

Consumption of fruits and vegetables and association with life habits and nutritional status: a prospective study in a cohort of the elderly

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Abstract *The aim of this study was to estimate the association between life habits and adequate consumption of fruits and vegetables (F&V) after four years of follow-up among elderly of a cohort in Florianópolis, Santa Catarina. This is a longitudinal population-based study, the sample being composed of individuals 60 years of age or older living in the urban area of the city of Florianópolis-SC. The baseline study took place in 2009-2010 and the second wave in 2013-2014. Adequate consumption was assessed by considering the frequency of ingestion of F&V at least five times a day at least five times a week. Life habits (smoking, alcohol consumption, physical activity and Internet use) and a biological variable (nutritional status) were associated. Multilevel logistic regression was used for the statistical analysis. There was a 5.23% increase in F&V consumption between evaluations. In the adjusted final models, internet use was associated with a greater chance of regular consumption of F&V (OR = 1.48, 95% CI: 1.09 - 2.01), while overweight was associated with a lower chance of outcome (OR = 0.76, 95% CI: 0.61 - 0.95). In conclusion, using the internet has proven to contribute significantly to a more adequate diet in F&V, as well as being overweight has shown to be a risk factor.*

Key words *Fruit, Vegetables, Life habits, Longitudinal studies, Elderly*

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Introduction

The World Health Organization (WHO) indicates the regular consumption of fruits and vegetables (F&V) as an important factor for the protection and prevention of chronic noncommunicable diseases (CNCD)^{1,2}. Recent studies in literature show an important association between the adequate consumption of those foods and lower risk of mortality due to cardiovascular disease and neoplasias³⁻⁶. The recommendation is 400g/day, what equates to five servings of 80g each of fruits, greens and/or vegetables¹.

However, low consumption in many middle-income/low-income countries is still a persistent phenomenon. According to data from the World Health Survey conducted in 2002, 78% of individuals over 18 years of age had low F&V consumption^{1,7}. In the same way, in Brazil, the 2008-2009 Household Budgets Survey found that daily consumption of F&V corresponded to a quarter of the recommended consumption⁸. Low consumption of FLV has also been found in other national surveys. The National Health Survey (PNS, 2013) found a 37.3% adequacy among those over 18 years of age⁹, while in the Risk-Factors Survey and Protection for Chronic Diseases Survey conducted by Telephone Inquiry (Vigitel), the adequacy was only 27.8% among individuals aged 65 years or over¹⁰.

Among the factors that determine the inadequate consumption, the sociodemographic factors are widely reported in the literature. Higher age, lower education and income influence the lower F&V consumption¹¹⁻¹⁵. Evidence also indicates that healthy eating habits coexist with other healthy behaviours. It is believed that individuals who are more concerned about health, weight maintenance and physical activity consume F&V more regularly^{11,12,16}. On the other hand, smoking and alcohol consumption are associated with less healthy diet¹⁷.

We found few national studies conducted with the elderly¹¹⁻¹⁴ and no prospective studies that assessed F&V consumption over the years. Obtaining accurate data on food consumption is a complex task in population studies. One of the main problems attributed is the great intra-individual variability, because diet varies from day to day, from week to week and more deeply over the years in the same individual. Physiological, cultural, environmental and economic factors contribute strongly to this variation¹⁸.

Furthermore, insufficient F&V consumption evidenced by national surveys^{9,10} indicate

the need to monitor this pattern of food continuously, especially in risk groups such as the elderly. Thus, the objective of this study was to estimate the association between life habits and nutritional status (exposure) and adequate F&V consumption (outcome) after four years of follow-up among elderly participants of a cohort in Florianópolis, Santa Catarina, between 2009/10 and 2013/14.

Methods

Outline and site of the research

This is a longitudinal population-based study conducted with a sample of individuals aged 60 and over, living in the urban area of Florianópolis, capital of the state of Santa Catarina, southern Brazil. This study is part of a larger research called *EpiFloripa Idoso* (EpiFloripa Elderly).

EpiFloripa Idoso is a cohort of elderly people, and its baseline started in 2009-2010. The eligibility criteria of the sample were that the individuals should be aged 60 years or over, living in the urban area of the city of Florianópolis. Institutionalised or hospitalised elderly people were excluded. In order to follow up the cohort, the second interview with the same participants was carried out in 2013-2014.

