

The role of emotional states in fruit and vegetable consumption in Brazilian adults

O papel dos estados emocionais
no consumo de frutas e vegetais em adultos brasileiros

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Abstract *The objective was to investigate the association between emotional states with adequate fruit and vegetable consumption (FVC). This is a population-based cross-sectional study with 1,100 adults from a medium-sized city in Southern Brazil. Adequate FVC was defined as concomitant intake ≥ 3 fruits and ≥ 5 tablespoons of vegetables per day. Exposures were self-perception of nervousness/stress and minor psychiatric disorders (MPD). Data analysis used logistic regression. After controlling for demographic, socioeconomic and behavioral variables, adults reporting lack of nervousness/stress were twice more likely to report adequate FVC than those who reported it. Similarly, those reporting not having MPD symptoms were 52% more likely to have adequate FVC than those who did not. These effects increased and remained significant among women.*

Key words *Self concept, Mental health, Minor psychiatric disorders, Fruit and vegetable intake*

Resumo *O objetivo foi verificar a associação entre a autopercepção do estado emocional com o consumo adequado de frutas, verduras e legumes (FVL). Este é um estudo transversal de base populacional com uma amostra probabilística de 1100 adultos residentes na zona urbana de um município de médio porte do Brasil. Considerou-se como consumo adequado uma ingestão ≥ 3 frutas concomitante com ≥ 5 colheres de verduras/legumes ao dia. O estado emocional foi avaliado através da autopercepção do nervosismo/stress e distúrbios psiquiátricos menores (DPM). Potenciais fatores de confundimento incluíam variáveis demográficas, socioeconômicas e comportamentais. Foram observadas associações significativas entre a autopercepção de nervosismo/stress e DPM com o consumo adequado de FVL. Após o controle de fatores de confusão, adultos relatando ausência de nervosismo/stress possuíam uma chance de apresentar um consumo adequado duas vezes maior do que aqueles relatando nervosismo/stress. Similarmente, participantes com ausência de distúrbios psiquiátricos possuíam uma chance de consumo adequado FVL 52% mais elevada quando comparados àqueles que relataram presença desses sintomas. Quando estratificada por gênero, esse efeito aumentou e manteve-se com significância estatística apenas entre as mulheres.*

Palavras-chave *Autopercepção de nervosismo/stress, DPM, Consumo de frutas, verduras e legumes*

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Introduction

The rapid changes in population dietary patterns along with reductions in malnutrition and increases in obesity rates elicit global concern^{1,2}. In Brazil, large national surveys such as the National Survey of Household Expenditure in 1974-1975, the National Survey on Health and Nutrition in 1989 and the Consumer Expenditure Surveys in 2002-2003 and 2008-2009 have shown that, in all regions of the country and in all age and income categories, the percentages of overweight and obese people have increased continuously and substantially^{1,3}. There has been a concomitant increase in the consumption of processed products, which are rich in refined carbohydrates and fats, and a decrease in the consumption of fruits and vegetables (FV)^{1,2}.

There is considerable evidence for the protective roles of an adequate consumption of FV in the prevention of obesity and of chronic non-communicable diseases (NCDs) such as diabetes⁴ and, cardiovascular diseases⁵. It has also been shown that regular consumption of FV facilitate the prevention of asthma, iron deficiency anaemia⁶ and mental disorders^{7,8}.

Previous studies also indicate that FV intake is strongly influenced by demographic and economic aspects. Generally, women, married and white people, those with better education and income, physically active, non-smokers, and with moderate alcohol consumption habits tend to consume adequately FV⁹⁻¹².

There has also been increasing interest on the role of emotional states on eating behaviour. Aspects such as anger, sadness, daily stressors and other stressful situations may affect the whole process of intake (e.g., motivation to eat, food choices, chewing, time spent eating, amount of food intake), as well as metabolism and digestion¹³. Several studies have reported the association between adequate consumption of FV and favourable mental states^{7,8,14-17}. Absence of association has also been reported¹⁸. The aim of this study was to investigate the association between emotional states and FV intake in adults from a medium-sized city in southern Brazil.

