DOI: 10.1590/1980-549720200066

ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Simultaneity of risk factors for chronic non-communicable diseases in a rural population of a Southern Brazilian city

Simultaneidade de fatores de risco para doenças crônicas não transmissíveis em população rural de um município no sul do Brasil

Roberta Hirschmann[I], Caroline Cardozo Bortolotto[I], Thais Martins-Silva[I], Adriana Kramer Fiala Machado[I], Mariana Otero Xavier[I], Mayra Pacheco Fernandes[I], Rafaela Costa Martins[I], Renata Moraes Bielemann[II], Luciana Tovo-Rodrigues[I], Fernando César Wehrmeister[I]

ABSTRACT: ***Objectives:*** To describe the occurrence of simultaneous risk factors for chronic noncommunicable diseases, and factors associated with these prevalences in rural adults of a Southern Brazilian city. ***Methods:*** The design of this study was cross-sectional with a sample of 1,445 adults from the rural area of Pelotas, RS. Four risk factors were considered: smoking, alcohol consumption, physical inactivity and inadequate consumption of vegetables. To verify the simultaneous occurrence of the outcomes, a cluster analysis was used. The association was tested by ordinal regression resulting in odds ratios. ***Results:*** Among the four risk factors evaluated, three were the most prevalent among men, and only physical inactivity was greater among women. In the cluster analysis, only the combination of alcohol consumption + smoking + inadequate vegetable consumption presented an observed prevalence that was significantly higher than the expected (O/E = 2.67, 95%CI 1.30, 5.48), and higher than another study in the south of the country. This can be justified because that study included an evaluation of urban dwellers and the consumption of fruits. After adjustment, men, single individuals, non-white people, those with less schooling, those with a worse socioeconomic status, those who reported poor perception of health, and those who do not work in specifically rural activities had a greater probability of having the simultaneity of risk factors. ***Conclusion:*** The results show the importance of developing priority actions regarding the health of rural populations with special attention to the subgroups with an identified higher risk.

Keywords: Noncommunicable diseases. Cross-sectional studies. Rural areas.

[I]Post-graduate Program in Epidemiology, Universidade Federal de Pelotas – Pelotas (RS), Brazil.

[II]Post-graduate Program in Food and Nutrition, Universidade Federal de Pelotas – Pelotas (RS), Brazil.

Corresponding author: Roberta Hirschmann. Programa de Pós-graduação em Epidemiologia, Universidade Federal de Pelotas. Rua Marechal Deodoro, 1.160, centro CEP: 96010-610, Pelotas, RS, Brasil. E-mail: r.nutri@hotmail.com

Conflict of interests: nothing to declare – **Financial support:** Academic Excellence Program (PROEX) of the Coordination for the Improvement of Higher Education Personnel (CAPES), Process no. 23038.002445/2015-97.

RESUMO: ***Objetivos:*** Descrever a ocorrência simultânea de fatores de risco para doenças crônicas não transmissíveis e os fatores associados à simultaneidade dessas prevalências em adultos residentes na zona rural de um município no sul do Brasil. ***Métodos:*** Trata-se de estudo transversal com 1.445 adultos da zona rural de Pelotas, RS. Foram considerados quatro fatores de risco: tabagismo, consumo de álcool, inatividade física e consumo inadequado de legumes/verduras. Para verificar a ocorrência simultânea, utilizou-se análise de clusters. A associação foi avaliada por regressão ordinal, obtendo-se estimativas em razões de odds. ***Resultados:*** Dos quatro fatores de risco avaliados, três foram mais prevalentes entre os homens, sendo apenas inatividade física maior entre as mulheres. Na análise de clusters, consumo de álcool + tabagismo + consumo inadequado de vegetais foi a única combinação que apresentou prevalência observada significativamente maior que a esperada (O/E = 2,67; IC95% 1,30; 5,48), sendo superior a encontrada em outro estudo no sul do país, dado que pode ser justificado pois tal estudo incluiu o consumo de frutas além de ter avaliado população urbana, enquanto para este estudo avaliou-se apenas a população rural. Após ajuste, os homens, indivíduos solteiros, de cor da pele preta, parda ou outra, com baixa escolaridade, pior condição socioeconômica, pior percepção de saúde e que não desenvolviam atividades rurais apresentaram maior *odds ratio* de acúmulo de fatores de risco. ***Conclusão:*** Os achados evidenciam a importância do desenvolvimento de ações prioritárias em relação à saúde da população rural com atenção específica aos subgrupos de maior risco identificados.

Palavras-chave: Doenças não transmissíveis. Estudos transversais. Zona rural.

INTRODUCTION

Chronic non-communicable diseases (NCDs) are responsible for 70% of deaths worldwide, of which 80% occur in low and middle income countries[1]. In Brazil, NCDs represent 72.6% of annual deaths[2,3]. Among the factors that increase the burden of these diseases are physical inactivity, alcohol abuse, inadequate diet, and smoking[3]. The result of a time trend analysis carried out by the Global Burden of Diseases showed that smoking, inadequate consumption of vegetables and physical inactivity were, respectively, the 9th, 20th and 21st in ranking among the conditions responsible for the years of life lost due to disability in 2015[4].

Although there is extensive literature showing the increase in the prevalence of NCDs due to several known risk factors (RF)[3,5,6], there are few studies that evaluate the concomitant occurrence of these behaviors[7-11]. Nevertheless, observed prevalences are high[7-11]. In Pernambuco, a study with adolescents found that more than half of young people (58.5%) were simultaneously exposed to two or more RF[8], and in the south of the country, this prevalence in the elderly was 88.1%[7].