Baseline sampling process (2009-2010)

The sample size calculation was performed by the *EpiInfo* 6.04 program (*Centers for Disease Control and Prevention, USA*) and, according to parameters defined a priori, a minimum sample of 1,599 elderly was estimated. The sampling process was carried out in clusters in two stages: in the first stage the census sectors were selected, followed by the second stage, when the households were select. After the draw of the households by sector to be visited, 1,911 eligible elders were identified. The elderly who had been chosen but could not be found after four visits, including weekends and evenings, were considered losses. Further details on the sampling and weighting process are available in prior publication¹⁹.

Sampling in the second wave (2013-2014)

In the second wave of the study in 2013-2014 all the elderly interviewed in 2009/2010 were contacted again. To avoid loss of follow-up, four attempts to contact the elderly, at least in one

evening and over the weekend, were made. Those individuals who were not found, were in hospital or had moved to other cities were considered losses. Those who refused to respond to the questionnaire were considered refusals.

Data collection instrument

In both waves of the study data collection was performed by using standardised and pre-tested questionnaires applied by trained interviewers. To register information, in 2009-2010, the *Personal Digital Assistants* (PDA) was used, while in 2013-2014, laptops were used.

Dependent variable

As a dependent variable, regular F&V consumption was considered, dichotomised in adequate/inadequate consumption. This variable was collected by the *EpiFloripa Idoso* study in both waves 2009-2010 and 2013-2014. The same questionnaire on food consumption was used in the national survey carried out with the Brazilian population by telephone, Vigitel¹⁰.

Regular or adequate F&V consumption was investigated considering the weekly frequency of consumption. WHO recommends a daily intake of at least 400 grams, equivalent to the consumption of five daily servings of those foods. The study considered the consumption adequate when the individual reported a frequency of intake of those foods at least five times a day at least five times a week. To construct the variable, the researchers used the combination of the daily intake of fruits (≥ 3 times/day) and greens and vegetables (≥ 2 times/day). This variable was thus collected due to the difficulties to transmit the interviewees the concept of portions¹.

Monteiro et al.²⁰ show that the food consumption indicators used by Vigitel research are reproducible (*Kappa* between 0.6-0.8) and comparable to a number of three 24-hour recalls, with validity adequate for most indicators (sensitivity and specificity of $\sim 80\%$ for indicators of unhealthy food consumption and 42-80% for indicators of healthy food consumption).

It should be noted that the participants of the study were not instructed a priori on healthy eating habits or on the desirable F&V consumption either at the baseline or at the follow-up of the study.

Exploratory variables

All the exploratory variables were collected in both the 2009-2010 and 2013-2014 study periods, being assessed by the same instruments and categorized in the same way.

The exploratory variables were life habits, including: smoking (non-smoker and ex-smokers/currently smoking); alcohol consumption (never consumed and consumes); leisure physical activity (physically active and insufficiently active) and Internet use (no and yes), with a variable of nutritional status included (adequate weight and overweight).

The variable Internet use was the self-reported ability to use a computer to send and receive messages over the Internet. Alcohol consumption was verified through the first three questions in the AUDIT questionnaire (*The Alcohol Use Disorders Identification Test*)²¹.

Physical activity was assessed by the International Physical Activity Questionnaire (IPAQ). The elderly who reported 150 minutes or more of physical activity per week were considered physically active and those who practiced less than 150 minutes per week, insufficiently active for leisure and displacement²².

The nutritional status was calculated from the body mass index (BMI), and categorized according to Lipschitz recommendations²³, considering BMI values ≤ 27 kg/m² as adequate weight, and BMI ≥ 27 kg/m² as overweight.

Adjustment variables

The following variables could be considered confounding factors: sex (male and female), age in age groups (60 to 69, 70 to 79 and 80 years or over), per-capita family income in quartiles (1 quartile < R\$ 700,00; R\$ 700,00 to R\$ 1.206,25; R\$ 1.206,26 to R\$ 2.650,00; > R\$ 2.650,00), obtained from the baseline, and schooling in years of study (0 to 8 years; 9 to 11, 12 or more). The questionnaire containing all the variables collected in this study can be accessed online at the following electronic address: <http://www.epifloripa.ufsc.br>.

The research used *Stata* software version 13.0 (*College Station Stata Corp*, Texas, USA) for statistical analysis. Because sampling was selected in clusters, sample weights were used in all the analyses. To characterise the sample at the baseline and second wave, descriptive analyses were performed presenting the results as absolute and relative frequencies (Table 1).

To evaluate the association between exposure and outcome, a two-level multilevel longitudinal model was used. The first level represented by the repeated measures of each person individually (2009-2010 and 2013-2014), formulated to describe the change of outcome and exploratory variables.

