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Cardiovascular risk factors in a Brazilian rural population

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Abstract *Given the extensive costs due to cardiovascular diseases and the increased prevalence of these diseases in farmers, this study aims to estimate the prevalence of cardiovascular risk factors in this population and to evaluate their associated factors. A cross-sectional study was carried out involving 790 farmers from the municipality of Santa Maria de Jetibá-ES, Brazil. Six out of ten evaluated farmers had at least one cardiovascular risk factor (CRF). High blood pressure was the most prevalent risk factor in 35.8% (95%CI 32-39, n = 283) followed by dyslipidemia (34.4%, 95%CI 31-38, n = 272). Those aged more than 50 years were 5.6 times (95%CI 2.03-15.43) more likely to evidence two or more CRFs. High waist circumference or tricipital skinfold indicating overweight increased 2.35 times (95%CI 1.47-3.76) and 1.6 times (95%CI 1.05-2.44) this likelihood, respectively. These findings reveal the high prevalence of CRF in rural workers and the significant impact of age and the accumulation of body fat in the development of these factors, showing the need to intensify public health policies geared to this population.*

Key words *Rural Population, Risk Factors, Cardiovascular Diseases, Epidemiology*

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Introduction

Cardiovascular diseases (CVD) occupy the first place in mortality in the world and are responsible for 17.9 million deaths yearly. Of these, more than three quarters occurred in low- and middle-income countries[1]. In Brazil. despite the lower mortality rates in the last decade, CVDs were responsible for the deaths of two million Brazilians from 2010 to 2015. approximately eight million years of life lost in the period and a high socioeconomic impact, with a total cost of R$ 205 billion, referring to hospitalizations, visits, medical procedures, social security costs with pension benefits and the costs of temporary or permanent loss of work activities due to the disease[2].

Changes in the age structure of the population and exposure to risk factors due to urbanization, technological advances and changes in the population's lifestyle, such as unhealthy diet, tobacco use, sedentary lifestyle, hypertension, diabetes and stress are the main culprits of developing diseases in the circulatory system[3,4]. It is estimated that modifiable risk factors control may contribute to a 50% reduction in mortality due to cardiovascular diseases[5].

In the field, modernization processes and the consequent changes in lifestyle and diet have also exposed rural workers to the increased risk of cardiovascular diseases due to elevated levels of lipids, glucose, overweight and accumulated abdominal fat in these workers[6-8]. Evidence suggests that the prevalence of cardiovascular diseases and their risk factors is higher in the rural population than in the urban population[9-11] and that the consequences of CVDs are one of the main reasons for absenteeism or non-performance of usual activities in this population[12].

Besides exposure to modified lifestyle, rural workers are exposed to several occupational factors that are also associated with an increased risk of cardiovascular diseases, such as exposure to pesticides[13], noise[14] and occupational stress[11]. As an aggravating factor, the difficult access to health services, the low level of education and the low socioeconomic level of rural workers make this population even more vulnerable to cardiometabolic risk[15,16].

Thus, considering the extensive costs of CVDs, the higher prevalence of these diseases in rural workers and the shortage of population-based studies developed with rural workers, this study aims to estimate the prevalence of the main cardiovascular risk factors and their associated factors in a sample of Brazilian rural workers. Corroborating the strategic actions defined by the Ministry of Health to address chronic noncommunicable diseases in Brazil[17], data from this study may contribute to surveillance actions, collaborating in the planning, implementation and evaluation of public policies for this population.

Materials and methods

This is a cross-sectional epidemiological study carried out in the municipality of Santa Maria de Jetibá, located in the mountain region of Espírito Santo, Brazil.

This study is an integral part of a broader population-based project entitled "Health condition and associated factors: a study of farmers in Espírito Santo", funded by the Foundation for Research Support of Espírito Santo, in which the target population consisted of rural workers whose primary source of income was agriculture. Non-pregnant participants in the 18-59 years' age group who were included in the work activity for at least six months participated in all stages of the project.