Materials and methods

Design and procedure

This is a population-based cross-sectional study of a representative sample of adults aged

18 years or more who live in the city. In 2010, the municipal area included 214,087 inhabitants, of whom 109,845 (51.3%) were females and 104,242 (49.7%) were males¹⁹.

The data were collected in 2006 and 2007 through structured interviews with a standardized and pre-tested questionnaire that comprised demographic, socioeconomic, behavioural, and mental health variables. A pilot study of the instrument with 100 people and a quality control with approximately 10% of the sample was performed.

Sampling

The sample size calculation was based on data from the pilot study, using the method for proportions with conglomerate randomization²⁰ and taking the self-perception health outcome. The sample size was calculated to have 85% power ($1 - \beta = 0.85$) to detect a difference of 7% in the prevalence of poor self-perceived health, with 95% confidence. A number of 35 households per sector and an intra-class correlation coefficient of 0.05 were adopted. From this, a sample of 1,260 households in 36 sectors was estimated. The sample size was increased by 20% in the number of households and 10% in the number of sectors, due to possible losses and the control of confounding factors in the data analysis. Thus, it was necessary to access a total of 1,512 households in 40 census tracts.

Participant selection occurred in 2 stages. First, a random selection of census tracts was conducted among the 270 existing tracts in the urban city area. Next, blocks were randomly selected within the sectors, and all households were visited. If, after completing the block, a sufficient number of households had not been visited, the interviewer would complete another block of the previously drawn sector. Questionnaires were administered at home to the person responsible for the household at the time of the interview. Persons under the age of 18 were excluded.

Outcome

Adequate FV consumption was assessed by 2 questions as follows: 1) the amount of fruit or natural fruit juice consumed per day, and 2) the number of tablespoons of vegetables consumed per day. In Brazil, the recommendation for adequate FV intake is 3 portions of fruits and 3 portions of vegetables, for a total of 6 daily portions of fruits and vegetables²¹. If this criterion

was used in this study, only 40 participants could participate in the analysis, which would significantly decrease the statistical power with which to detect associations. Therefore, it was decided to conduct the analysis according to the criteria used in studies from countries where the recommendations suggested the consumption of 5 FV portions^{22,23}. Therefore, adequate consumption was defined as the concomitant intake of 3 or more fruits (or natural fruit juices) and 5 or more tablespoons of vegetables per day.

Exposures

The exposures were assessed as the self-perceptions of nervousness/stress and the presence of minor psychiatric disorders (MPD). The former was assessed by the perceptions of nervousness/stress using the following question: "Do you see yourself as a nervous person?" The possible answers were "no", "sometimes" and "yes". The latter, used the Self-Report Questionnaire (SRQ-20), which consists of 20 questions and permits the tracking of MPDs (e.g., depression, anxiety, somatoform disorders and neurasthenia). The SRQ-20 has shown high sensitivity (83%) and specificity (80%) for the Brazilian population²⁴. Despite the fact that its results do not mean a clinical diagnosis, the World Health Organization recommends the SRQ-20 for this purpose and this tool has been shown to be effective in MPD detection²⁵. The cut-off points were six positive responses for males and seven for females.

Confounding factors

The confounding factors included demographic, socioeconomic and behavioural variables. The demographic variables were age (10-year-range age groups), race (white, black and other) and marital status (married, single or divorced/alone). The socioeconomic variables were family income (in R\$) and education (years of schooling), which were further categorized into high (highest 25% of the individual scores), medium (intermediate 50% of the scores) and low (lowest 25% of the scores). The behavioural variables included smoking (non-smoker or smoker), physical activity (insufficiently active: do not practice physical activity or practice for up to 150 minutes/week or active:> 150 minutes/week)²⁶ and alcohol consumption (do not consume/consume moderately: < 24AU/month for women and < 40AU/month for men or yes/excess: > 24AU/month for women and > 40AU/month for men)²⁷.