Multilevel modelling is also known as the mixed-effects model, currently one of the most important tools for longitudinal data analysis. This model comprises a combination of two stages of analysis: one stage includes the estimation of specific effects of the study population (fixed effects) and the other stage includes the estimation of individual parameters (random effects), allowing to control the existing intraindividual variation, capturing changes in individual responses²⁴.

Initially the data were declared to be used in panel form. Thus, it was possible to perform the descriptive analysis with the proportions of the changes occurred between the two waves of the study. For the gross and adjusted analysis, the Multilevel Logistic Regression was used and the *Odds Ratio* (OR) was estimated considering 95% CI (Table 3). In the adjusted analysis, all the variables of the study were included (*full model*) and in the sequence the variables with higher p-value (*backward method*) were taken, and so on, until the most explanatory model was achieved. The different models were tested by the maximum likelihood test. The evaluation of the random effects was calculated by intraclass correlation (ICC). A significance level of $p < 0.05$ was considered.

Ethical aspects

The project was approved in both waves by the Human Research Ethics Committee of the Federal University of Santa Catarina. The subjects were informed about the aims of the study and they were requested to sign the Informed Consent Term.

Results

In the baseline of the study *EpiFloripa Idoso* in 2009-2010, 1,702 elderly were interviewed (non-response rate of 10.8%). Out of these, 1,197 elderly people were located and interviewed again in 2013-2014 (70.2% of baseline respondents). Between the first and second wave of the study 217 deaths, 129 denials and 159 losses were recorded. The mean age of the elderly was 71

years, more than half were female and a quarter had more than 12 years of education. The results of the proportions of deaths, refusals and losses are presented in Table 1.

Between the baseline and the second wave there was an average increase of 5.23% in the adequacy of F&V consumption. The changes that occurred during the four years of the study, both in F&V consumption and other exploratory variables are presented in Table 2. The percentage of individuals who became adequate in consuming F&V (22%) was greater than those that became inadequate (13.6%). The analysis of the changes in Internet use showed an increase of 7.9% among those who started using the web, and, in the second interview, only 3.0% had stopped using it. In relation to physical activity, the percentage of elderly people who became insufficiently active (15.8%) was higher than those who became physically active (12.0%). Most of the elderly reported consuming alcohol in the second interview, in a total of 37.2%; 9.5% started to consume alcohol between the two interviews; and 27.7% remained consuming it.

In the gross analysis (Table 3), there were statistically significant associations with higher education, the third quartile of income, Internet use and overweight. The chance of regularly consuming F&V was 56% higher among those who had 12 or more years of schooling ($p < 0.001$), 60% higher among those using the Internet ($p < 0.001$), and excess weight was inversely associated with 24% less chance of regular consumption of F&V ($p = 0.020$). In the adjusted analysis, the use of the Internet and nutritional status remained associated. The elderly who used the Internet had a 1.48 times greater chance of regular consumption of F&V, while being overweight was associated with a 24% lower chance of adequacy in F&V consumption (Table 3).

Other models were tested excluding the variables with higher p-value. The subsequent models were not more explanatory than model 1. The intraclass correlation coefficient (ICC) indicated that 28% of the outcome is explained by the variables included in the model.

Discussion

Because it is a cohort of elderly people and because aging is conditioned to higher risk behaviours that affect appetite and healthy eating patterns, it was considered that there was a significant increase in the regular consumption of

Table 1. Descriptive analysis of the sample according to the follow-up status, Florianópolis, Santa Catarina, 2009/2010 and 2013/2014.