The identification of the rural workers that met the inclusion criteria was carried out with the help of the Community Health Workers (ACS) to define the universe of the sample, through the data available in the registers of individuals and households conducted by the Family Health Strategy teams, responsible for covering 100% of the territories of the municipality (11 health regions).

Thus, 7,287 rural workers of both genders and belonging to 4,018 households were identified. The prevalence of 50% outcome was considered to calculate the sample size, with a sampling error of 3.5%, a significance level of 95%, making a minimum sample of 625 farmers. Eight hundred six farmers were invited to cater for possible losses.

The study participants were selected using a stratified lot, considering the number of households per health region, in order to respect proportionality among the eleven regions. Only one individual was drawn per household, thus avoiding the interdependence of information. In cases of refusal of participation or non-attendance on the day of data collection, a new participant in the reserve list of the draw was called, respecting the gender and health unit of the origin of the dropout.

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Data were collected between December 2016 and April 2017. The information was obtained through an interview with a standardized questionnaire, systemic blood pressure measurements, anthropometric evaluation and biochemical tests. The questionnaire consisted of seven modules that included sociodemographic, occupational, lifestyle, eating habits. physical and mental health status data, and those of interest to this paper were selected for analysis.

The anthropometric measures were obtained with participants in orthostatic position, barefoot and wearing light clothing. The anthropometric variables evaluated in this study were: Waist Circumference (WC), classified according to the World Health Organization (WHO)[18] and classified as "non-cardiovascular risk" for WC ≤ 94cm for men and ≤ 80cm for women and "increased cardiovascular risk" for the other values; triceps skinfold (TS), classified as per Frisancho[19], grouped into "Adequate" for percentile < 90 and "Overweight" for percentile ≥ 90 and Body Mass Index (BMI), calculated by dividing weight (kg) by height (m) raised to the square, classified according to WHO cut-off points[18] and regrouped in "Low weight/Eutrophy" for BMI ≤ 24.9 kg/m² and "Overweight/Obesity" for BMI > 25.0 Kg/m².

The weight was measured with an Omron-514C® digital scale, with a capacity of 150 Kg and a precision of 0.1Kg. The height was measured with a Sanny® portable stadiometer model ES-2060, to the nearest 0.1 mm. WC was measured with Sanny® insole model TR-4010. TS was measured with a Lange® adipometer with a scale of 0 to 60 mm, a resolution of 1 mm and a spring with a pressure of 10g/mm².

The measurement of hemodynamic data, Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) followed the procedures described in the protocol of the Seventh Brazilian Hypertension Guideline[20]. All four measurements were performed on the right arm. The first one was discarded, and we considered the average between the second and third measurements as the final value. If the difference between the second and third was ≥ 5 mmHg, the fourth measure was used as the final value. For the hemodynamic protocol, the Omron® Automatic Pressure Monitor HME-7200 was calibrated and validated by the National Institute of Metrology, Quality and Technology (INMETRO).

Hypertension (AH) was classified according to SBH (2016) and grouped into "normal" (SBP ≤ 120 mmHg and DBP ≤80 mmHg), "prehypertension" (PAS 121-139 mmHg and/or PAD 81-89 mmHg) and "hypertension" (SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg). Individuals who reported taking antihypertensive drugs were also considered hypertensive.

For the biochemical data, 10 mL of blood was collected by venipuncture, after 12 hours of fasting. The blood collected was divided into two tubes, one containing EDTA anticoagulant and one without anticoagulant. The determination of total cholesterol was performed by the enzymatic colorimetric method with the Cholesterol Liquicolor Kit® (In Vitro Diagnóstica Ltda.). Regarding HDL cholesterol, the colorimetric enzyme was used with the HDL Cholesterol® (In Vitro Diagnóstica Ltda) Cholesterol Kit, and the Friedewald[21] formula was used to determine LDL Cholesterol. Triglycerides (TG) were established by the enzymatic colorimetric method with the Tricyclic Liquid Mono Kit® (In Vitro Diagnostica Ltda), and blood glucose by the enzymatic colorimetric method with the Enzymatic Glucose Kit® (In Vitro Diagnóstica Ltda).