Studies on the topic are, in general, carried out in urban areas[7], but individuals from rural areas have lower life expectancy and less access to primary health services[12], conditions that can negatively impact health. With regard to RF for NCDs, rural residents of Brazil have a high consumption of foods that are a source of fat, and a low consumption of fruits and vegetables[13]. In addition, the prevalence of current smokers in rural areas of the country is higher than in urban areas (16.7 and 14.4%, respectively)[14]. On the other hand, lower prevalences of physical inactivity were observed[13,15,16]. However, with regard to the simultaneous occurrence of these factors, studies evaluating rural populations in the country have not been found in the literature.

Thus, studies that identify the most frequent RF combinations for the occurrence of NCDs in the rural population can assist in the planning and execution of actions aimed at promoting health, and reducing the occurrence of these factors among residents of rural areas. Therefore, the objectives of the present study were to describe the simultaneous occurrence of RF for NCDs, as well as to estimate the prevalence and the sociodemographic, behavioral and health factors associated with the simultaneity of these factors in adults living in rural areas in southern Brazil.

METHODS

A cross-sectional population-based study, carried out between January and June 2016, with individuals aged 18 years or over and living in the rural area of Pelotas. The municipality is located in the southern half of the state of Rio Grande do Sul. The rural area of the city is composed of eight districts, totaling about 22 thousand inhabitants[17].

To calculate the sample size, the following prevalence estimates were used: smoking 20%; alcohol consumption risk 15%; physical inactivity 13.5%, and inadequate consumption of vegetables 78.4%. The other parameters used were: a 95% confidence level, a margin of error of three percentage points and a design effect of 2.0. There was 10% added to the value obtained for losses or refusals. The largest sample size required was 1,540 individuals.

The sampling process was carried out in two stages. The census sectors were defined as primary sample units, with 24 sectors being randomly selected from the 50 that make up the rural area of Pelotas[18]. In the second stage, 30 households were selected within each sector, in the areas identified as community nuclei, which corresponded to the largest cluster of households in that sector.

Individuals excluded were those: with cognitive or mental disabilities, who did not have the help of caregivers/family members; hospitalized or institutionalized during data collection; who did not speak/understand Portuguese, since a small part of the rural population of the municipality only speaks the Pomeranian language. More details on the methodology of the study can be found in another publication[18].

Data collection was performed with the aid of tablets by interviewers who were trained to conduct the interview in a standardized manner. The data collection instrument covered sociodemographic, behavioral and health issues.

The quality control of the information collected was carried out over the telephone by reapplying the reduced version of the questionnaire to 10% of the sample, which was selected at random. The question about smoking was used to assess agreement according to the existence of specific temporality in the questions on the other RFs for NCDs. The Kappa coefficient of the smoking variable (yes/no) was 0.96.

The RF considered for this study were:

- smoking, with current smokers considered those who smoked one or more cigarettes a day for at least a month, or those who reported having stopped smoking less than a month previously, at the time of the interview;
- high-risk alcohol consumption, assessed by Alcohol Use Disorder Identification Test[19], with a positive screening considered ≥ 8 points in the score[20];
- physical inactivity, considered as <150 minutes/week of physical activity assessed by the Global Physical Activity Questionnaire[21];
- inadequate consumption of vegetables, assessed through the question: "In the past seven days, how many days did you eat cooked or raw vegetables? Potato and cassava should not be considered"; inadequate consumption was considered when ≤ five days/week, regardless of the amount eaten.

To verify the simultaneous occurrence of RF, an analysis of clusters was used, in which the ratio between observed (O) and expected (E) prevalences for each combination was considered. Expected prevalence was calculated by multiplying the prevalence of RF present by the complement of the prevalence of missing factors. For example, to calculate a cluster of physical inactivity (I), smoking (T) and alcohol consumption (A), we have: $I \times T \times A \times (1\text{-}E)$. In this case, the RFs present were also multiplied by the complement of the prevalence of inadequate consumption of vegetables (1-E), since the last risk factor is missing in this cluster. In this analysis, the clusters were understood as the combinations in which the O/E ratio was greater than one and whose 95% confidence interval (95%CI) did not include the unit (1).

To assess the association between RF accumulation for NCDs and demographic and socioeconomic variables, RF scores classified into four categories were used: 0, 1, 2 and 3 or more. The independent variables analyzed were: sex (male, female); age in full years (18–29; 30–39; 40–49; 50–59; 60 or more); self-reported skin color (white; black, brown or other); marital status (married or living with a partner; separated or widowed; single); schooling in completed years (0–4; 5–8; 9 or more); economic class according to the Brazilian Association of Research Companies (*Associação Brasileira de Empresas de Pesquisas* - ABEP) (A or B; C; and D or E)[22]; rural occupation (yes; no), considering rural occupation as performing some daily or frequent work related to agriculture, livestock and fishing in the rural area; and health perception (very good or good; fair; bad or very bad).

The cluster analyses and the respective 95%CI were performed using Microsoft Excel 2016. The other data were analyzed using Stata software, version 14.0, using the command "survey", in order to consider the sampling effect. The data were weighted according to the number of households sampled in relation to the total number of permanent households in each district.

Data description was performed using Pearson's χ^2 test for heterogeneity. To assess the association between RF for NCDs and the independent variables, ordinal regression was used. The estimates were obtained in gross and adjusted odds ratio (OR) and respective 95%CI. As a result, an OR was presented for each category of independent variables, which corresponds to the estimate of those exposed to move to a category with more RF (0, 1, 2, 3 or more).

The adjusted analysis was developed in a hierarchical manner[23] on two levels. In the first level, the variables sex, age, skin color, marital status and education were included, and in the second level, economic class, rural occupation and health perception were added. Variables with $p < 0.20$ in the adjusted analysis were maintained in the model for confusion control. The statistical significance of each variable was assessed by the Wald heterogeneity test, considering $p < 0.05$.

The ethical aspects were assured to the participants. An interview was conducted only after the participants had read and signed the informed consent form. Furthermore, their right to not participate in the research and the confidentiality of the data collected was guaranteed. The study was approved by the Research Ethics Committee of the School of Medicine of the Universidade Federal de Pelotas (no. 1,363,979).