Variables	Baseline	2013-2014				P-value*
	2009 - 2010 n (%)	Losses	Respondents	Refusals	Deaths	
		n (%)	n (%)	n (%)	n (%)	
Sex (1,702)						0,055
Female	1088 (62,5)	101 (9,3)	779 (71,6)	87 (8,0)	121 (11,1)	
Male	614 (37,5)	57 (9,3)	419 (68,2)	42 (6,8)	96 (15,6)	
Age group (1,702)						< 0,001
60 to 69	851 (51,0)	98 (11,5)	639 (75,1)	69 (8,1)	45 (5,3)	
70 to 79	612 (35,3)	48 (7,8)	436 (71,2)	47 (7,7)	81 (13,2)	
80+	239 (13,7)	12 (5,0)	123 (51,5)	13 (5,4)	91 (38,1)	
Income in quartiles (1,702)						0,002
1	426 (22,6)	36 (8,5)	298 (70,0)	41 (9,6)	51 (12,0)	
2	435 (25,5)	51 (11,7)	288 (66,2)	23 (5,3)	73 (16,8)	
3	424 (25,3)	45 (10,6)	301 (70,1)	27 (6,4)	51 (12,0)	
4	417 (26,6)	26 (6,2)	311 (74,6)	38 (9,1)	42 (10,1)	
Schooling in years (1,694)						< 0,001
No schooling	161 (9,5)	21 (13,04)	96 (59,63)	9 (5,59)	35 (21,74)	
1 to 4	584 (34,4)	41 (7,02)	418 (71,58)	46 (7,88)	79 (13,53)	
5 to 8	321 (18,9)	40 (12,43)	216 (66,36)	27 (8,41)	41 (12,77)	
9 to 11	234 (13,8)	17 (7,26)	173 (73,93)	16 (6,84)	28 (11,97)	
12 or more	394 (23,2)	42 (10,66)	292 (74,11)	31 (7,87)	29 (7,36)	
F&V consumption (1,567)						0,001
Inadequate	1.173 (74,8)	131 (11,17)	840 (71,61)	91 (7,76)	111 (9,46)	
Adequate	394 (25,1)	21 (5,33)	291 (73,86)	24 (6,09)	58 (14,72)	
Smoking (1,702)						0,765
No	1.561 (91,7)	148 (9,48)	1.093 (69,97)	121 (7,75)	200 (12,80)	
Yes	141 (8,2)	14 (9,93)	103 (73,05)	8 (5,67)	16 (11,35)	
Alcohol Consumption (1,702)						< 0,001
No	1.105 (64,8)	97 (8,75)	766 (69,13)	76 (6,86)	196 (15,25)	
Yes	597 (35,1)	65 (10,89)	431 (72,19)	53 (8,88)	48 (8,04)	
Physical activity at leisure (1,702)						< 0,001
Physically active	494 (30,9)	52 (10,5)	364 (73,7)	46 (9,3)	32 (6,5)	
Insufficiently active	1208 (69,1)	106 (8,8)	834 (69,0)	83,6,9)	185 (15,3)	
Nutritional status (1,643)						0,239
Adequate	776 (47,29)	80 (10,31)	541 (69,72)	56 (7,22)	99 (12,76)	
Overweight	865 (52,71)	80 (9,25)	630 (72,83)	69 (7,98)	86 (9,94)	
Using the Internet (1,702)						< 0,001
No	1358 (77,1)	118 (8,7)	931 (68,6)	103 (7,6)	206 (15,2)	
Yes	344 (22,9)	40 (11,6)	267 (77,6)	26 (7,6)	11 (3,2)	

*P-value of the chi-square test; 95% CI - Confidence Interval of 95%; % - Relative frequency.

F&V (5.23%) in the 4-year interval. In addition, the percentage of elderly people who passed to an adequate condition (22%) was higher when compared to those that became inadequate (13.5%), in a total of 38.0% of the sample with regular consumption in 2013-2014. Comparing total consumption, this result was very close to

that of the National Health Survey (Pesquisa Nacional de Saúde - PNS)⁹ in 2013, where consumption was 37.3%, however, above one of the main sources of consumption monitoring of these foods in the country, Vigitel, which shows a proportion of 27.8% of regular consumption of F&V among individuals aged 65 or older¹⁰.

Table 2. Absolute and relative values of the variables of exposure and outcome that changed during the four years of follow-up (2009/10 - 2013/14) of the elderly of the EpiFloripa Idoso cohort, Florianópolis, Santa Catarina.

Variables	n	%
F&V consumption (n = 996)		
Remained inadequate	482	48,4
Became appropriate	219	22,0
Became inadequate	135	13,6
Remained adequate	160	16,0
Internet use (n = 1,131)		
Remained unused	781	69,0
Stopped using	34	3,0
Remained using	227	20,1
Started to use	89	7,9
Physical Activity (n = 1,131)		
Remained insufficiently active	641	56,7
Maintained physically active	175	15,5
Became insufficiently active	179	15,8
Became physically active	136	12,0
Smoking (n = 1,195)		
Remained smoking	73	6,10
Stopped smoking	30	2,5
Started smoking	9	0,75
Remained without smoking	1,083	90,62
Nutritional status (n = 1,138)		
Remained adequate	430	37,8
Passed to overweight	93	8,2
Passed to adequate weight	85	7,5
Remained overweight	530	46,6
Alcohol consumption (n = 1,197)		
Remained consuming	332	27,7
Stopped consuming	99	8,3
Started to consume	114	9,50
Remained without consuming	652	54,5