Dyslipidemia was classified as per the Updated Brazilian Guidelines for Dyslipidemia and Prevention of Atherosclerosis[21]. Individuals with isolated hypercholesterolemia (LDL-c ≥ 160 mg/dL), isolated hypertriglyceridemia (TG ≥ 150 mg/dL) were considered dyslipidemic, hyperlipidemic (LDL-c ≥ 160 mg / dL and TG ≥ 150 mg / dL) or low HDL-c (Men <40 mg/dL and Women <50 mg/dL) alone or in combination with increased LDL-c or TG. Also considered as dyslipidemic were individuals who used lipid-lowering drugs.

Blood glucose was classified according to the Guidelines of the Brazilian Society of Diabetes 2015-2016[22], with individuals with glycemia ≤ 100 mg/dL classified as "normal glycemia" and the others as "hyperglycemia". "Hyperglycemia" was also classified for individuals who used hypoglycemic drugs.

Regarding the lifestyle-related variables, tobacco use was classified according to the Consensus Approach and Treatment of Smoker[23], classified as "non-smokers", "smokers" and "former smokers". Sedentary leisure was classified according to Sichieri and Souza[24], classified as screen time "<120 min/day" and "≥ 120 min/day". Alcohol consumption was investigated employing an inquiry about the volume, type and frequency of drinks consumed. Consumption was classified according to the National Survey on the Patterns of Alcohol Consumption in the Brazilian Population[25], and classified as "abstinent", "usual consumption" and "binge consumption".

Sociodemographic data included age, gender, socioeconomic class, ethnicity/skin color and schooling. The age range was classified as "up to 30 years", "31-40 years", "41-50 years", and "over 50 years". Gender was divided into "female" and "male". The socioeconomic class was established from the Brazilian economic classification criterion of the Brazilian Association of Research Companies (ABEP)[26], with individuals classified as "A/B", "C" and "D/E". The self-reported ethnicity/skin color was classified as black, brown, white, yellow and indigenous and reclassified as "white" and "non-white". The self-reported schooling was classified as per the corresponding number of years of study in "less than four years", "4 to 8 years" and "over 8 years".

The occupational data included were type of production, classified as "conventional", "agroecological" and "organic". Conventional production was defined as dependent on supplies such as chemical fertilizers and agrochemicals; the agroecological production corresponded to a crop based on the principles of agroecology, with adequate soil management and controlled use of external supplies and organic production a system that entirely excludes the use of pesticides and inorganic fertilizers[27].

Also included as occupational variables were land tenure, classified as "owner" and "non-owner"; weekly hours worked, classified as "≤ 40 hours" and "40 hours"; working time as a farmer, classified as "< 20 years", "≥ 20 years and <30 years" and "≥ 30 years"; and use of Personal Protective Equipment (PPE), classified under "Uses Full PPE". "Uses Incomplete PPE" and "Does not use PPE".

For this study, we considered "Full PPE" the farmers who reported using at the time of contact with pesticides: cap, chemically resistant clothing and pants, goggles, respirators, gloves and waterproof boots[28]. Those with "incomplete PPE" reported using only some of these items, and those who "Do not use PPE" reported not using any of these items during pesticide application/manipulation.

The dependent variable corresponded to the number of cardiovascular risk factors (CRF) as described by Wilson[29] in his study on predictors of coronary artery disease, and included AH, dyslipidemia, tobacco use, and hyperglycemia. Farmers were classified as having "none", "one", "two" and "three or four" according to the number of risk factors shown.

The association between variables was assessed using the chi-square test. Fisher's exact test was used when the expected values were < 5 or when the sum of the column value was < 20. The variables with a p-value < 5% were included in the binary logistic regression. The outcome variable was reclassified to "none or one CRF" and "two or more CRFs" to perform the model. The category "none or one CRF" was the baseline category. BMI values were not included in the analysis because they had collinearity with WC values.