Data analysis

Double data entry was performed with the *Epi Info 6* program, version 6.0 (Center for Disease Control and Prevention, Atlanta, GA, USA) to identify typos. Data analysis was performed with the *Stata 11.0* program (Stata Corp., College Station, TX, USA) in 2012. A controlled logistic regression for complex samples was used to provide estimate of the crude and adjusted odds ratios (OR) and their respective 95% confidence interval ranges (95% CI). Only the potential confounding factors were entered in the multivariable analysis. The variable must have been associated with both the exposure and the outcome at a significance level < 20% ($p < 0, 20$) to be considered a confounding factor. After conducting the analysis, the interactions between expositions and gender were tested. The gender variable was found to be a potential modifier of the exposure effect on the outcome ($P = 0.128$ and $P = 0.132$). Therefore, analyses were conducted separately for males and females.

Ethics

The research project was approved by the Research Ethics Committee of Vale do Rio dos Sinos University, and all participants signed an informed consent.

Results

A total of 1,100 people were interviewed from 38 census tracts in the city. Eight per cent of the selected places were uninhabited or were trading points. Overall, 4% of the individuals refused to participate and those responsible for the households were not found in 2% of the cases, even after the interviewer returned on 3 separate occasions.

Adequate FV consumption

The overall prevalence of adequate FV consumption was 11.6% (95% CI 9.7 to 13.5%). Similar prevalence rates were found in males and females. Higher prevalence rates of adequate FV consumption were found in older, white, married and divorced/alone people with higher income and education levels, as well as non-smokers and those who were physically active (Table 1).

Table 1. Prevalence of adequate fruit and vegetable consumption according to demographic, socioeconomic and behavioral variables.

	Total		Men		Women	
	% of adequate consumption of FV					
	n	%	n	%	n	%
Fruit and Vegetable Consumption						
Adequate	128	11,6	36	11,6	92	11,6
Inadequate	972					
Selfperception nervousness/stress						
Yes	310	7,7	49	12,2	261	6,9
Sometimes	319	10,3	85	4,7	234	12,4
No	470	15,1	175	14,9	295	15,3
Minor Psychiatric Disorders						
Yes	349	8,9	71	11,3	278	8,3
No	748	13,0	239	11,7	509	13,6
Skin color						
White	922	12,1	260	11,2	662	12,5
Other	101	8,9	25	12	76	7,9
Black	58	6,9	17	5,9	41	7,3
Age group						
18-29	247	8,1	69	5,8	178	9,0
30-39	182	9,3	46	8,7	136	9,6
40-49	258	10,5	66	7,6	192	11,5
50-59	217	16,6	62	21,0	155	14,8
>=60	196	14,3	67	14,9	129	14,0
Marital status						
Married	615	12,8	180	13,9	435	12,4
Single	267	9,0	86	9,3	181	8,8
Divorced/Alone	218	11,5	44	6,8	174	12,6
Income ^a						
Low	235	7,7	27	0,0	208	8,7
Medium	565	11,2	154	10,4	411	11,4
High	268	16,4	117	15,4	151	17,2
Schooling ^b						
Low	204	9,3	39	5,1	165	10,3
Medium	697	10,6	203	12,3	494	9,9
High	166	16,9	51	9,8	115	20,0

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Self-concept and mental disorders

Adults who reported a lack of nervousness/stress were approximately twice more likely to re-

port adequate FV consumption than those who reported nervousness/stress. Similarly, participants with no MPD indicators were 53% more likely to report adequate FV consumption when

Table 1. continuation

	Total		Men		Women	
	% of adequate consumption of FV					
	n	%	n	%	n	%
Smoking						
Smoker	262	9,9	76	10,5	186	9,7
No smoker	838	12,2	234	12	604	12,3
Excessive Alcohol Consumption ^c						
Sim	60	11,7	33	12,1	27	11,9
Não	1037	11,7	275	11,6	762	11,9
Physical activity ^d						
Insufficiently active	527	9,9	143	11,9	384	9,1
Active	569	13,4	167	11,4	402	14,2