Some characteristics of the city of Florianópolis may have influenced those changes, such as convenient access, quality and low cost of horticultural products. The municipality counts on a supply program that offers to the population products at more accessible prices than the regular shops (in average R\$ 1.49 per kilo for year 2013). This program includes several shops called “sacolões” and “Direto do Campo”, distributed in several districts of the city (including the most peripheral and less privileged ones), totalising 59 green groceries or produce markets²⁵. According to Figueira *et al.*²⁶, the main barriers to the consumption of fruits and vegetables are related to the access to these foods, identified as high cost, lack of quality of local commerce and inadequate

location of produce markets. According to the authors, Belo Horizonte, MG, has a very program that is very similar to that agreed by Florianópolis municipality, called “ABasteCer”, which aims to guarantee quality products at set prices for the population, providing products at an average price 30% lower than other F&V sellers. Consistent with this, the Ministry of Health has emphasised in its policies the importance of measures to encourage the consumption of F&V, including the interrelation of the several sectors involved in promoting healthy eating²⁷.

The variables that were associated with the outcome were the use of the Internet and the excess weight, but with opposite effects. The use of the Internet increased the prevalence of adequate F&L consumption, while the excess of weight decreased.

One possible explanation for the association found is that the internet is an important vehicle for communication and favours access to information in a fast, free and dynamic way. In addition, it is a unique means of communication because it uses features that generate greater interest in a highly interactive environment, helping to produce attractive messages with strong graphic appeals. The interactive communications on the Internet are among the possibilities that help promote healthier behaviours, enable decision making, enable experience exchange and mutual support, and promote self-care. These communications include participation in chat groups, support groups, and e-mailing to health services. About 80% of the people who use the Internet resort to it as a source of health information, with 50% of the searches being carried out on diet and food, highlighting the change in lifestyle as one of the actions taken after the online consultation²⁸.

In the *English Longitudinal Study of Aging* (ELSA) conducted between 2002 and 2011 with individuals over 50 years of age, the proportion of F&V consumption was higher among Internet users (62.6%) when compared to those who did not use the tool (52.9%). The study also showed that individuals who used the Internet had a 24% higher probability of fruit and vegetable intake²⁹. Another research that evaluated digital inclusion relating it to health outcomes showed that elderly people who use the Internet maintain healthier lifestyles, have a better functional and cognitive capacity, and present lower risk of chronic diseases³⁰. Nevertheless, if on the one hand there is an easy search for any source of information, the greatest bias lies in the difficulty of locating reli-

Table 3. Gross and adjusted analysis with the longitudinal data of the elderly of the study EpiFloripa Idoso in the two waves of the study, 2009-2010 and 2013-2014 in Florianópolis, Santa Catarina.

Variable	Gross Analysis OR (95% CI)	P- value*	Null model OR (95% CI)	Adjusted Analysis Model 1 OR (95% CI)	P- value*
Intercept	-		0.44 (0.39-0.50)	0.56 (0.33 -0.95)	
Sex		0.975			0.371
Female	1.00			1.00	
Male	0.99 (0.78-1.26)			0.89 (0.69-1.14)	
Age (years)		0.257			0.596
60 to 69	1.00			1.00	
70 to 79	0.97 (0.77-1.23)			1.04 (0.82-1.32)	
80 or +	0.82 (0.60-1.11)			0.89 (0.64 -1.24)	
Schooling (years)		< 0.001			0.092
0-8	1.00			1.00	
9-11	1.41 (1.04-1.92)			1.32 (0.95 -1.84)	
12 or more	1.56 (1.21-2.02)			1.41 (1.01 -1.95)	
Income in quartiles		0.036			0.512
1 (up to R\$ 700,00)	1.00			1.00	
2 (from 700,00 to R\$ 1.206,25)	1.19 (0.88-1.60)			1.27 (0.94 -1.72)	
3 (from R\$1.206,26 to R\$2.650)	1.49 (1.11-2.01)			1.40 (1.03- 1.89)	
4 (more than R\$ 2.650)	1.29 (0.96-1.75)			1.03 (0.73 -1.44)	
Smoking		0.383			0.462
Non-smoker or gave up	1.00			1.00	
Smokes currently	1.20 (0.79-1.84)			1.15 (0.75 -1.77)	
Alcohol consumption		0.752			0.116
No	1.00			1.00	
Yes	0.96 (0.77-1.20)			0.81 (0.63 -1.04)	
Physical activity		0.072			0.260
Physically active	1.00			1.00	
Insufficient	0.82 (0.67-1.00)			0.89 (0.71 -1.11)	
Internet use		< 0.0001			0.018
No	1.00			1.00	
Yes	1.60 (1.24 - 2.06)			1.48 (1.09-2.01)	
Nutritional status		0.020			0.019
Adequate weight	1.00			1.00	
Overweight	0.76 (0.61-0.95)			0.76 (0.61-0.95)	
Random Effects					
ICC (%)	-		29.0	28.0	

able sources, and the individual may be exposed to a great number of inconsistent information²⁸.