Data analysis was performed using the IBM SPSS Statistics 22.0 software, with a significance level of $\alpha \leq 5\%$. Descriptive analyses included absolute and relative values.

The study was approved by the Research Ethics Committee (CEP) of the Health Sciences Center (CCS) of the Federal University of Espírito Santo (UFES). All participants signed the Informed Consent Form.

Results

Of the 806 invited rural workers, 790 were effectively evaluated. The final loss was 1.98% and there were no significant differences between the distribution by gender and age group between the sample evaluated and the total population of rural workers.

We found that 58% (n = 459) of the rural workers had at least one of the evaluated cardiovascular risk factors. AH (Table 1) was the most frequent risk factor, with 35.8% (CI95% 32-39, n = 283) of the rural workers, and was similar among men (36.6%, CI95% 33-40, n = 151) and women (35%, CI95% 32-38, n = 132). The second most prevalent CRF was dyslipidemia, found in 34.4% (CI95% 31-38, n = 272) of rural workers, and was higher in females (38.2%, CI95% 35-42, n = 144) (p = 0.036) than males (31%, CI95% 28-34, n = 128). Tobacco use was reported by 7.8% (CI95% 6-10, n = 62) of rural workers, and was more frequent among males than females (p = 0.001). Hyperglycemia was found in approximately 4% of the rural workers (3.8%, CI95% 2-5, n = 30), with no differences between genders.

The sociodemographic and occupational variables that were associated with the number of cardiovascular factors (Table 2) were age range (p = 0.001), schooling (p = 0.001), land tenure (p = 0.003), weekly work hours (p = 0.004) and field working time (p = 0.001). Regarding the lifestyle and the anthropometric variables (Table 3), an association was found with the number of CRFs and WC (p = 0.001), the TS (p = 0.005) and the Body Mass Index (p = 0.001).

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Table 1. Prevalence of cardiovascular risk factors in farmers by gender in the municipality of Santa Maria de Jetibá (ES).

Variables	Men			Women			Total			p value
	n	%	95%CI	n	%	95%CI	n	%	95%CI	
AH										0.001
Normal	81	19.6	17 -22	163	43.2	40 - 47	244	30.9	28 - 34	
Pre-hypertension	181	43.8	40 - 47	82	21.8	19 - 25	263	33.3	30 - 37	
Hypertension	151	36.6	33 - 40	132	35	32 - 38	283	35.8	32 -39	
Dyslipidemia*										0.036
No dyslipidemia	285	69	66 - 72	233	61.8	58 - 65	518	65.6	62-68	
With dyslipidemia	128	31	28 - 34	144	38.2	35 - 42	272	34.4	31-38	
Smoking										0.001
Non-smoker	303	73.4	70 -76	362	96.0	95 - 97	665	84.2	82 - 87	
Smoker	55	13.3	11 - 16	7	1.9	1 - 3	62	7.8	6 - 10	
Former smoker	55	13.3	11 - 16	8	2.1	1 - 3	63	8.0	6 - 10	
Glycemia*										0.999
Glycemia	397	96.1	95 -97	363	96.3	95 - 98	760	96.2	95 - 97	
Hyperglycemia	16	3.9	2 - 5	14	3.7	2 - 5	30	3.8	2 - 5	

Chi-square test. * Fisher's exact test. N = 790. AH: Arterial hypertension.

The logistic regression analysis (Table 4) evidenced that age, WC and TS were still associated with the presence of two or more cardiovascular risk factors. Regarding age, the 41-50 years' age group was 3.51 times more likely to have two or more CRFs (CI95% 1.32-9.35), and those in the age group over 50 years were 5.6 times more likely to evidence this (CI95% 2.03-15.43). Elevated WC was 2.35 times more likely to reveal two or more CRFs (CI95% 1.47-3.76), and high TS increased 1.6 times this likelihood (CI95% 1.05-2.44).