^a Income in Brazilian Reals (R\$): Low (lowest 25% of the individual scores), Medium (intermediate 50% of the scores), High (highest 25% of the scores). ^b Educational level in years: Low (lowest 25% of the individual scores), Medium (intermediate 50% of the scores), High (highest 25% of the scores). ^c Do not consume/consume moderately: < 24AU/month for women and < 40 AU/month for men; yes/excess: > 24AU/month for women and > 40 AU/month for men. ^d Insufficiently active: do not practice physical activity or practice for less than 150 min/week; active: > 150 min/week.

compared to those who reported the presence of MPD. After controlling for confounding factors, these expositions remained independently associated with the outcome and maintained their effect measures with the same clinical and statistical effects (Table 2).

The stratified analysis by gender showed that the effects of psychological variables increased and remained statistically significant only in women. After controlling for socioeconomic, demographic and behavioural variables, women who reported a lack of nervousness/stress were 2.32-fold more likely to report adequate FV consumption than those who reported nervousness/stress. Likewise, women with no MPD were 68% more likely to report adequate FV consumption when compared to those who reported the presence of MPD indicators.

Discussion

The present study aimed to investigate the association between self-perceptions of nervousness/stress and MPD with FV consumption. The main findings suggest that there is a significant association between favourable mental states and adequate FV consumption, particularly among women.

Several other studies in different countries found similar results. Five large cross-sectional studies that were conducted between 2000 and 2009 and included more than 250,000 Canadians found a strong inverse association between FV consumption and the presence of depression symptoms, mood swings and anxiety¹⁶. In the same light, a cohort study of 3,486 participants showed that people with dietary patterns based on FV and fish had lower rates of depression symptoms⁷. Another cohort study of 9,272 men and 3,132 women, aged between 45 and 60 years old, showed that a higher FV intake was associated with a lower likelihood of depressive symptoms¹⁴. Other large cross-sectional studies of elderly subjects in China¹⁷ and college students¹⁵ demonstrated that lower FV consumption was associated with the presence of stress and depressive symptoms. Finally, a cross-sectional study that included more than 18,000 people in the former Soviet Union reported that participants who reported fewer depressive symptoms also reported higher FV consumption²⁸.

The results of this study suggest that, in the study population, the associations were limited to women. This suggests that men and women might react differently to stressful situations and emotional demands and those psychological symptoms tend to more directly influence

Table 2. Unadjusted and adjusted odds ratios for adequate fruit and vegetable consumption associated with emotional states.

	Unadjusted		Adjusted	
	OR (IC 95%)	p	OR (IC 95%)	p
Selfperception nervousness/stress				
Total sample		0,006		0,010
Yes	1		1 ^a	
Sometimes	1,38 (0,84-2,25)		1,38 (0,80-2,38)	
No	2,12 (1,25-3,59)		1,99 (1,17-3,37)	
Men		0,210		0,310
Yes	1		1 ^b	
Sometimes	0,35 (0,09-1,32)		0,31 (0,08-1,26)	
No	1,25 (0,48-3,23)		1,03 (0,35-3,00)	
Women		0,003		0,006
Yes	1		1 ^c	
Sometimes	1,91 (1,03-3,59)		1,95 (1,02-3,74)	
No	2,43 (1,37-4,32)		2,32 (1,25-4,28)	
Minor Psychiatric Disorders				
Total sample		0,018		0,016
with MPD	1		1 ^d	
without MPD	1,53 (1,08-2,16)		1,52 (1,10-2,10)	
Men		0,918		0,882
with MPD	1		1 ^b	
without MPD	1,05 (0,45-2,40)		1,07 (0,41-2,82)	
Women		0,029		0,074
with MPD	1		1 ^e	
without MPD	1,74 (1,06-2,86)		1,68 (0,96-2,94)	