Another result of our consistent study in the literature was that the elderly who were overweight were less likely to consume F&V regularly. According to studies published in recent years, enough consumption of these foods is one of the protective factors for overweight³¹. This fact is justified because fruits and vegetables have high fibre content and low glycaemic load. The increased intake of fibre provides greater satiety

and in turn reduces the amount of calorie ingested, contributing to the prevention of weight gain. In addition, individuals with diets consisting of foods with low glycaemic index increase basal energy expenditure, promoting weight maintenance^{1,30}. Like what was found in this study, the association between changes in fruit and vegetable intake and weight change in three large adult prospective cohorts in the United States showed that increased fruit and vegetable intake was associated with weight reduction³².

Regarding alcohol consumption, in the present study no significant effect of this variable was observed in the regular consumption of F&V. According to a previous study in the literature, the relationship between alcohol consumption and its effects on health is complex and multi-dimensional. Alcohol consumption in high doses may be a risk factor for a balanced diet and consequently for health maintenance, because it decreases the appetite by interfering in the adequate supply of nutrients, having an impact on the reduction in the consumption of food in general. This makes it possible not to reach the adequacy of food groups, such as F&V¹. In contrast, there is evidence that alcohol consumption ranging from mild to moderate, and absent from episodes of heavy consumption (higher than 60g of alcohol/day) may have beneficial effects on ischemic heart disease, stroke and Diabetes Mellitus³³. For example, the Mediterranean diet is characterised by moderate consumption of alcohol and high consumption of F&V, and contributes to the prevention of metabolic diseases, and is associated with low mortality rates caused by heart disease, chronic diseases and high life expectancy^{34,35}.

The regular practice of physical activity is a healthy behaviour is usually associated with healthy eating habits¹⁶. Studies with the elderly show an increase in the use of F&V among individuals who practice physical activity in leisure^{6,11}. One of the hypotheses for the non-association between these variables is that the sample of elderly people evaluated is relatively healthy and little heterogeneous among the categories of analysis (smoker/non-smoker, alcohol drinker/non-alcoholic), with few individuals in the exposure category, which confers low statistical power to detect these differences.

Among the highlights of the study are the longitudinal design and the fact that it was per-

formed with a representative sample of elderly people from a Brazilian capital, using standardised data collection procedures, thus guaranteeing the internal validity of the study. Another important aspect was a high response rate and a small loss of follow-up, especially because it is a cohort of elderly people where the death rate is usually higher than in other age groups.

Despite the strong points of the study, the use of the “frequency of consumption in number of times a day” indicator instead of daily portions of said foods is limited as a result of the data collection instrument used by the *EpiFloripa Idoso*, as described in the methodology. This difference in measure may have led to the researchers to underestimate the F&V consumption by the elderly of the study. However, other studies have previously used measures in the form of frequency without considering the size of portions of fruits and vegetables, which are quite common in the literature^{10,12}. In addition, the survey did not investigate further details about the use of the Internet, such as the frequency of access and the quality of the information sources that are used.

Considering that within 40 years the elderly population will practically double in Brazil, with an estimated total of 74.5 million³⁶, it is necessary to prepare for this contingent and to develop strategies continually to increase their quality of. Knowing that changes in F&V consumption have shown associations with Internet use, it is advisable to think of ways to promote its use, guaranteeing digital inclusion, for example by creating free Internet access points and training courses aimed at seniors. In addition, we suggest the continuation of studies that deepen the theme in campaigns that encourage the consumption of a healthier diet through digital media, especially those with greater potential to reach the elderly population.

Collaborators

BB Souza, F Cembranel, ALC Hallal and E d'Orsi participated directly in the planning, execution and analysis of this study. All authors of this article have read and approved the final version submitted.