RESULTS

Of the 1,697 eligible individuals, 1,519 were interviewed. Individuals who did not have information for at least one of the four RF for NCDs evaluated were excluded. Thus, 1,445 individuals comprised the sample of this study. The percentage of losses and refusals was 14.9%, and the proportion of non-respondents was higher among men ($p < 0.001$).

Table 1 shows the characteristics of the sample. Most of the individuals were female, 60 years old or more, reported themselves to be white, were married or lived with a partner, had less than nine years of schooling and belonged to economic class C. In addition, more than half of the individuals had no rural occupation and considered their health to be good or very good (Table 1).

Most behavioral RFs were more prevalent among men, except for physical inactivity (Table 1). According to Figure 1, the inadequate consumption of vegetables was the most reported risk behavior for NCDs from the sample (62.3%), while alcohol consumption was the least reported (8.4%).

Table 2 shows the observed and expected prevalences and the O/E ratio for the 16 possible RF combinations. About 25% of the sample did not show any RF. In the analysis of clusters, the only combination that had an observed prevalence that was significantly higher than expected was: high-risk alcohol consumption + smoking + inadequate consumption of vegetables (1.87%) (O/E = 2.67; 95%CI 1.30 – 5.48).

Associations between RF accumulation according to sociodemographic characteristics are shown in Table 3. After adjustment, men had an odds ratio that was 2.2 times greater

Table 1. Prevalence of risk factors for chronic noncommunicable diseases according to sociodemographic, behavioral and health characteristics. Pelotas, RS, 2016. (n = 1,445).

Variables	Total sample	Smoking	Consumption of risk alcohol	Physical inactivity	Inadequate consumption of Vegetables/ legumes
	n (%)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)
Sex		p < 0.001	p < 0.001	p = 0.024	p < 0.001
Male	689 (48.3)	22.1 (19.2 – 25.4)	15.6 (13.1 – 18.5)	14.1 (11.7 – 16.9)	69.4 (65.9 – 72.7)
Female	747 (51.7)	11.3 (9.2 – 13.9)	1.7 (0.9 – 2.9)	18.2 (15.6 – 21.2)	55.6 (52.0 – 59.1)
Skin color		p = 0.427	p = 0.080	p = 0.542	p < 0.001
White	1235 (85.5)	15.3 (13.4 – 17.5)	7.9 (6.5 – 9.5)	16.5 (14.5 – 18.7)	60.6 (57.8 – 63.3)
Black, brown or other	210 (14.5)	23.6 (18.3 – 30.0)	11.4 (7.7 – 16.6)	14.8 (10.9 – 20.3)	72.0 (65.6 – 77.7)
Age		p = 0.003	p < 0.001	p < 0.001	p = 0.007
18–29 years old	276 (19.1)	12.9 (9.3 – 17.5)	11.2 (7.9 – 15.5)	10.6 (7.5 – 14.8)	72.5 (66.9 - 77.4)
30–39 years old	221 (15.3)	18.5 (13.8 – 24.3)	10.5 (7.1 – 15.4)	14.5 (10.4 – 19.9)	64.7 (58.1 - 70.7)
40–49 years old	287 (19.9)	20.3 (16.0 – 25.4)	9.4 (6.5 – 13.4)	10.4 (7.3 – 14.7)	63.5 (57.7 – 68.8)
50–59 years old	278 (19.2)	21.8 (17.3 – 27.0)	10.0 (6.9 – 14.2)	13.1 (9.6 – 17.6)	57.3 (51.4 – 63.0)
60 or older	383 (26.5)	11.4 (8.5 – 15.0)	3.3 (1.9 – 5.7)	28.1 (23.8 – 32.9)	56.1 (51.0 – 61.0)
Marital status		p = 0.142	p = 0.006	p = 0.007	P < 0.001
Married; with a partner	879 (60.6)	14.3 (12.1 – 16.8)	7.0 (5.4 – 8.8)	14.4 (12.2 – 16.9)	56.7 (53.4 – 60.0)
Separated/ Widowed	190 (13.1)	16.0 (11.4 – 21.9)	5.3 (2.9 – 9.6)	26.9 (2.1 – 33.7)	62.8 (55.8 – 69.4)
Single	376 (26.3)	22.1 (18.1 – 26.6)	13.3 (10.2 – 17.2)	15.1 (11.8 – 19.1)	74.6 (70.0 – 78.8)
Schooling (years)		p = 0.005	p = 0.181	p < 0.001	p = 0.025
0–4	538 (37.6)	18.7 (15.6 – 22.3)	6.5 (4.7 – 9.0)	21.8 (18.5 – 25.5)	66.1 (62.0 – 70.0)

Continue...

Table 1. Continuation.

Variables	Total sample	Smoking	Consumption of risk alcohol	Physical inactivity	Inadequate consumption of Vegetables/ legumes
	n (%)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)
5–8	538 (37.4)	18.2 (15.1 – 21.7)	9.9 (7.6 – 12.8)	13.1 (10.5 – 16.3)	62.9 (58.8 – 66.9)
9 years or more	360 (25.1)	10.9 (8.0 – 14.7)	8.9 (6.3 – 12.3)	12.2 (9.2 – 16.0)	55.3 (50.1 – 60.4)
Rural occupation		p = 0.139	p = 0.104	p < 0.001	p = 0.528
No	958 (66.3)	17.3 (15.0 – 19.9)	7.5 (6.0 – 9.3)	22.5 (19.9 – 25.3)	63.1 (60.0 – 66.1)
Yes	487 (33.7)	15.0 (12.1 – 18.5)	10.1 (7.7 – 13.2)	3.9 (2.5 – 6.0)	60.6 (56.2 – 64.9)
Economic class		p < 0.001	p = 0.164	p = 0.007	p < 0.001
A or B	291 (20.3)	10.6 (7.5 – 14.7)	9.5 (6.6 – 13.4)	16.0 (12.2 – 20.7)	48.4 (42.7 – 54.1)
C	775 (53.8)	14.1 (11.8 – 16.8)	6.8 (5.2 – 8.9)	14.5 (12.2 – 17.2)	63.6 (60.2 - 67.0)
D or E	364 (25.9)	25.4 (21.1 – 30.2)	10.1 (7.4 – 13.8)	20.2 (16.3 – 24.7)	70.3 (65.5 – 74.8)
Perception of health		p = 0.020	p = 0.006	p < 0.001	p = 0.047
Very good/Good	928 (64.6)	15.2 (13.0 – 17.7)	10.2 (8.4 – 12.3)	13.7 (11.7 – 16.1)	60.8 (57.6 – 63.9)
Fair	442 (30.5)	17.5 (14.2 – 21.3)	5.8 (4.0 – 8.5)	18.3 (14.9 – 22.2)	63.3 (58.7 – 67.6)
Bad/Very bad	70 (4.9)	26.8 (17.6 – 38.6)	0	33.7 (23.6 – 45.5)	75.1 (63.7 – 83.8)