Discussion

Approximately six out of ten evaluated rural workers were exposed to at least one risk factor for the development of cardiovascular diseases. The main one was AH, found in more than a third of rural workers. Similar prevalence levels were found in rural communities in Bahia (36.5%)[30], Minas Gerais (40%)[31] and Rio Grande do Sul (39.1%)[32].

These results are above those estimated for the Brazilian population through studies, such as the National Health Survey (PNS)[33], which identified a prevalence of 21.4% of self-reported AH and the Surveillance System of Risk and Protective Factors for Chronic Non-Communicable Diseases through Telephone Enquiry (VIGITEL)[34], which identified self-reported AH ranging from 16.1% to 30.7%. with a mean of 24.3%. Both studies showed a higher prevalence in women than in men. While not representative of the Brazilian population, greater similarity is found when the results of this study are compared with the 35.8% estimated hypertension in the Adult Health Longitudinal Study (ELSA-Brazil)[35], showing that the high prevalence of AH in this rural population resembles many rural and urban areas, possibly because of similar exposure to modifiable risk factors for elevated blood pressure.

The prevalence of dyslipidemia among rural workers in Santa Maria de Jetibá was similar to that of AH. A survey carried out in the Chinese rural population[36] showed values close to those presented, where 36.9% of the population studied had at least one type of dyslipidemia. In the studied population, the levels of dyslipidemia are comparable to those found in rural and urban populations, even with a low percentage of HDL-c changes, due to the high physical activity involved in this type of work practice. Studies in rural communities identified substantial differences in the percentage of hypercholesterolemia, which was 15.9% in Minas Gerais[31] and 58% in Rio Grande do Sul[9]. Data from the ELSA-Brazil cohort[37] found a prevalence of hypercholesterolemia and hypertriglyceridemia of 61.5% and 31.2%, respectively, with a difference between

Table 2. Prevalence of cardiovascular risk factors according to sociodemographic and occupational variables of farmers in the municipality of Santa Maria de Jetibá (ES).

Variables	Number of cardiovascular risk factors								p value
	None		One		Two		Three or more		
	n	%	n	%	n	%	n	%	
Gender									0.729
Male	167	40.4	161	39.0	71	17.2	14	3.4	
Female	164	43.5	143	37.9	61	16.2	9	2.4	
Age group									0.001
Until 30 years	122	57.3	76	35.7	13	6.1	2	0.9	
31 to 40 years	111	48.1	91	39.4	25	10.8	4	1.7	
41 to 50 years	67	34.3	77	39.5	47	24.1	4	2.1	
Over 50 years	31	20.5	60	39.7	47	31.2	13	8.6	
Schooling									0.001
Less than 4 years	195	36.6	216	40.5	102	19.1	20	3.8	
4 to 8 years	89	51.5	60	34.7	21	12.1	3	1.7	
Over 8 years	47	56.0	28	33.3	9	10.7	0	0.0	
Ethnicity/Skin color									0.404
White	296	42.2	274	39.0	113	16.1	19	2.7	
Non-white	35	39.8	30	34.1	19	21.6	4	4.5	
Social class									0.267
A/B	32	55.2	17	29.3	9	15.5	0	0.0	
C	158	40.0	157	39.8	70	17.7	10	2.5	
D/E	141	41.8	130	38.6	53	15.7	13	3.9	
Type of production									0.464
Conventional	301	42.3	272	38.3	116	16.3	22	3.1	
Organic	24	44.4	20	37.0	9	16.7	1	1.9	
Agroecological	6	24.0	12	48.0	7	28.0	0	0.0	
Land tenure									0.003
Owner	250	41.0	243	39.8	106	17.4	11	1.8	
Non-owner	81	45.0	61	33.9	26	14.4	12	6.7	
Weekly working hours									0.004
≤ 40 hours	59	36.4	61	37.7	30	18.5	12	7.4	
> 40 Hours	272	43.3	243	38.7	102	16.2	11	1.8	
Working time									0.001
< 20 years	128	59.0	77	35.5	10	4.6	2	0.9	
≥ 20 years and < 30 years	103	47.3	83	38.1	28	12.8	4	1.8	
≥ 30 years	100	28.1	144	40.6	94	26.5	17	4.8	
Use of PPE									0.553
Uses full PPE	65	42.8	61	40.1	23	15.1	3	2.0	
Uses incomplete PPE	121	46.8	93	35.9	40	15.4	5	1.9	
Does not use PPE	41	35.1	48	41.0	23	19.6	5	4.3	