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References

1. World Health Organization (WHO). *Diet, nutrition and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation*. Geneva: WHO; 2003.
2. World Health Organization (WHO). *GLOBAL STATUS REPORT on noncommunicable diseases 2014*. Geneva: WHO; 2014.
3. Wang X, Ouyang Y, Liu J, Zhu M, Zhao G, Bao W, Hu FB. Fruit and vegetable consumption and mortality from all causes, cardiovascular disease, and cancer: systematic review and dose-response meta-analysis of prospective cohort studies. *BMJ* 2014; 349:g4490.
4. Zhang X, Shu X, Xiang Y, Yang G, Li H, Gao J, Cai H, Gao YT, Zheng W. Cruciferous vegetable consumption is associated with a reduced risk of total and cardiovascular disease mortality. *Am J Clin Nutr* 2011; 94(1):240-246.
5. Nguyen B, Bauman A, Gale J, Banks E, Kritharides L, Ding D. Fruit and vegetable consumption and all-cause mortality: evidence from a large Australian cohort study. *Int J Behav Nutr Phys Act* 2016; 13:9.
6. Nicklett EJ, Semba RD, Xue Q, Tian J, Sun K, Cappola AR, Simonsick EM, Ferrucci L. Fruit and vegetable intake, physical activity, and mortality in older community-dwelling women. *J Am Geriatr Soc* 2012; 60(5):862-868.
7. Hall JN, Moore S, Harper SB, Lynch JW. Global Variability in Fruit and Vegetable Consumption. *Am J Prevent Med* 2009; 36(5):402-409.e5
8. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa de Orçamentos Familiares 2008-2009: Mais de 90% da população comem poucas frutas, legumes e verduras*. Rio de Janeiro: IBGE; 2010.
9. Brasil. Ministério da Saúde (MS). *Pesquisa Nacional de Saúde (PNS 2013): Percepção de estado de saúde, estilo de vida e doenças crônicas*. Rio de Janeiro: MS; 2014.
10. Brasil. Ministério da Saúde (MS). *VIGITEL 2014: Vigilância de fatores de Risco para doenças crônicas por inquérito telefônico*. Brasília: MS; 2015.
11. Silveira EA, Martins BB, Kellen C, Cardoso DS. Baixo consumo de frutas, verduras e legumes: fatores associados em idosos em capital no Centro-Oeste do Brasil. *Cien Saude Colet* 2015;20(12):3689-700.
12. Damiani TF, Pereira LP, Ferreira MG. Consumo de frutas, legumes e verduras na Região centro-oeste do Brasil: prevalência e fatores associados. *Cien Saude Colet* 2017; 22(2):369-382.
13. Moura EC, Morais Neto OL, Malta DC, Moura L, Silva NN, Bernal R, Claro RM, Monteiro CA. Vigilância de Fatores de Risco para Doenças Crônicas por Inquérito Telefônico nas capitais dos 26 estados brasileiros e no Distrito Federal (2006). *Rev Bras Epidemiol* 2008; 11(2006):20-37.
14. Viebig RF, Pastor-Valero M, Scazufca M, Menezes PR. Consumo de frutas e hortaliças por idosos de baixa renda na cidade de São Paulo. *Rev Saude Publica* 2009; 43(5):806-13.
15. Borges CA, Claro RM, Martins APB, Villar BS. Quanto custa para as famílias de baixa renda obterem uma dieta saudável no Brasil? *Cad Saude Publica* 2015;31(1):137-148.
16. Tassitano RF, Tenório MCM, Cabral PC, Silva GAP. Agregamento entre a inatividade física e consumo de frutas, legumes e verduras e fatores associados em adultos jovens. *Rev. Nutr.* 2014; 27(1):25-34.

