

Association between social capital and food patterns in women from Southern Brazil

Lisandr ea da Concei ao Caetano (<https://orcid.org/0000-0002-9176-8298>)¹
Anderson Garcez (<https://orcid.org/0000-0003-1111-4890>)^{1,2}
Fernanda de Souza Bairros (<https://orcid.org/0000-0002-8611-058X>)³
Juvenal Soares Dias da Costa (<https://orcid.org/0000-0003-3160-6075>)²
Maria Teresa Anselmo Olinto (<https://orcid.org/0000-0002-3950-4594>)⁴

Abstract *The present study aimed to verify the association between psychosocial aspects (social capital) and food patterns in adult women. A cross-sectional, population-based study was conducted with a representative sample of 1,128 women, aged 20 to 69 years, living in the urban area of the municipality of S o Leopoldo, Rio Grande do Sul, Brazil, in 2015. The food patterns were identified based on the frequency of food intake and classified as: healthy (fruits, vegetables, and whole foods), at-risk (ultraprocessed foods), and Brazilian (rice and beans), while social capital was evaluated using a collective efficacy scale. It was observed that 18.9% of the sample was classified with high collective efficacy. After adjusting for potential confounding factors, a 44% higher probability was observed for adherence to the healthy pattern (PR [prevalence ratio] = 1.44; 95%CI [95% confidence interval]: 1.01-2.03; p = 0.040) and 71% higher for the Brazilian pattern (PR = 1.71; 95%CI: 1.18-2.47; p= 0.004) among women with a higher level of collective efficacy, when compared to those with a low level of collective efficacy. Thus, this study verified a significant relationship between psychosocial aspects and food intake in women.*

Key words *Social capital, Psychosocial aspects, Food patterns, Women*

¹ Programa de P s-Gradua o em Ci ncias da Nutri o, Universidade Federal de Ci ncias da Sa de de Porto Alegre. Porto Alegre RS Brasil.

² Programa de P s-Gradua o em Sa de Coletiva, Universidade do Vale do Rio dos Sinos. S o Leopoldo RS Brasil.

³ Departamento de Sa de Coletiva, Universidade Federal do Rio Grande do Sul. Porto Alegre RS Brasil.

⁴ Programa de P s-Gradua o em Alimenta o, Nutri o e Sa de, Universidade Federal do Rio Grande do Sul. R. Ramiro Barcelos 2.400, Santa Cec lia. 90035-003 Porto Alegre RS Brasil. mtolinto@gmail.com

Introduction

Important changes have occurred in food intake in recent decades, observing mainly a rise in unhealthy food intake (including processed and ultraprocessed food, ice cream, soft drinks, juices, cookies, stuffed cookies, hamburgers, pizzas, among others) and a consequent decline in healthy foods (including in natura and minimally processed foods, such as fruits, vegetables, legumes, milk, and meats)¹. These changes have turned the food aspect into one of the main risk factors for Noncommunicable Diseases (NCDs) and mortality^{2,3}. In this sense, the standard food pattern includes, in a more complex sense, normal food intake combined with foods and nutrients that are considered to cause potential environmental, cultural, and religious influences⁴. Moreover, studies point out that women tend to present more healthy eating habits, including a greater intake of in natura and minimally processed foods, when compared to men⁵⁻⁷.

The social capital has been investigated as an important psychosocial aspect, associated with the occurrence of diverse outcomes in health, including obesity⁸, stress, common mental disorders, and behaviors favorable to health, such as physical activity and eating habits⁹. Social capital refers to the capacity of individuals to achieve their goals, which they would not be able to achieve alone, through their participation in social networks and other social structures¹⁰. In this sense, social capital can be found among people and groups of people, including characteristics of the social organization, such as confidence, norms, and social networks responsible for an improvement in the efficiency and efficacy of society¹¹.

In the field of food and nutrition, different psychosocial indicators have been associated with nutritional states in different life cycles¹²⁻¹⁴, with eating behaviors¹⁵, as well as with food intake^{16,17} and eating habits¹⁸. Studies point out that higher levels of social capital are associated with a greater intake of healthy food (including mainly in natura and minimally processed foods, including fruits, vegetables, and leafy green vegetables)^{19,20}, given that this association tends to be more evident in women than in men^{17,21}. Furthermore, social capital seems to have a mediator effect, reducing the socioeconomic differences among women in the intake of fruits, for example²¹.

These findings point to an important influence on the social context concerning eating habits. However, the relationship between social

capital and food patterns is scarce and is still relatively unexplored in the Brazilian scenario, considering its importance for public policies on collective food intake in the field of collective health. In this light, the present study sought to investigate the association between social capital and food patterns of women residing in a municipality in Southern Brazil. It is hoped that this study will lead to a greater understanding and advances in knowledge on the present theme, considering its unprecedented nature in exploring the association between social capital and food patterns within the Brazilian context, focusing on food patterns. Furthermore, the findings from this study seek to contribute to formulating public policies and action strategies in health, eating habits, and nutrition.

