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Comparative study of cardiovascular and cancer mortality of Adventists and non-Adventists from Espírito Santo State, in the period from 2003 to 2009

Estudo comparativo da mortalidade cardiovascular e por neoplasia de Adventistas e Não Adventistas do Estado do Espírito Santo, no período de 2003 a 2009

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ABSTRACT: ***Introduction:*** Populations with healthier habits have been investigated regarding their pattern of disease occurrence. ***Objective:*** This study aims at evaluating mortality patterns (all-cause, cardiovascular diseases) among members of the Seventh-day Adventists Church in the State of Espírito Santo, Brazil, and to compare those with the mortality rates in the State population. ***Methods:*** The study investigated 14.519 living Adventists and 995 deaths among those aged ≥ 30 years old from 2003 to 2009. A total of 896 deaths were confirmed by the Mortality Information System of the Ministry of Health. Standardized mortality ratios (SMR) were calculated utilizing the indirect method, with the state population ≥ 30 years old as the standard population. ***Results:*** Adventists presented all-cause mortality rate 42.5% lower than the Espírito Santo population (SMR = 57.5; 95%CI 47.8 – 68.2), 52.2% lower by ischemic heart disease (SMR = 48; 95%CI 25.02 – 82,75) and 46.3% less by stroke (SMR = 54; 95%CI 30.4 – 87.8). ***Conclusion:*** The Adventists' healthier lifestyle in relation to diet, smoking, and alcohol consumption may have influenced their lower mortality rates.

Keywords: Mortality. Life style. Religion. Chronic disease. Epidemiology. Cardiovascular Diseases.

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RESUMO: ***Introdução:*** Populações com hábitos de saúde mais saudáveis têm sido investigadas quanto ao seu padrão de ocorrência de doenças. ***Objetivo:*** Este estudo teve o objetivo de avaliar os padrões de mortalidade geral e por doenças cardiovasculares em Adventistas do Sétimo Dia (ASDs) do Estado do Espírito Santo (ES), Brasil, e compará-los com a mortalidade pelas mesmas causas na população do Estado. ***Métodos:*** Foram investigados 14.519 Adventistas vivos e 995 falecidos com idade ≥ 30 anos no período de 2003 a 2009. Entre esses, 896 óbitos registrados foram confirmados no Sistema de Informação sobre Mortalidade (SIM) do Ministério da Saúde. Foram calculadas as razões padronizadas de mortalidade (RPM) com o método indireto, tendo como população padrão a população ≥ 30 anos de idade do Estado. ***Resultados:*** Os Adventistas apresentaram taxas mais baixas de mortalidade geral, 42,5% menor em relação à população do ES (RMP = 57,5; IC95% 47,8 – 68,2), 52,2% menor por doenças isquêmicas do coração (RMP = 48; IC95% 25,0 – 82,8) e 46,3% menor por doenças cerebrovasculares (RMP = 54; IC95% 30,4 – 87,8). ***Conclusão:*** Hábitos saudáveis dos Adventistas em relação a dieta, tabagismo e consumo de álcool podem ter influenciado suas taxas de mortalidade mais baixas.

Palavras-chave: Mortalidade. Estilo de vida. Religião. Doença crônica. Epidemiologia. Doenças cardiovasculares.

INTRODUCTION

The scientific community is interested in investigating morbidity patterns of population groups that share behaviors associated with health, such as dietary and physical activity patterns, as well as alcohol and tobacco consumption. Some of these groups, including those of a religious nature, acquire structure and operation of typical social networks, which also tend to favor more homogeneous health behaviors[1].

The Seventh-day Adventists (ASDs) are a religious group characterized, for example, by preferably vegetarian diet, abstention from tobacco and alcohol, and regular physical activity, as well as the use of meditation techniques[2,3].

Since the 1960s, there are longitudinal studies on the determinants of morbidity and mortality patterns of ASDs, especially those among the residents of California, in the United States of America[4]. Compared to the general population, ASDs showed inferior overall rates of mortality for coronary and cerebrovascular[5] diseases, and cancer related to alcohol and tobacco consumption[4]. In general, the vegetarian diet of ASDs in addition to abstention from alcohol and smoking, was considered the main determinant of lower mortality rates and better metabolic and health profile[4], such as serum cholesterol, blood pressure, lower body mass index (BMI), and lower prevalence of hypertension and diabetes[5,6]. The ASDs showed life expectancy higher than the general population (men over 7.3 years and women over 4.4 years), and vegetarians had nearly two additional years of life expectation[6,7]. The INTERHEART study showed that smoking, hypertension, diabetes, physical inactivity, abdominal obesity, HDL and low-density lipoprotein (LDL) cholesterol levels, psychosocial factors, and family history accounted for more than 90% of the attributable risk for cardiovascular events, specifically myocardial infarction[8].