17. Neutzling MB, Azevedo MR. Fatores associados ao consumo de frutas, legumes e verduras em adultos de uma cidade no Sul do Brasil. *Cad Saude Publica* 2009; 25(11):2365-2374.
18. Willett WC. *Nutritional Epidemiology*. 3ª ed. Oxford: Oxford University Press; 2013.
19. Confortin SC, Schneider IJC, Antes DL, Cembranel F, Ono LM, Marques LP, Borges LJ, Krug RR, d'Orsi E. Life and health conditions among elderly: results of the EpiFloripa Idoso cohort study. *Epidemiol Serv Saude* 2017; 26(2):305-317.
20. Monteiro CA, Moura EC, Jaime PC, Claro RM. Validade de indicadores do consumo de alimentos e bebidas obtidos por inquérito telefônico Validity of food and beverage intake. *Rev Saude Publica* 2008; 42(4):582-589.
21. Babor TF, Higgins-Biddle J, Saunders J, Monteiro M. *The alcohol use disorders identification test*. 2ª ed. Geneva: World Health Organization; 2001.
22. Matsudo S, Araújo T, Matsudo V, Andrade D, Andrade E, Oliveira L C, Braggion G. Questionário Internacional De Atividade Física (Ipaq): Estudo de validade e reprodutibilidade no Brasil. *Revista Brasileira de Atividade Física & Saúde* 2012; 6(2):5-18.
23. Lipschitz DA. Screening for nutritional status in the elderly. *Prim Care* 1994; 21(1):55-67.
24. Kac G. *Epidemiologia Nutricional*. Rio de Janeiro: Fio-cruz; 2007.
25. Prefeitura Municipal de Florianópolis. Superintendência de Serviços Públicos. *Dados municipais sobre estabelecimentos que comercializam Hortifrutigranjeiros*. [acessado 2017 Jun 20]. Disponível em: <http://www.pmf.sc.gov.br/entidades/susp/index.php?cms=feira+hortifrutim&menu=8>
26. Figueira TR, Lopes ACS, Modena CM. Barreiras e fatores promotores do consumo de frutas e hortaliças entre usuários do Programa Academia da Saúde. *Rev. Nutr.* 2016; 29(1):85-95.
27. Brasil. Ministério da Saúde (MS). *Guia Alimentar para a População Brasileira*. 2ª ed. Brasília: MS; 2014.
28. Moretti FA, Oliveira VE, Silva EMK. Acesso a informações de saúde na internet: uma questão de saúde pública? *Revista da Associação Médica Brasileira* 2012; 58(6):650-658.
29. Xavier AJ, d'Orsi E, Wardle J, Demakakos P, Smith SG, Von Wagner C. Internet use and cancer-preventive behaviors in older adults: Findings from a longitudinal cohort study. *Cancer Epidemiol Biomarkers Prev* 2013; 22(11):2066-2074.
30. Medeiros FDL, Xavier AJ, Schneider IJC, Ramos LR, Sigulem D, d'Orsi E. Inclusão digital e capacidade funcional de idosos residentes em Florianópolis, Santa Catarina, Brasil (EpiFloripa 2009-2010). *Rev Bras Epidemiol* 2012; 15(1):106-22.
31. Boeing H, Bechthold A, Bub A, Ellinger S, Haller D, Kroke A, Leschik-Bonnet E, Müller MJ, Oberritter H, Schulze M, Stehle P, Watzl B. Critical review: vegetables and fruit in the prevention of chronic diseases. *Eur J Nutr* 2012; 51(6):637-663
32. Bertoia ML, Mukamal KJ, Cahill LE, Hou T, Ludwig DS, Mozaffarian D, Willett WC, Hu FB, Rimm EB. Changes in Intake of Fruits and Vegetables and Weight Change in United States Men and Women Followed for Up to 24 Years: Analysis from Three Prospective Cohort Studies. *PLoS Med* 2015; 12(9):1-20.
33. Beulens JWJ, Fransen HP, Struijk EA, Boer JMA, Wit GA, Onland-Moret C, Hoekstra J, Bueno-de-Mesquita HB, Peeters PHM, May AM. Moderate alcohol consumption is associated with lower chronic disease burden expressed in disability-adjusted life years: a prospective cohort study. *Eur J Epidemiol* 2017; 32(4):317-326.
34. Salvadó JS, Guash-Ferré M, Lee C, Estruch R, Clish CB, Ros E. Protective Effects of the Mediterranean Diet on Type 2 Diabetes and Metabolic Syndrome. *J Nutr* 2016; 146(Supl.):920S-7S.
35. Pérez-Martínez P, Mikhailidis DP, Athyros GV, Bullo M, Couture P, Covas MI, de Koning L, Delgado-Lista J, Díaz-López A, Drevon CA, Estruch R, Esposito K, Fitó M, Garaulet M, Giugliano D, García-Ríos A, Katsiki N, Kolovou G, Lamarche B, Maiorino MI, Mena-Sánchez G, Muñoz-Garach A, Nikolic D, Ordoñas JM, Pérez-Jiménez F, Rizzo M, Salas-Salvadó J, Schröder H, Tinahones FJ, de la Torre R, van Ommen B, Wopereis S, Ros E, López-Miranda J. Lifestyle recommendations for the prevention and management of metabolic syndrome: an international panel recommendation. *Nutr Rev* 2017; 75 (5):307-326.
36. Instituto Brasileiro de Geografia e Estatística (IBGE). *Projeção da população do Brasil por sexo e idade. 1980-2050*. Rio de Janeiro; IBGE; 2008.

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