Chi-square test. N = 790. PPE: Personal Protective Equipment.

genders only for hypertriglyceridemia, which was almost twice as frequent in men (40.9% versus 23.0%).

Concerning tobacco use, it was verified that less than 10% of the rural workers reported smoking, with a significantly higher prevalence among men, as already evidenced by studies such as Barros et al.[38]. The National Health Survey in 2013 found a tobacco use prevalence of 15%, and the percentage of smokers in the rural area were higher (17.4%) than in the urban area (14.6%)[33]. In the national telephone enquiry, the frequen-

Table 3. Prevalence of cardiovascular risk factors according to living habits and anthropometric variables of farmers in the municipality of Santa Maria de Jetibá (ES).

Variable	Number of cardiovascular risk factors								p value
	None		One		Two		Three or more		
	n	%	n	%	n	%	n	%	
Sedentary leisure[1]									0.120
< 120 min/day	168	38.9	168	38.9	81	18.7	15	3.5	
≥ 120 min/day	163	45.7	136	38.1	50	14.0	8	2.2	
Alcohol consumption[2]									0.071
Abstinent	190	42.9	163	36.8	81	18.3	9	2.0	
Usual consumption	61	50.0	40	32.8	17	13.9	4	3.3	
Binge consumption	80	36.0	100	45.0	33	14.9	9	4.1	
Waist circumference[3]									0.001
No cardiovascular risk	209	54.4	138	35.9	33	8.6	4	1.1	
Increased cardiovascular risk	122	30.1	165	40.7	99	24.5	19	4.7	
Triceps cutaneous fold									0.005
Proper	213	45.7	179	38.5	65	13.9	9	1.9	
Overweight	118	36.4	125	38.6	67	20.7	14	4.3	
Body mass index									0.001
Low weight/Eutrophic	222	57.4	129	33.3	31	8.0	5	1.3	
Overweight/Obesity	109	27.0	175	43.4	101	25.1	18	4.5	

Chi-square test. N = 790. [1]N = 789; [2]N = 787; [3]N 789.

cy of adult smokers was 15.7% in 2006, and decreased to 10.1%. in 2017, and was greater in men (13.2%) than in women (7.5%). In the capital of Espírito Santo, the frequency found was 8.5%, similar to the data found in this investigation[34]. Studies involving rural populations identified 11% tobacco use rates in Minas Gerais[31] and Bahia[30], a value close to that found in this study. This reduction may be due to the successful anti-tobacco policies adopted by the Brazilian government throughout the country since 1989, and which due to satisfactory results, have become a global reference[39]. Smoking is known to be an aggressive factor for the cardiovascular system due to its harmful action on endothelial cells, with a consequent increase in arterial stiffness and inflammation[40]. Besides, it contributes to the increased risk of AH, platelet aggregation, reduced HDL cholesterol and increased concentration of LDL cholesterol and triglycerides, stimulating and anticipating the process of atherosclerosis[41], an important CRF for these farmers.

In this study, the risk factor that affected the lowest number of farmers was hyperglycemia, found in less than 5% of the sample. The prevalence of age-standardized diabetes according to an international study that analyzed data from 199 countries and territories and 2.7 million participants was 9.8% in men and 9.2% in women[42]. Among the Brazilian population, data from VIGITEL of 2017[34] identified that the frequency of adults who reported a medical diagnosis of diabetes was 7.6%. Comparatively. the rural population of Santa Maria de Jetibá showed lower rates when compared to capital Vitória. which showed the second highest national prevalence of diabetes (8.5%), possibly due to the active nature of its work practice.