In Brazil, the ASDs, according to records of their churches, represent 0.69% of the population; in the State of Espírito Santo (ES), ASDs comprised 1.25% of the population in 2012. National studies have focused on the risk profile for cardiovascular disease in this population, assessing the presence of dyslipidemia, hypertension, diabetes, physical activity pattern, food, alcohol, and tobacco intake[2,3,9].

The studies in California initiated in the 1950s were important in the late 1990s and mid-2000s, constituting today in a consolidated research line. However, in reality, there is a lack of studies comparing standards of health and illness among ASDs and the Brazilian population, with the objective to investigate the possibility of default groups with specific behaviors that may or may not have better health conditions.

Therefore, this study aimed to evaluate the pattern of mortality in cardiovascular disease and cancer among the ASDs of ES state, and compare it with mortality in the same causes in the state's population.

METHODS

A descriptive study was conducted based on deaths registered in the Mortality Information System (SIM).

The sample universe consisted of all ASDs aged ≥ 30 years registered in two Associations of the Adventist Church of the Seventh Day of ES State. They have provided information on active official members and those who were shut off because of death regarding full name, affiliation, date of birth, baptism in the church, and year of death. Mortality data were obtained from the ES SIM Ministry of Health, provided by the ES State Health Secretariat in the form of nominal database. Records for the period 2003 – 2009 were used, as they demarcated the beginning of data computerization by the secretariat of the Church and the complete SIM database.

Information on the resident population and mortality of ES state's population was obtained from the Department of the Unified Health System (DATASUS) of the Ministry of Health. Mortality was categorized according to the International Classification of Diseases, 10th revision (CID-10); for the general population, intercensal projections of 2003 – 2009, according to age, were considered.

The relationship of data between registered ASDs in the churches of ES and all SIM individuals was conducted to identify and confirm ASDs who died. Initially, this search was manual; then, the Probabilistic Record Program – RecLink III, version 3.1.6.3160, was used.

According to CID-10, the basic cause of death was identified considering the grouping of related causes for ischemic heart disease (IHD) (I20 to I25) and cerebrovascular disease (I60 to I69), for large groups of causes or chapters for all cancers (Chapter II), and ill-defined causes (Chapter XVIII), to evaluate the quality of information on mortality. The amount of 4 to 6% deaths from ill-defined causes is acceptable[10].

Distribution of deceased, according to age and sex from the general population and ASDs, was performed, as well as data loss constituted by ASDs who died, but was not found in the SIM.

The general mortality rate (GMR) of reference or standard population considered the average number from 2003 – 2009 in the municipalities of the state.

For the comparative analysis of general mortality, we calculated the Standardized Mortality Ratios (SMR) and their respective values of 95% confidence interval (95% CI) for all causes and for specific causes (tumors/cancers, cerebrovascular diseases, and IHD). We adjusted for age using the indirect method considering ES population as standard. Therefore, we calculated the ratio between the number of deaths observed and the expected number multiplied by 100 [$SMR = (O/E) \times 100$]. Standardizing the indirect method expresses the force of mortality to which the Adventist population would be exposed, in case it had the specific mortality rates by age derived from the population of the entire state (reference). This allows inferences about differences in mortality between both populations[10].

All analyzes were performed using the statistical program R, version 2.15.1.

The project was approved by the Research Ethics Committee (CEP) of the Health Sciences Center of Universidade Federal do Espírito Santo, under Process nº 178/2011, and the Children's Hospital Nossa Senhora da Glória, registration nº 25/2011.

RESULTS

The database provided by both churches totaled 1,015 deceased ASDs from 2003 to 2009; however, 20 were excluded because of incomplete information. Of the 995 remaining, 196 (19.6%) were not related to the SIM database and were considered data loss, and may even have died in another state. From the 14,519 alive ASDs aged ≥ 30 years registered in the SIM database, 97 had already died, although they were classified as alive. Thus, the final database consisted of 896 ASDs who died between 2003 and 2009, related in both databases.

Between 2003 and 2009, the average of ES population aged ≥ 30 years was 1,522,905.7 inhabitants; 14,518.9 (0.95%) were ASDs. There is a lower proportion of ASDs in the age groups between 30 and 49 years and gradually higher in the following age groups, especially those aged ≥ 80 years. The mortality rate in both populations increase with advancing age, therefore there are proportionally more deaths in ES population between 30 and 59 years (Table 1).

