225	0.207
Driving after alcohol intake abuse													
0 to 8		1.2	0.5	1.4	0.1	1	0.7	0.2	0.4	0	0.2	0.0385	-0.106
9 to 11		4	2.7	2.1	3	2.2	1.4	1.2	0.9	0.8	1	<0.001	-0.318
12 and +		4.6	3.7	5.3	4.9	3	3.3	1.2	2.6	1.6	1.6	0.0028	-0.4
Diabetes													
0 to 8	6.7	8.3	10.3	8.9	9.8	11.1	10.7	15.4	13.6	13.5	19.4	<0.001	0.983
9 to 11	1.8	3.7	3	4.5	5.3	3.7	4.7	4	5.6	5.4	6.5	0.0016	0.332
12 and +	2.8	4	2.2	3.4	2.8	2.8	3.8	2.3	2.3	3.5	5.4	0.3378	0.092

Source: *Vigitel* 2006-2016.

adopted in the control of smoking, such as the increase in taxes and prices on tobacco products, advertising ban; legislation on tobacco-free environments, smoking bans in public places and warnings on cigarette packs, among others.¹²⁻¹⁵ *Belo Horizonte* also has the Municipal Tobacco Control Program that which implemented actions such as 100% tobacco-free environments, celebrations of dates alluding to tobacco control, training of professionals in the SUS-BH network for a brief and intensive approach to smokers, with an increase in the offer of support and treatment to smokers.³ In 2008 *Belo Horizonte* has 42.6% of the smoking cessation rate for more than six months.¹⁶

There was an improvement in the prevalence of recommended consumption of fruits and vegetables. The trend was increasing in both genders, although the prevalence is higher in women and people with medium and high education, as found in other studies.^{17,18} The consumption of this kind of food contributes to the prevention of NCDs, especially cardiovascular diseases and cancer,¹ as they have a low caloric and fat content and a high supply of fibers, resulting in greater satiety and reduced total food intake.¹⁹

The trends reducing the consumption of meat with visible fat and soft drinks were also observed. This reduction is very important because of the high intake of saturated fat and cholesterol has health risks, especially for cardiovascular diseases.²⁰ The decrease of the trend of soft drinks consumption is also important since the consumption of free sugar by the Brazilian population exceeds more than 50% of the maximum limit recommended by the WHO, that is 10% of the total calories.²¹

This study found that the practice of physical activity has been increasing, with more frequent in men, young adults (18 to 24 years old and 35 to 44 years old), and with more education level. The studies explained that this increase in the population with more education levels because they have more knowledge about the benefits of physical activity and more access to spaces for physical activity.²²⁻²⁵ The fourth leading cause of death in the world is the sedentarism²² and this study shows the importance of investing in public policies to improve public spaces for the practice of physical activity to reduce inequalities.

Although there was an improvement in the indicators of diet and physical activity, there was an increase in the prevalence of obesity in the capital of *Minas Gerais*. The WHO considers overweight and obesity to be the main public health problems of the world population, affecting all age groups and both genders and associated with a high risk of cardiovascular diseases.¹ As in *Belo Horizonte*, obesity is a constant problem in Brazil and worldwide, as well as the diseases associated with it, being a challenge for health managers and the population in general.

The alcohol intake abuse did not change in the trend, but the habit of drinking and driving dropped. Alcohol is an important risk factor related to cardiovascular, liver disease, cancer, neurological disorders, depression, and increases the exposure to accidents and violence.²⁶ The implementation of the so-called "Dry Law" (Law 11,705, of June 19 of 2008)²⁷ and the approval of Law 12,760/2012,28, which increases the amount of the fine and authorize the use of evidence such as videos, testimonies or other means of proving in criminal proceedings showing the drunkenness of the driver, contributed to the reduction of the practice of alcohol abuse related to driving,²⁹ but these laws still lack the element of constant supervision over drinking and driving.³⁰

There was an increase in self-reported diabetes for the population of *Belo Horizonte* in the period, as already found in another study.³ The prevalence of diabetes was higher in men with low education levels and the elderly population (65 years and over). Studies^{31,32} have discussed the association of diabetes with low education level, suggesting that people with more education years have more access to health promotion practices, such as physical activity, healthy eating, and access to health services and medications.³²

CONCLUSION

This study showed that the trend of risk factors for NCDs in *Belo Horizonte* follows the trend in Brazil. Also, the time series analysis obtained positive aspects, such as the increase in trends in protective factors: leisure-time physical activity and recommended consumption of fruits and vegetables; and the reduction of risk factors: smoking, consumption of soft drinks, meat, and milk with fat. However, there was an increase in overweight, obesity, and diabetes.

The surveillance of risk factors and protection against NCDs can identify social and economic conditions and the analysis of data by capitals can support the planning of programs and local actions for the prevention of chronic diseases and their risk factors, both individual and collective. The prevention and control of NCDs and their conditions are essential to contain the epidemic growth of these diseases and their consequences for the population.

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