^a Adjusted OR for income, education and physical activity. ^b Adjusted OR for income and education. ^c Adjusted OR for income, education and physical activity. ^d Adjusted OR for age, income, education and physical activity. ^e Adjusted OR for age, marital status, income, education and physical activity.

women's eating habits. It has been suggested that women might be more likely to eat in response to stressful situations^{14,29,30}, at which times they would increase the total amount of consumed food³¹ or, in particular, the consumption of carbohydrates and fats³². However, women tend to consume more fruits when they are not under stress^{32,33}. In contrast, men tend to eat unhealthy foods regardless of the emotional situation³², and the greatest reported influence on men is related to socioeconomic aspects³¹. Simultaneously, in stressful situations, there is evidence that men are more likely to use alcoholic beverages, cigarettes and other drugs³⁴.

The action mechanisms behind the association between mental states and adequate FV consumption are complex and thus require further studies^{15,35,36}. On one hand, individually

stressful situations are presented as those that cause increased excretion of corticosteroids and adrenergic hormones, which are associated with a high consumption of foods with saturated fat, and decreased FV intake. Accordingly, it has been suggested that the intake of foods rich in fats and sugars, which are considered palatable, satiating or comfort foods (affective foods), decrease the activity of neuronal circuits involved in stress mechanisms and thus act as protectors against the harmful effects of stress^{15,35,36}. Repetitive hormonal and alimentary stimuli can act as external opioids that generate feelings of satisfaction and consequent overeating³⁷⁻³⁹. Additionally, an increase in leptin production (which is responsible for the sense of satiety), a mechanism of hormonal regulation, might be associated with the decreased consumption of comfort food⁴⁰.

Dietary changes are also considered to result from emotional eating. In this case, the eating behaviour is motivated by emotional and/or stressful situations and now operates in a feedback system related to emotions and food¹³. This process of regulation between food and emotions is also influenced by the individual's coping strategies with regard to the stressful situations⁴¹, as well as endocrine factors^{15,35,36}, the context of the individual's life and/or aspects of his/her personality⁴². In regard to negative mental states such as depressive symptoms, for example, the literature has shown that there is an overall deterioration in the quality of consumed food, which may lead, in some cases, to a lack of appetite^{7,8,16}.

A two-way relationship between food and mental states may exist, in which emotions affect both the quantity and quality of consumed food, and, in turn, the consumed food may affect the emotional wellbeing of the individual⁴³. In addition, it could be considered that self-perceptions of nervousness, might be associated with methods of coping with milder and more transient stressful emotional states, while the MPD indicators may provide clues about the chronicity of negative emotional states. Therefore, further studies could investigate how the different coping strategies of individuals mediate the association between adequate FV consumption and mental health indicators.

One of the main weaknesses of this study refers to its cross-sectional nature. Because exposure and outcome were measured at the same time point, reverse causality may be present. Thus, it could be reasoned that, because emotions can affect the quality and quantity of consumed food, consumption could also affect emotional wellbeing^{7,14,43}. Thus, longitudinal studies are needed to elucidate the causal relationships. Furthermore, new studies could address gender differences with respect to this association in greater depth. On the other hand, this is a relatively unexplored field in the Brazilian context, the study was based on a representative sample of adults, the procedures adhered to high standards of methodological

rigor and the analyses controlled for important confounding factors such as demographic, socio-economic and behavioural variables.

Our findings could inform public policies targeting the promotion of healthy habits and therefore, fostering the protective role of FVL intake in preventing diseases. In addition, health professionals should take into account emotional states in designing and implementing programs targeting healthy eating. To sum up, although our results suggest that mental health may play an important role in adequate FV consumption, especially among women, other aspects such as reducing production and consumer costs of FVL for the whole population are essential to shape eating habits of the whole population⁴⁴.

Collaborations

HB Rower originated the study, participated in data collection, reviewed the literature and wrote the manuscript. TR Gonçalves and MTA Olinto critically reviewed the article. MP Pattussi designed and supervised the study and data analysis. All authors interpreted results and approved the final version of the article.

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