*Variable with the largest number of missing (15); 95% confidence interval,

for having more RF when compared to women. Individuals who declared themselves black, brown, yellow or indigenous had odds ratio that were 1.5 times greater for presenting more than one RF for NCDs when compared to those with white skin color (OR = 1.45 95%CI 1.06 – 1.99). As for the marital status, single people had an odds ratio that was 2.1 times greater for having more than one RF when compared to those who were married or who lived with a partner.

Education and economic class remained associated after adjustment and showed an inverse relationship with the outcome. As education level decreased, the odds ratio of having more RF increased. In addition, individuals with worse economic conditions (classes

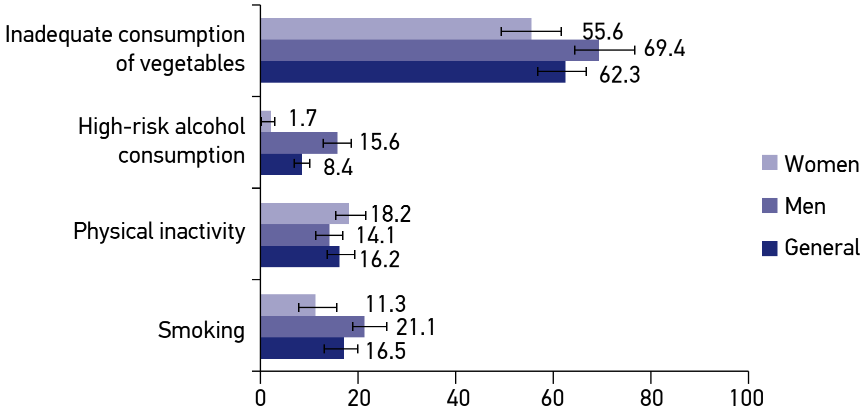

Figure 1. Prevalence of risk factors for chronic noncommunicable diseases stratified by sex in adults from rural Pelotas / RS, 2016 (n = 1,445).

Table 2. Prevalence and association of the four behavioral risk factors (n=1,445).

Number of factors	(A)	I	S	C	O (%)	E (%)	O/E	95%CI
4	+	+	+	+	0.07	0.14	0.50	0.04 - 5.43
3	+	+	+	-	0.07	0.08	0.87	0.06 – 12.6
3	+	+	-	+	0.42	0.70	0.60	0.21 – 1.63
3	+	-	+	+	1.87	0.70	2.67	1.30 – 5.48
3	-	+	+	+	1.59	1.50	1.06	0.59 – 1.89
2	+	+	-	-	0.07	0.43	0.16	0.01 – 1.39
2	+	-	-	+	3.46	3.60	0.96	0.65 – 1.40
2	-	+	+	-	0.48	0.90	0.52	0.20 – 1.30
2	-	-	+	+	7.96	7.74	1.02	0.80 – 1.32
2	+	-	+	-	0.76	0.43	1.76	0.66 – 4.71
2	-	+	-	+	8.93	7.68	1.16	0.91 – 1.48
1	+	-	-	-	1.59	2.22	0.71	0.42 – 1.21
1	-	+	-	-	4.57	4.75	0.96	0.69 – 1.33
1	-	-	+	-	3.46	4.78	0.72	0.40 – 1.03
1	-	-	-	+	37.51	39.75	0.79	0.86 – 1.03
0	-	-	-	-	27.20	24.57	1.10	0.97 – 1.25

A: high-risk alcohol consumption; I: physical inactivity; S: smoking; C: inadequate consumption of vegetables; O: observed value; E: expected value; O/E: observed/expected value; 95%CI: 95% confidence interval.

Table 3. Association between risk factors for chronic diseases and sociodemographic, behavioral and health variables in rural adults. Pelotas, RS, 2016 (n = 1,455).

	Crude OR (95CI%)	p*	Adjusted OR (95%CI)	p*
Sex[a]				
Female	1.00	< 0.001	1.00	< 0.001
Male	2.15 (1.82; 2.55)		2.16 (1.79; 2.60)	
Skin Color[a]				
White	1.00	0.004	1.00	0.021
Black, brown, or other	1.61 (1.18; 2.21)		1.45 (1.06; 1.99)	
Age[a]				
60 years or more	1.00	0.759	1.00	0.454
50–59 years	1.03 (0.79; 1.35)		1.18 (0.87; 1.61)	
40–49 years	1.06 (0.77; 1.46)		1.28 (0.92; 1.78)	
30–39 years	1.19 (0.76; 1.85)		1.53 (0.94; 2.50)	
18–29 years	1.21 (0.89; 1.65)		1.42 (0.87; 2.31)	
Marital Status[a]				
Married; with a partner	1.00	< 0.001	1.00	0.001
Separated/Widowed	1.59 (1.20; 2.12)		1.90 (1.38; 2.60)	
Single	2.13 (1.64; 2.76)		2.10 (1.52; 2.91)	
Schooling (in years)[a]				
9 or more	1.00	0.002	1.00	< 0.001
5–8	1.44 (1.02; 2.05)		1.63 (1.12; 2.37)	
0–4	1.78 (1.30; 2.44)		2.36 (1.58; 3.51)	
Economic class[b]¥				
A or B	1.00	< 0.001	1.00	0.011
C	1.41 (0.99; 2.01)		1.22 (0.87; 1.70)	
D or E	2.66 (1.82; 3.87)		1.82 (1.22; 2.70)	
Rural Occupation[b]				
No	1.00	< 0.001	1.00	< 0.001
Yes	0.61(0.47; 0.78)		0.51 (0.40; 0.64)	
Perception of health[b]				
Very Good/Good	1.00	< 0.001	1.00	0.212
Fair	1.14 (0.93; 1.40)		1.05 (0.82; 1.35)	
Bad/Very Bad	2.35 (1.59; 3.48)		2.09 (1.25; 3.49)	