After regression analysis, the variables that remained associated with the most significant number of cardiovascular risk factors were age and those related to excess body fat, such as TS, and especially WC, responsible for increasing the likelihood of farmers to have two or more risk factors. These results are compatible with other studies involving both rural and urban populations[8,10,32].

The effect of age on the cardiovascular system is well established. Arterial aging seems to be proportional to body aging, which would lead to increased arterial stiffness, thus elevating blood pressure levels and, consequently, the risk of cardiovascular events[43]. A recent study carried out in Brazil evidenced a progressive increase in mortality due to acute myocardial infarction with age, with higher mortality in men when compared

Table 4. Association between the number of cardiovascular risk factors and sociodemographic. occupational. lifestyle and anthropometric variables in farmers from Santa Maria de Jetibá (ES).

Variable	Crude values				Adjusted values			
	Presence of two or more CRFs				Presence of two or more CRFs			
	OR	CI Lower 95%	CI Upper 95%	p-value	OR	CI Lower 95%	CI Upper 95%	p-value
Age								
Up to 30 years	1				1			
31 to 40 years	1.97	1.03	3.77	0.041	1.53	0.76	3.07	0.234
41 to 50 years	5.31	2.89	9.78	0.001	3.51	1.32	9.35	0.012
Over 50 years	9.19	4.96	17.04	0.001	5.60	2.03	15.43	0.001
Schooling								
< 4 years	1				1			
4 to 8 years	0.49	0.31	0.79	0.004	1.08	0.62	1.87	0.780
Over 8 years	0.32	0.15	0.69	0.003	0.60	0.26	1.36	0.220
Land tenure								
Owner	1.00				1			
Non-owner	1.13	0.76	1.69	0.549	1.20	0.76	1.88	0.430
Weekly working hours								
≤ 40 hours	1				1			
> 40 Hours	0.65	0.44	0.98	0.038	0.97	0.61	1.53	0.893
Working time								
< 20 years	1				1			
≥ 20 years and < 30 years	4.47	0.60	33.45	0.144	2.47	0.31	19.73	0.394
≥ 30 years	17.92	2.43	132.34	0.005	2.98	0.32	27.57	0.336
Waist circumference[3]								
No cardiovascular risk	1				1			
Increased cardiovascular risk	4.06	2.74	6.039	0.001	2.35	1.47	3.76	0.001
Triceps cutaneous fold								
Proper	1				1			
Overweight	2.01	1.42	2.842	0.001	1.60	1.05	2.44	0.030

Binary logistic regression. OR: Odds ratio.

to women in all regions of the country and both genders[44]. The progressive increased mortality has also been found in several other studies, such as those carried out in countries like South Korea[45], Japan[46], China[47] and Australia[48].

As with age, the association between overweight and increased cardiovascular risk has substantial evidence in the literature. Obesity and especially central obesity increases the risk of cardiometabolic events by favoring, among other consequences, increased blood pressure, insulin resistance, diabetes, elevated LDL and triglycerides and lower levels of HDL[49]. In a study conducted with approximately 900.000 individuals with a mean age of 46 years, it was concluded that, in each gender, every 5kg/m increase in BMI increased 30% the likelihood of total mortality and 40% of vascular mortality[50]. A factor of concern is the progressive weight gain in the Brazilian population, including in rural populations[34]. Géa-Horta et al.[8] identified, besides weight gain, a significant increase in LDL-C levels. LDL/HDL ratio and SBP among the studied farmers. In Santa Maria de Jetibá, more than half of the farmers had high WC (51.2%. n = 405), similar to the findings in rural workers in the South of the country (47.1%)[32], but higher when compared to the percentage found in rural workers of the Vale do Jequitinhonha, Minas Gerais (40.6%)[51].