Methods

Design

This is a population-based, cross-sectional study, with a representative sample of adult women, between 20 and 69 years of age, residents in an urban area of the municipality of São Leopoldo, RS, Brazil. This study was part of a larger project conducted at Universidade do Vale do Rio dos Sinos, Unisinos, conducted between February and October 2015, entitled, "The conditions of life and health of adult women: a population-based study in Vale do Rio dos Sinos".

Study population

This study included women, aged 20 to 69 years, residing in the urban zone of São Leopoldo, a municipality in the metropolitan region of the city of Porto Alegre, RS, Brazil, located approximately 33 km from the capital city of the state of Rio Grande do Sul. São Leopoldo has a geographic area of 102,738 km² and, according to estimates from the 2010 census, a population of 214,087 inhabitants, who are predominantly women (109,845)²². The demographic density of the municipality is of 2,060.31 inhabitants/km². In 2010, The Municipal Human Development Index (MHDI) was 0.739, classified as high, and was higher than the Brazilian index (0.727)²³.

Sample process

The sample of this study was conducted in clusters, including two stages. In the first stage, 45

of the 371 census sectors of São Leopoldo, according to the 2010 census, were systematically selected. In the second stage, 36 homes were selected in each sector. All of the women who fulfilled the inclusion criteria – living in the municipality and being 20 to 69 years of age – were invited to participate. Our study excluded women who do not live in the selected residence, pregnant women, those in wheelchairs or with their lower limbs immobile in the week before the interview, and those who did not have the conditions to answer the questionnaire.

The sample calculation for the larger study was performed considering many outcomes that would be investigated in the study, given that the larger size was obtained for the “late cytopathological exam” outcome and the exposure of “level of education”. The calculation of the necessary sample size was performed considering a Hazard Ratio of 2.0, a 95% confidence interval (95%CI), a statistical power of 80%, and an unexposed:exposed ratio of 1:2. To the obtained value, 10% was added for possible loss or refusal to participate, and 15% for the control of confounding factors, totaling 1,281 women. To evaluate the associations between the psychosocial aspects and the food patterns, the obtained sampled showed a power of 70% or more to detect significant prevalence ratios of 1.3 or higher for exposures that affect 33.6% to 78.0% of the population, with a 95%CI.

Data collection

Data collection was conducted through face-to-face interviews given by chosen interviewers. A training program was provided with the intention of standardizing the application of standardized, pre-coded, and tested questionnaires. A pilot study was applied in a census sector not included in the sectors selected for the main study. The internal validity of the pilot study was evaluated through quality control carried out in a random group of 10% of the individuals included in the study. The present study was evaluated and approved by the Research Ethics Committee from Universidade do Vale do Rio dos Sinos (logged under protocol number 653.394, on May 20, 2014). All of the participants signed the free and informed consent form.

Evaluation of food intake (outcome)

The evaluated outcomes contemplated three food patterns (FPs): healthy, at-risk, and Brazilian. These FPs had been previously identified

and published by Ternus et al.²⁴ (2019). The FPs were obtained through the application of a Food Frequency Questionnaire (FFQ), consisting of 82 food intake items in the past three months. The intake frequency of each food or item referred to the day, week, or month. This information was transformed into frequency-day. Prior to the identification of the FPs, the intake frequency of each food item was verified, excluding the items with an intake of less than 20%. After, the food items were placed in groups, based on their nutritional composition, in their culinary use, in their seasonality, in their intake frequency, and in the way they were already grouped in the FFQ.

The derivation of the FPs was performed through the Principal Component Analysis (PCA), including an adequate applicability of the present method (Kaiser-Meyer-Olkin (KMO) coefficient ≥ 0.60) and a sufficient correlation between the items ($p < 0.001$ for the Bartlett sphericity test). The food items that presented an absolute factorial load ≥ 0.30 were considered to contribute significantly to a specific factor (FI). The FPs (healthy, at-risk, and Brazilian) were obtained and named according to the impact of food on health or according to cultural aspects of the food groups found and their representativity through factorial load values. The healthy FPs present the highest percentage to explain the variance (11.6%), that is, the FPs best represented the food intake of this population. Further details on this study's procedures and analyses to attain the respective FPs in the present population are available in a previous publication²⁴.

The healthy FP was defined as that consisting predominantly of in natura and minimally processed foods, such as leafy green vegetables, citrus fruits, green vegetables, common fruits, seasonal fruits, vegetable fat, whole grains, natural juice, low-fat dairy products, fish, oilseeds, and lentils. The at-risk FP was defined as that consisting predominantly of processed and ultraprocessed foods, such as fried foods, fast food, sweet baked goods, chocolate and ice cream, mayonnaise, stuffed cookies, industrialized foods, baked snacks, barbeque, high-fat creams, soft drinks/industrialized juices, and eggs. Finally, the Brazilian FP was defined as that consisting predominantly of foods typically found in traditional Brazilian meals, based on minimally processed foods, such as white rice, beans, refined cereals, pasta, fried meat, *farofa*, red meats, whole grain cereals, and oilseeds.