OR: odds ratio; 95% CI: 95% confidence interval; [a]first level; [b]second level; * Wald test; ¥ variable with the highest number missing (15)

D/E) had odds ratios that were twice as high for having more than one risk factor (95%CI 1.22 – 2.70) when compared to those in classes A/B.

Regarding occupation, individuals who performed rural activities showed 49% protection from having more RF (OR=0.51; 95%CI 0.40 – 0.64) in relation to those who did not perform rural activity (Table 3).

Regarding health perception, those who reported having poor or very poor health had odds ratios that were twice as high of having more RF for NCDs when compared to those who reported having very good or good health (OR = 2.35; 95%CI 1.59 – 3.48) in the crude analysis. However, after the adjustment, the statistical significance of the association was lost. There was no association between age and RF accumulation.

DISCUSSION

The results of the study showed a high prevalence of RF for NCDs among adults living in rural Pelotas. Inadequate consumption of vegetables was the most prevalent among the four risk factors studied. Additionally, being male, non-white, single or without a partner, having less schooling, lower economic conditions, not doing rural work and considering health as bad or very bad were considered to be factors associated with RF .

Studies show that the consumption of fruits and vegetables is lower among residents of rural areas when compared to those in urban areas[13,24]. One possible explanation can be attributed to the changes that have occurred in recent decades. The rural area of the south of the country, which was previously characterized by producing food for subsistence, today is mainly focused on monoculture, aiming at the sale/export of its products. This can contribute to greater adherence to a dietary pattern that is "modern", rich in simple fats and carbohydrates[25,26]. Additionally, specific characteristics of the rural area, such as lower income and education[27], can also have a negative influence, since there is a relationship between higher consumption of fruits and vegetables and more schooling[28].

Several studies have sought to evaluate RF for NCDs in adults, however the factors have been assessed individually, with simultaneous analysis used infrequently[29,30]. Among the studies that carried out this type of analysis[31,32], different RFs were evaluated, and different combinations, measures and cutoff points were employed. In addition, studies generally evaluated only rural residents, which makes comparison with other studies difficult. In this study, the combination of "risky alcohol consumption + smoking + inadequate consumption of vegetables" occurred two and a half times more than expected at random, and was higher than that found in another study conducted with adults in southern Brazil for the combination "consumption of high-risk alcohol + smoking + inadequate consumption of fruits/vegetables" (1,9)[33]. However, it is important to note that Silva et al.[33] evaluated individuals from the urban area and this study also included fruit consumption, which may, in part, justify this difference.

In the present study, higher prevalences of inadequate consumption of vegetables and consumption of alcohol and smoking were observed among men, factors that contribute to an increase in the mortality burden and years lived with disability[34]. In the urban area of the same city, studies have shown higher consumption of vegetables[35] and physical inactivity among females[36]. In addition, a higher prevalence of smoking and alcohol consumption are observed worldwide among men when compared to women[37,38]. These gender differences can be explained by biological, socioeconomic and cultural aspects[33]. Several studies have pointed out that men have worse lifestyle habits compared to women[36,39,40], are more exposed to risky behaviors and are less careful about their health[13].

No association was found between age and simultaneous exposure to RF. Despite not reaching statistical significance, the simultaneous presence of RF seems to decrease with advancing age[41-43]. Older individuals use health services more often, where they receive guidance to improve their lifestyle and health care, which could have influenced the reduction of their RF for NCDs[44]. It is also necessary to consider the survival bias, since adults with unhealthy behaviors may have already died before reaching more advanced ages.

As for marital status, the results of this study showed that individuals living without a partner were more likely to accumulate RF for NCDs. Those who live with a partner tend to have better health behaviors, since support between the couple, both social and economic, can have a protective effect on health[33]. A recent systematic review noted that health behaviors are consistent among couples, including physical activity, food consumption, alcohol consumption and smoking[45]. In relation to changes in habits, the fact that one of the partners adopts healthier lifestyle habits, increases the probability of the other being positively influenced to adhere to these same habits[46].

Non-white rural residents showed a greater accumulation of RF for NCDs. This was also observed in a study carried out with an adult population living in an urban area in southern Brazil[33]. Black, brown and indigenous individuals make up the population stratum that are most impacted by health inequities in the country, such as a lower level of education, worse work situation, and less access to social goods and services[47], which may reflect on health conditions.

Although the RFs studied here are subject to change, the socioeconomic condition and the social environment in which the individual is inserted are factors that influence the adopted behaviors and lifestyle[29,48]. A higher proportion of combined RF was observed among those with lower levels of education and lower income. These results are consistent with other studies on RF simultaneity for NCDs carried out in the urban area[9,33,49]. Some authors suggest that the relationship between higher levels of income and education and lower RF load can be explained by greater access to health services, which allow for the opportunity for more knowledge and to receive guidance for a healthier life[8,9]. In this sense, RF can be augmented in individuals with lower socioeconomic conditions.