This investigation did not identify an association between the higher number of cardiovascular factors and variables such as gender, schooling and socioeconomic class. Matos and Ladeia[30] also did not identify gender influence in the increased

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cardiovascular risk in the rural community of Bahia. Pohl et al.[32], however, found a higher risk in male farmers and low socioeconomic class. Gender association was also found in rural workers in the South of Brazil[16].

Although it is well-established in the literature that low levels of physical activity are a well-known risk factor for cardiovascular diseases[41,52], sedentary leisure was not associated with a more significant number of cardiovascular risk factors in Santa Maria de Jetibá's rural workers. It should be noted that the lack of association may have been due to the tool used to assess the level of physical activity. The quantification through screen time evaluation may not have been adequate to the reality of the rural population analyzed since it does not take into account the physical activity performed during the working day of these professionals.

Also, no association with occupational characteristics such as exposure to pesticides was identified. Active ingredients used in the formulations of these products may have harmful potential on the cardiovascular system, as identified in the study by Dayton et al.[53]. It should be pointed out that, because it was not the focus of this paper, the evaluation of exposure to pesticides was carried out using the variable "Type of production" and "Use of PPE", and not by means of time and intensity of exposure, which may have influenced the results.

Besides their exposure to diseases and diseases related to their professional activity, rural workers were also exposed to modifiable risk factors, strongly related to the development of chronic non-transmissible diseases[5], putting at risk the health of this very important professional category to the Brazilian economy. It should be noted that rural workers, unlike the urban population, live in inland areas, which can hamper access to primary health care, knowledge of health care[8] and, consequently, more complex medical care, and lead to the vulnerability of these workers. Thus, it is necessary to implement policies that increase this people's access to health care.

The higher consumption of animal, processed and high caloric density food by rural populations[54], aggravated by the lower physical activity rates may have had a direct influence on the results found. These changes are a reflection of the globalized economy and easy access to industrialized foodstuffs by rural communities, and changes in the organization of agricultural work resulting from the greater mechanization of agriculture[55], also requiring a proper and healthy eating practice, as well as in urban populations. Moreover, the lower income of rural populations, when compared to urban populations, may hinder their access to healthier foods, especially fruits, since these products would be available to these communities only during harvest periods[56]. Also, unlike urban centers, the characteristics of the built environment of the rural area with the absence of squares, hiking trails and gyms can hinder the performance of physical activity by workers[51], especially during their leisure time.

The limitations of this study include the external validity of the data, which does not allow the generalization of the results, the cross-sectional design that hinders inferences and possible memory biases. However, to minimize the potential sources of errors, some precautions were taken, such as the evaluation of a large and representative sample, selection of participants in a stratified and random manner, small proportions of losses and evaluation of the outcome based on the use of anthropometric data, biochemical information and hemodynamics derived from verified information and not from self-report, which could underestimate the prevalence of risk factors evaluated.

Conclusion

Approximately six out of ten rural workers evaluated had at least one risk factor for the development of cardiovascular disease. AH and dyslipidemia were the most prevalent CRF in the population of farmers in Santa Maria de Jetibá. Increasing age and body fat accumulation have significantly increased the likelihood of rural workers having two or more CRFs.

These results show the importance of the implementation of public policies in the Brazilian Unified Health System (SUS) based on more comprehensive care, considering the environmental, occupational and social factors to which rural workers are subjected, and there is a need to promote healthy living practices, such as the stimulation of healthy eating, and body weight control, leisure physical activity, in moments of leisure and mitigation of alcohol and tobacco consumption, as already recognized in urban populations. Also, it is necessary to increase access to health care beyond primary health care in the territory, reaching a public system of effective and efficient health for the prevention and control of cardiovascular risk factors. It should be noted that policies aimed at rural workers are required globally, but especially in countries such as Brazil, where the economy is closely related to agriculture.

Collaborations

TC Luz, M Cattafesta, GB Petarli, OMPA Bezerra and LB Salaroli participated in the conception, design, analysis and interpretation of the data, as well as the writing of the article and approval of the version to be published. L Zandonade participated in the conception, design and analysis of the data. JP Meneghetti participated in the planning and preparation of the study.

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