Data losses, according to age group, have similar distribution of deaths in ASDs and ES population. It is lower in the age group 50 – 69 years and higher in the age ≥ 80 years, perhaps because of the difficulty in getting data of older people.

The deaths of ASDs have similar distribution between sexes, with a slight increase in the male population (50.4%); it was also found that more men die in ES (57.4%). There was no information as to the sex of living ASDs; females predominated (56.1%) in data losses.

Regarding age, 41 (4.5%) were in the age group between 30 and 39 years, 59 (6.6%) between 40 and 49 years, 108 (12.1%) between 50 and 59 years, 177 (19.7%) between 60 and 69 years, 218 (24.4%) between 70 and 79 years, and 293 (32.7%) were 80 years or older.

Other demographic data were obtained from the SIM database. They were mostly white: 383 (43.7%), and brown: 217 (24.2%); married: 382 (42.6%) and widowers: 220 (24.5%). In all the variables there was much incomplete data, and only 44% of ASDs who died had information regarding their schooling in the SIM. The data showed that among ASDs, almost 13% studied, 145 (16%) had 1 to 3 years of education, and 94 (11%) had between 4 and 7 years of education.

In the group of ASDs, there were 52 (5.8%) deaths because of ill-defined causes (Chapter XVIII of CID-10), and 34 of them occurred in the elderly who were aged ≥ 70 years. It is noteworthy that, in the elderly, when the main cause of death is senility, the death certificate lists it as ill-defined cause.

The observed deaths were lower than expected in all age groups and also the age specific rates were below 100 (Table 2). When adjusted for age, SMR was 57.5 (95%CI 47.84 – 68.21), which shows that being an Adventist reduces the likelihood of mortality by 42.5% compared with the ES population in the period 2003 – 2009.

As for mortality from specific diseases, Table 3 shows that approximately 50% less of the ASDs die from IHD and cerebrovascular diseases, in relation to the state's population. With respect to cancer, no significant differences were observed and, when deaths from colorectal cancer and breast cancer were assessed, the results were inconclusive because of the small number of deaths identified. These data were not presented.

Table 1. Relative and absolute frequency of the average population and deaths of Espírito Santo State of the Adventists (alive and dead) and total data loss from 2003 to 2009, according to age group.

Age group (years)	ES population	Deaths ES population	ADV ES	Deaths ADV ES	Data loss[a]
	n (%)	n (%)	n (%)	n (%)	n (%)
30 – 39	526,200 (34.6)	13,208 (8.1)	42,478 (29.3)	58 (4.5)	19 (9.7)
40 – 49	4,278,628 (28.1)	19,147 (11.7)	35,078 (24.2)	84 (6.6)	8 (4.1)
50 – 59	2,729,091 (17.9)	24,091 (14.7)	27,947 (19.2)	154 (12.1)	10 (5.1)
60 – 69	1,650,264 (10.8)	28,861 (17.6)	18,055 (12.4)	252 (19.7)	14 (7.1)
70 – 79	923,517 (6)	37,448 (22.8)	12,774 (8.8)	311 (24.4)	45 (22.9)
80 +	385,555 (2.5)	41,254 (25.1)	7,527 (5.2)	418 (32.7)	77 (39.3)
Missing data[b]	–	–	133 (0.9)	–	23 (11.8)
Total	15,229,057 (100)	164,011 (100)	145,189 (100)	1,277 (100)	196 (100)

[a]Adventists with death record, but not found in the database of the Mortality Information System; [b]No record of date of birth. ES: Espírito Santo; ADV ES: Adventist population of Espírito Santo.

Table 2. Deaths observed and expected and specific age rates compared with the general population of the state of Espírito Santo, 2003 – 2009.

Adventists of the State of Espírito Santo					
Age group (years)	GMR[a]	Population[b]	Observed deaths[b]	Expected deaths	Age rate ratios (95% CI)
30 – 39	2.51	4,553.7	5.8	11.4	50.74 (18.23 – 111.84)
40 – 49	4.47	3,516.2	8.4	15.7	53.47 (23.65 – 103.72)
50 – 59	8.82	2,810.1	15.4	24.8	62.15 (35.09 – 101.85)
60 – 69	17.48	1,830.8	25.2	32	78.75 (51.06 – 116.07)
70 – 79	40.55	1,308.5	31.1	53.1	58.60 (39.84 – 83.13)[c]
≥ 80	107	794.5	41.8	85.1	49.14 (35.39 – 66.47)[c]

GMR: general mortality rate; 95%CI: 95% confidence interval.
[a]General mortality rate per 1,000 inhabitants; [b]Average of the years 2003–2009; [c]Confidence Interval significantly lower than 100.