In the present study, it was observed that those who had a rural occupation, had less RF for NCDs when compared to those who did not perform this type of activity. The fact of doing rural work can be beneficial for health in some aspects, such as the practice of physical activity[50]. However, the high prevalence of physically active individuals was mainly due to their work, corroborating the findings of another study carried out with adults in rural Minas Gerais[16]. In contrast, data from the National Household Sample Survey (*Pesquisa Nacional por Amostra de Domicílios* - PNAD) of 2008 showed a higher frequency of smoking among agricultural workers in the country when compared to those whose occupation was related to the sciences and arts[51]. Thus, the results of this study should be evaluated with caution, since no stratified analysis by labor category was performed, and the observed joint effect may not have the same result for each of the variables analyzed separately.

In adults in the rural area of Pelotas, accumulation of RF was higher in individuals who reported their health as poor or very bad, however the lack of association in the adjusted analysis may be related to the power of the study, which is insufficient to detect this difference.

The study has some limitations that deserve to be highlighted. First, the fact that losses and refusals were more prevalent in males is highlighted, since it may lead to the underestimation of results in this group. Another point to consider is that the results may have been affected by the survival bias, since individuals who had their factors evaluated may have already died as a result of health problems developed from these behaviors. Nevertheless, because all individuals in a household were selected, it is likely that the sample became more homogeneous, especially with regard to behavioral habits. However, the weighting of the analyses, considering the effect of the sample design, sought to alleviate this problem.

On the other hand, it is worth noting that a population-based study was carried out, with methodological rigor that allowed for the diagnosis of important variables related to the health of a little investigated population. Although there are different rural areas in Brazil and socio-cultural heterogeneity among these populations, these findings may be able to be extrapolated to the target population (adults in the rural area of Pelotas) and may provide an initial overview of these health conditions in other rural populations in the country.

CONCLUSION

Risk behaviors for NCDs were frequent in this population, with emphasis on the inadequate consumption of vegetables in more than 60% of the population. It should also be noted that the most vulnerable subgroups with RF accumulation were: men, non-white individuals, single people, those with lower levels of education, those with lower economic conditions, those who did not perform rural work, and those who considered their health to be poor/very bad. The factors evaluated, as well as the subgroups with the highest risk identified, should form an agenda for the development of priority actions in relation to the health of this population, since these factors can cause negative impacts for both individuals, their families and the society as a whole, especially in years of life lost due to disability, premature deaths, spending on public health and worsening quality of life.

ACKNOWLEDGMENTS

This work was carried out with the support of the Coordination for the Improvement of Higher Education Personnel (CAPES) – Financing Code 001 – and the National Council for Scientific and Technological Development (CNPq).

REFERENCES

1. World Health Organization. Noncommunicable diseases [Internet]. Genebra: World Health Organization; 2018 [Accessed on Apr. 27, 2018]. Available from: http://www.who.int/mediacentre/factsheets/fs355/en/
2. Malta DC, Moura L, Prado RR, Escalante JC, Schmitt MI, Duncan BB. Mortalidade por doenças crônicas não transmissíveis no Brasil e suas regiões, 2000 a 2011. Epidemiol Serv Saúde 2014; 23(4): 599-608. https://doi.org/10.5123/S1679-49742014000400002
3. World Health Organization. Global action plan for the prevention and control of noncommunicable diseases 2013-2020 [Internet]. Genebra: World Health Organization [Accessed on Apr. 26, 2018]. Available from: http://www.who.int/nmh/events/ncd_action_plan/en/
4. GBD 2015 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet 2016; 388(10053): 1659-724.
5. World Health Organization. From burden to "best buys": reducing the economic impact of non-communicable diseases in low- and middle-income countries: executive summary 2011 [Internet]. Genebra: World Health Organization; World Economic Forum; 2011 [Accessed on Apr. 27, 2018]. Available from: http://www.who.int/nmh/publications/best_buys_summary/en/
6. Schmidt MI, Duncan BB, Azevedo e Silva G, Menezes AM, Monteiro CA, Barreto SM, et al. Chronic non-communicable diseases in Brazil: burden and current challenges. Lancet 2011; 377(9781): 1949-61. https://doi.org/10.1016/S0140-6736(11)60135-9
7. Cruz MF, Ramires VV, Wendt A, Mielke GI, Martinez-Mesa J, Wehrmesiter FC. Simultaneidade de fatores de risco para doenças crônicas não transmissíveis entre idosos da zona urbana de Pelotas, Rio Grande do Sul, Brasil. Cad Saúde Pública 2017; 33(2): e00021916. https://doi.org/10.1590/0102-311x00021916
8. Brito ALS, Hardman CM, de Barros MGV. Prevalência e fatores associados à simultaneidade de comportamentos de risco à saúde em adolescentes. Rev Paul Pediatr 2015; 33(4): 423-30. https://doi.org/10.1016/j.rpped.2015.02.002
9. Muniz LC, Schneider BC, Silva IC, Matijasevich A, Santos IS. Fatores de risco comportamentais acumulados para doenças cardiovasculares no sul do Brasil. Rev Saúde Pública 2012; 46(3): 534-42. https://doi.org/10.1590/S0034-89102012005000021
10. Wu F, Guo Y, Chatterji S, Zheng Y, Naidoo N, Jiang Y, et al. Common risk factors for chronic non-communicable diseases among older adults in China, Ghana, Mexico, India, Russia and South Africa: the study on global AGEing and adult health (SAGE) wave 1. BMC Public Health 2015; 15: 88. https://doi.org/10.1186/s12889-015-1407-0
11. Tassitano RM, Dumith SC, Chica DAG, Tenório MCM. Agregamento dos quatro principais comportamentos de risco às doenças não transmissíveis entre adolescentes. Rev Bras Epidemiol 2014; 17(2): 465-78. https://doi.org/10.1590/1809-4503201400020014ENG
12. Programa das Nações Unidas para o Desenvolvimento. Relatório de Desenvolvimento Humano. A verdadeira riqueza das nações: Vias para o desenvolvimento humano. Programa das Nações Unidas para o Desenvolvimento; 2010.
13. Instituto Brasileiro de Geografia e Estatística. Diretoria de Pesquisas. Coordenação de Trabalho e Rendimento. Pesquisa Nacional de Saúde 2013. Percepção do estado de saúde, estilos de vida e doenças crônicas. Rio de Janeiro: Ministério do Planejamento, Orçamento e Gestão; 2014.
14. Malta DC, Vieira ML, Szwarcwald CL, Caixeta R, Brito SMF, Reis AAC. Tendência de fumantes na população Brasileira segundo a Pesquisa Nacional por Amostra de Domicílios 2008 e a Pesquisa Nacional de Saúde 2013. Rev Bras Epidemiol 2015; 18(Supl. 2): 45-56. https://doi.org/10.1590/1980-5497201500060005
15. Martins RC, Da Silva ICM, Hallal PC. Atividade física na população de Pelotas, RS: prevalência e fatores associados. Rev Saúde Pública 2018; 52(Supl. 1): 9s. https://doi.org/10.11606/s1518-8787.2018052000265
16. Bicalho PG, Hallal PC, Gazzinelli A, Knuth AG, Velásquez-Meléndez G. Atividade física e fatores associados em adultos de área rural em Minas Gerais, Brasil. Rev Saúde Pública 2010; 44(5): 884-93. https://doi.org/10.1590/S0034-89102010005000023

17. Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2010. Brasília: Instituto Brasileiro de Geografia e Estatística; 2010 [Accessed on Apr. 27, 2018]. Available from: http://www.censo2010.ibge.gov.br
18. Gonçalves H, Tomasi E, Tovo-Rodrigues L, Bielemann RM, Machado AKF, Ruivo ACO, et al. Estudo de base populacional na zona rural: metodologia e desafios. Rev Saúde Pública 2018; 52(Supl. 1): 3s. https://doi.org/10.11606/S1518-8787.2018052000270
19. Babor TF, Higgins-Biddle JC, Saunders JB, Monteiro MG. AUDIT - The Alcohol Use Disorders Identification Test: guideline for use in Primary Care [Internet]. 2. ed. Genebra: WHO; 2001 [Accessed on Mar. 15, 2018]. Available from: https://apps.who.int/iris/handle/10665/67205
20. Lima CT, Freire AC, Silva AP, Teixeira RM, Farrel M, Prince M. Concurrent and construct validity of the Audit in urban Brazilian sample. Alcohol Alcohol 2005; 40(6): 584-9. https://doi.org/10.1093/alcalc/agh202
21. World Health Organization. Global physical activity questionnaire (GPAQ): analysis guide [Internet]. Genebra: WHO; 2010 [Accessed on Mar. 15, 2018]. Available from: http://www.who.int/ncds/surveillance/steps/resources/GPAQ_Analysis_Guide.pdf
22. Associação Brasileira de Empresas de Pesquisa. Critério de Classificação Econômica do Brasil [Internet]. São Paulo: ABEP; 2014 [Accessed on Mar. 15, 2018]. Available from: http://www.abep.org
23. Victora CG, Huttly SR, Fuchs SC, Olinto MT. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. Int J Epidemiol 1997; 26(1): 224-7. https://doi.org/10.1093/ije/26.1.224
24. Jaime PC, Monteiro CA. Fruit and vegetable intake by Brazilian adults, 2003. Cad Saúde Pública 2005; 21(Supl. 1): S19-S24. https://doi.org/10.1590/S0102-311X2005000700003
25. Grisa C, Schneider S. "Plantar pro gasto": a importância do autoconsumo entre famílias de agricultores do Rio Grande do Sul. Rev Econ Sociol Rural 2008; 46(2): 481-515. https://doi.org/10.1590/S0103-20032008000200008
26. Perestrelo JPP, Martins IS. Modernização rural: transformações econômicas e suas implicações demográficas, epidemiológicas e nutricionais nos municípios de Monteiro Lobato e Santo Antônio do Pinhal. Saúde Soc 2003; 12(2): 38-55. https://doi.org/10.1590/S0104-12902003000200005
27. Dias EC. Condições de vida, trabalho, saúde e doença dos trabalhadores rurais no Brasil. In: Pinheiro TMM, editor. Saúde do trabalhador rural: RENAST. Brasília: Ministério da Saúde; 2006. 27 p.
28. Kim JI, Sillah A, Boucher JL, Sidebottom AC, Knickelbine T. Prevalence of the American Heart Association's "Ideal Cardiovascular Health" metrics in a rural, cross-sectional, community-based study: The Heart of New Ulm Project. J Am Heart Assoc 2013; 2(3): e000058. https://doi.org/10.1161/JAHA.113.000058
29. Silva Jr. JB, Gomes FBC, Cezário AC, Moura L. Doenças e agravos não-transmissíveis: bases epidemiológicas. In: Rouquayrol MZ, Almeida Filho N, editores. Epidemiologia e saúde. 6ª ed. Rio de Janeiro: Medsi; 2003. p. 289-311.
30. Moura EC, Malta DC, de Morais Neto AL, Monteiro CA. Prevalence and social distribution of risk factors for chronic noncommunicable diseases in Brazil. Rev Panam Salud Publica 2009; 26(1): 17-22. https://doi.org/10.1590/s1020-49892009000700003
31. Schröders J, Wall S, Hakimi M, Dewi FST, Weinehall L, Nichter M, et al. How is Indonesia coping with its epidemic of chronic noncommunicable diseases? A systematic review with meta-analysis. PloS One 2017; 12(6): e0179186. https://doi.org/10.1371/journal.pone.0179186
32. Del Duca GF, Silva KS, Garcia LM, de Oliveira ES, Nahas MV. Clustering of unhealthy behaviors in a Brazilian population of industrial workers. Prev Med 2012; 54(3-4): 254-8. https://doi.org/10.1016/j.ypmed.2012.02.005
33. Silva DA, Peres KG, Boing AF, González-Chica DA, Peres MA. Clustering of risk behaviors for chronic noncommunicable diseases: a population-based study in southern Brazil. Prev Med 2013; 56(1): 20-4. https://doi.org/10.1016/j.ypmed.2012.10.022
34. Institute for Health Metrics and Evaluation. Global burden of disease profile: Brazil, 2013 [Internet]. Institute for Health Metrics and Evaluation [Accessed on Apr. 7, 2018]. Available from: http://www.healthmetricsandevaluation.org/gbd/country-profiles
35. Neutzling MB, Rombaldi AJ, Azevedo MR, Hallal PC. Fatores associados ao consumo de frutas, legumes e verduras em adultos de uma cidade no Sul do Brasil. Cad Saúde Pública 2009; 25(11): 2365-74. https://doi.org/10.1590/S0102-311X2009001100007
36. Hallal PC, Cordeira K, Knuth AG, Mielke GI, Victora CG. Ten-year trends in total physical activity practice in Brazilian adults: 2002-2012. J Phys Act Health 2014; 11(8): 1525-30. https://doi.org/10.1123/jpah.2013-0031
37. World Health Organization. Global status report on alcohol and health [Internet]. Genebra: World Health Organization; 2011 [Accessed on June 27, 2019]. Available from: https://www.who.int/substance_abuse/publications/global_alcohol_report/msbgsruprofiles.pdf

38. Palipudi KM, Gupta PC, Sinha DN, Andes LJ, Asma S, McAfee T. Social determinants of health and tobacco use in thirteen low and middle income countries: evidence from Global Adult Tobacco Survey. PLoS One 2012; 7(3): e33466. https://doi.org/10.1371/journal.pone.0033466
39. Apelberg B, Aghi M, Asma S, Donaldson E, Yeong CC, Vaithinathan R. Prevalence of tobacco use and factors influencing initiation and maintenance among women. Genebra: WHO; 2010.
40. Wilsnack RW, Vogeltanz ND, Wilsnack SC, Harris TR, Ahlström S, Bondy S, et al. Gender differences in alcohol consumption and adverse drinking consequences: cross-cultural patterns. Addiction 2000; 95(2): 251-65. https://doi.org/10.1046/j.1360-0443.2000.95225112.x
41. Duncan BB, Schmidt MI, Polanczyk CA, Homrich CS, Rosa RS, Achutti AC. Fatores de risco para doenças não transmissíveis em área metropolitana na região sul do Brasil: prevalência e simultaneidade. Rev Saúde Pública 1993; 27(1): 43-8. https://doi.org/10.1590/S0034-89101993000100007
42. Poortinga W. The prevalence and clustering of four major lifestyle risk factors in an English adult population. Prev Med 2007; 44(2): 124-8. https://doi.org/10.1016/j.ypmed.2006.10.006
43. Schuit AJ, Van Loon AJ, Tijhuis M, Ocke M. Clustering of lifestyle risk factors in a general adult population. Prev Med 2002; 35(3): 219-24. https://doi.org/10.1006/pmed.2002.1064
44. Chiavegatto Filho ADP, Wang YP, Malik AM, Takaoka J, Viana MC, Andrade LH. Determinantes do uso de serviços de saúde: análise multinível da Região Metropolitana de São Paulo. Rev Saúde Pública 2015; 49: 1-15. https://doi.org/10.1590/S0034-8910.2015049005246
45. Meyler D, Stimpson JP, Peek MK. Health concordance within couples: a systematic review. Soc Sci Med 2007; 64(11): 2297-310. https://doi.org/10.1016/j.socscimed.2007.02.007
46. Jackson SE, Steptoe A, Wardle J. The influence of partner's behavior on health behavior change: the English Longitudinal Study of Ageing. JAMA Intern Med 2015; 175(3): 385-92. https://doi.org/10.1001/jamainternmed.2014.7554
47. Boing AC, Bertoldi AD, Peres KG. Socioeconomic inequalities in expenditures and income committed to the purchase of medicines in Southern Brazil. Rev Saúde Pública 2011; 45(5): 897-905. https://doi.org/10.1590/S0034-89102011005000054
48. Malta DC, Andrade SSCA, Stopa SR, Pereira CA, Szwarcwald CL, Silva Júnior JB, et al. Estilos de vida da população brasileira: resultados da Pesquisa Nacional de Saúde, 2013. Epidemiol Serv Saúde 2015; 24(2): 217-26. https://doi.org/10.5123/S1679-49742015000200004
49. Dumith SC, Muniz LC, Tassitano RM, Hallal PC, Menezes AM. Clustering of risk factors for chronic diseases among adolescents from Southern Brazil. Prev Med 2012; 54(6): 393-6. https://doi.org/10.1016/j.ypmed.2012.03.014
50. Lee I, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet 2012; 380(9838): 219-29. https://doi.org/10.1016/S0140-6736(12)61031-9
51. Barros AJD, Cascaes AM, Wehrmeister FC, Martínez-Mesa J, Menezes AMB. Tabagismo no Brasil: desigualdades regionais e prevalência segundo características ocupacionais. Ciênc Saúde Coletiva 2011; 16(9): 3707-16. https://doi.org/10.1590/S1413-81232011001000008

Received on: 04/16/2019
Revised on: 07/07/2019
Accepted on: 07/24/2019

Authors' contributions: RH and AKFM collaborated in the conception, planning, analysis, interpretation and writing of the work; CCB, TMS, MOX, MPF and RCM collaborated in the conception, planning, and writing of the work; RMB, LTR and FCW collaborated in the conception and analysis of the work and a critical review of the manuscript. This manuscript has been read and approved by all authors.