Table 3. Standardized mortality ratio adjusted for age and confidence intervals, according to cardiovascular diseases and all cancers.

Cause of death	GMR[a]	Observed/expected deaths in Adventists	SMR (95%CI)
Ischemic heart diseases	21.32	12.41/25.96	47.80 (25.02 – 82.75)[b]
Cerebrovascular diseases	26.21	15.55/28.96	53.69 (30.41 – 87.79)[b]
All cancers	26.05	26.12/35.46	73.66 (48.17 – 107.84)

GMR: general mortality rate; SMR: standardized mortality ratio; 95%CI: 95% confidence interval.
[a]General mortality rate per 1,000 inhabitants; [b]Confidence interval significantly lower than 100.

DISCUSSION

The low proportion of deaths from ill-defined causes (Chapter XVIII of ICD 10) showed good quality of data, especially regarding the completion of death certificates.

Sociodemographic characteristics of ASDs who died were compromised by the lack of information in the SIM database, a gap also present in the general population of the state. Another study of 1,296 ASDs who were alive and aged over 30 years only from the city of Vitória, ES, in 2011, worked with a probabilistic sample stratified by age, totaling 361 ASDs. The data were obtained through a self-administered questionnaire. By comparing the demographic and economic data of the living ASDs who resided in Victoria with the information from the Brazilian Institute of Geography and Statistics (IBGE) and DATASUS, it appears that, in relation to the education of ASDs, 71.7% had more than 8 years of education and concluded elementary school although the

population of Victoria aged 15 years or over represented 77.63%. The general population was a little more educated, despite the lower age group and higher number of elderly in the population of ASDs. According to IBGE, in 2010, 32.1% of the population earned half to two minimum wages, and 28.1% from two to ten minimum wages. In the study of alive ASDs, the average per capita family income was 1.8 (SD = 1.4) wages, and more than 11.4% did not report their income. Even if the data collection parameters are distinct, the ASDs showed lower per capita income than the population of Victoria in the year 2010[11].

A national study with the data from the National Survey by Household Sampling (PNAD) from 2003 and 2008 showed that chronic diseases are more prevalent among people with low education and lack of health insurance, which supports the premise that the social and economic determinants impact the chronic diseases[12].

The ASDs aged ≥ 30 years, when compared with the ES population, presented lower death rates in all age groups, but the reasons for specific rates by age were only statistically significant for age ≥ 70 years. When adjusted for age, SMR showed that being an ASD reduces in 43% the likelihood of mortality from all causes of diseases, in 52.20% from IHD, and 46.31% from cerebrovascular diseases, in relation to ES population. No difference was observed among populations with respect to cancer.

The vegetarian diet recommended by the Adventist Church has been identified as a factor that benefits the cardiovascular system, with reduced mortality from IHD[4,13]. Vegetarians, Adventists or not, compared with omnivores died 24% less from IHD, especially when following the diet for more than 5 years, according to a study on Americans from California, English, and German individuals[5].

On the other hand, vegetarians have other characteristics that influence the reduction of IHD, because in addition to the restriction of animal protein, they usually do not smoke, have a lower BMI, consume alcohol with moderation, and practice more physical activity, benefiting especially the cardiovascular system[5].

Adventist vegetarians, compared to semi-vegetarians and omnivores, have lower rates of IHD mortality, which has been justified by the LDL reduction, lower prevalence of hypertension, diabetes, and obesity[2,9,13].

Among American and British ASDs, approximately 50% follow a semi- or total vegetarian diet[13,14,5]; in Brazil, 20 to 70% of ASDs in São Paulo have a diet with total or partial restriction of animal protein[2,3,9]. Thus, this study infers that those who died had some kind of meat restriction and lower consumption of alcohol and cigarettes. In 2011, only 19 (5.3%) of the ASDs' residents in Vitória, ES, reported not eating any meat, a lower percentage compared with other studies. However, they had other protective factors for chronic diseases, such as no smoking (only 19.4% were former smokers), 96.6% did not consume alcohol, and 49.1% were physically active. Despite only a few were vegetarians, they kept other healthy behaviors[11].

There are several types of vegetarianism — total absence of animal protein, consumption of some animal protein, such as egg or dairy products and fish or meat intake at least once a week — which sometimes make the classification difficult for the researchers.

On the other hand, there are studies that show no difference in mortality between vegetarians and omnivores, which are justified by the fact that sick people generally refuse to participate in follow-up studies, characterizing the existence of the healthy volunteer effect. There is evidence that people with healthy lifestyle can benefit from good health, whether vegetarian or not[13,15].

Other components of the diet recommended by the Adventist Church have been associated with decreased incidence of IHD, for example, strong evidence of the protective effect on the cardiovascular system resulting from the consumption of vegetables, fruits, and nuts[16]. ASDs from Vitória consumed vegetables, fruits, and beans more than five times a week, which is considered a high intake for this type of food[11].

In addition to the standard of food intake, other factors related to lifestyle, such as alcohol consumption and smoking, may interfere with the lower rates of mortality among Adventists. Regarding smoking, 87% Brazilian ASDs reported never having smoked, 13% being smokers in the past,[9] and from 1.5 to 14.6% having consumed cigarettes, especially those who do not follow a vegetarian diet[2,3]. Among ASDs in the USA and Canada, 1.2% of men and 1% of women smoked[14].

The effect of alcohol on the cardiovascular system depends on the amount of ethanol ingested. When consumption is moderate, the effect may be protective, perhaps for acting on risk factors for coronary heart disease, with elevated high-density lipoprotein and decreased platelet aggregation, among other mechanisms. Furthermore, high alcohol consumption strongly increases the risk of death from stroke, especially hemorrhagic stroke, and some cancers, cirrhosis, and traumatic lesions[16-18].

One of the limitations in the alcohol variable is the self-report and the probable underestimated study. In Brazil, alcohol consumption among ASDs is low (0.9 to 3.7%)[3], and only 3% to 31.7% reported having consumed alcohol at least once in life, a habit more present in those who are not vegetarians[2,3]. As for ASDs in North America, 6.6% drank alcohol casually[14].

In 2006, studies were initiated on Californian Adventists, which focused on the psychosocial aspects of religion on physical and mental health[19]. In this line of research, a national study found that 44 to 81% of ASDs in São Paulo practiced prayer and antistress relaxation techniques 5 or more times a week, but showed no results about the effect of these practices on the health of ASDs[2].

In this study, as in others, mortality rates from cancer were similar among ASDs and ES general population[5]. It was not possible to assess the rates related to smoking, alcohol consumption, and specific diets, because of the small number of deaths observed, but the vegetarian diet has little impact on cancer in general and demands more investigation in the specific ones[14]. There are controversial results in finding differences in mortality from all causes of cancer according to diet[15], lower stomach, ovarian, bladder, lymphatic, and hematopoietic tissue cancer rates were seen in vegetarians, whereas colorectal cancer was higher in this group[15].

The consumption of fruits and vegetables to the risk of cancer is also considered. There is an inverse association between them, which is attributed to the antioxidant activity of these foods in addition to a healthier lifestyle (no smoking and drinking, and physical activity practice) of those who choose this type of diet, similar to vegetarians[20].

The standardized mortality rates from all causes, IHD and cerebrovascular diseases among ASDs were lower than those of ES population, which has been explained in the international literature by the vegetarian diet maintenance and abstention of tobacco and alcohol. Therefore, the social support network provided by the Church may be favoring individuals that choose healthy lifestyles, which would have a relationship with decreased mortality from chronic diseases in the population of this study.

The sample universe of ASDs was small, with a reduced number of observed deaths, which limited the comparative analysis for illnesses such as the more frequent malignant cancers in the Brazilian context; however, the results were similar to international studies[7,21].

Another limitation was the data loss of 196 ASDs, who were considered dead in the records of the churches, but were not found in the SIM. A total of 122 (64.5%) were aged ≥ 70 years, showing that the losses were more intense in this age group, which may be due to problems in the documentation of the elderly, issued in a period when registration services were less structured. We infer that ASDs could be under a different name in both databases, because the Church did not request identification, although for issuing the death certificate this procedure is required. Thus, advanced aged ASDs were excluded for lack of confirmation of the cause of death in SIM, which we understand as a possible selection imposed by the losses.

CONCLUSION

We conclude that being an Adventist was associated with lower mortality from all causes compared with general population of ES between 2003 and 2009. Regarding IDH, the death probability was reduced by 52.20%; in relation to cerebrovascular diseases, such risk decreased by 46.31%. Life habits of Adventists may have influenced the observed reduction in mortality rates.

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