After obtaining the scores for food intake generated for each FP, these were divided into

percentages and categorized in low (< percentile 75) and high (\geq percentile 75) intake, considering that the higher the score, the greater the adherence of intake to the food pattern.

Evaluation of psychosocial aspects (exposure)

The main exposure in question here referred to the evaluation of psychosocial aspects, social capital, obtained through the application of the Collective Efficacy Scale, as defined by Sampson, *et al.*²⁵. The present scale included a total of ten questions, including affirmations that evaluated the constructs of informal social control (five questions) and social cohesion (five questions).

Informal social control refers to the capacity of a group to regulate its members according to its own principles. The five questions of this construct contemplate the following aspects: perception of the interviewed individuals about the help received from neighbors if something should happen in the neighborhood, such as teenagers skipping class and wandering the streets; graffiti on walls and public buildings, showing disrespect to an adult; neighbors helping in critical situations, like a fight; and the closing of the nearest health unit. By contrast, social cohesion refers to trust and solidarity among neighbors. This, the five questions of this construct contemplate the perception related to the following aspects: if the neighbors helped each other; if the neighborhood is united and friendly; if the people are reliable; if the people get along with each other; and if they have similar values.

The answer categories for each of the questions were obtained through a 5-point Likert scale. Finally, a collective efficacy score was obtained through the sum of the answers of the 10 applied questions. Likewise, the respective answers for the questions related to the evaluated constructs were added in such a way as to formulate the informal social control and social cohesion scores, respectively. Higher scores represented higher levels of perception of the evaluated constructs. The obtained scores (continuous numerical variables) were categorized in quartiles, and were later reclassified as low (\leq percentile 25), medium (25 < percentile < 75), and high (\geq percentile 75).

Explanatory variables

Demographic, socioeconomic, and behavioral characteristics were used to characterize the

sample and to control possible confounding factors in the multivariate analysis. The demographic characteristics used in this study were: age (20-29 years; 30-39 years; 40-49 years; 50-59 years; 60-69 years), self-reported skin color (white; other), and marital status (with a partner [married/stable union]; without a partner [single/separated/divorced/widow(er)]). The socioeconomic characteristics included: complete years of study (< 4 years; 4 to 7 years; 8 to 10 years; \geq 11 years) and social class (A/B; C; D/E), classified according to the criteria proposed by the Brazilian Association of Research Companies (ABEP, in Portuguese), based on the possession of specific material goods, level of education of the head of the family, and number of employees²⁶.

The behavioral characteristics included: smoking habit (never smoked; ex-smoker; smoker); alcohol consumption in the last week (no [no consumption]; yes [moderate/high intake], and physical activity during leisure time based on the IPAQ-short adapted version (sufficiently active [\geq 150 min./week of moderate/vigorous physical activity]; insufficiently active [$<$ 150 min./week of moderate/vigorous physical activity])²⁷.

Statistical analyses

The entering of data was performed using the EpiData, version 3.1 program, with duplicate copy and later comparison. The numerical variables were described by median and standard deviation and the categorical variable by means of absolute and relative frequencies. The Prevalence Ratios (PRs) for the associations between psychosocial aspects and high intake (\geq percentile 75) of the FPs were obtained through Poisson regression²⁸, including three analysis models²⁹: Model I (unadjusted – gross analysis); Model II (analysis adjusted for demographic and socioeconomic characteristics); Model III (analysis adjusted for Model II and behavioral characteristics). The demographic, socioeconomic, and behavioral characteristics that were associated with the outcomes (FPs), at a significance interval of < 20% ($p < 0.20$) in the gross analysis, were included in the multivariate models as potential confounding factors.

All of the analyses were carried out using the Stata software version 14.0 (StataCorp, College Station, TX, USA), considering a p-value of less than 5% ($p < 0.05$) to be statistically significant.

Results

Of the 1,281 initially expected women, 11.9% did not provide all of the necessary data. Hence, 1,128 women were considered and included in the final analysis of this study. The average ages and years of study were of 43.4 years (SD \pm 13.9) and 8.7 years (SD \pm 3.9), respectively.

Table 1 presents the general characteristics of the sample, as well as the respective distributions of the prevalence of a high intake of the food patterns – healthy, at-risk, and Brazilian – according to demographic, socioeconomic, and behavioral characteristics and psychosocial aspects. The sample, for the most part, consisted of white women (74.5%), who live with a partner (63.8%), and who are middle-class (52.8%). In relation to the behavioral characteristics, most of the investigated women were non-smokers (58.6%), non-drinkers of alcohol (73.9%), and were considered to be insufficiently active (85.6%). Regarding the psychosocial aspects, it was observed

that 18.9% of the sample was classified with a high collective efficacy (\geq percentile 75), while 8.3% and 17.8% of the women reported a high informal social control and social cohesion, respectively.

Regarding the intake of food patterns, it was observed that the high intake of the healthy food pattern increased according to the age range and the level of education (directly proportional association), along with a greater probability of adherence among white women who were ex-smokers (Table 1). Concerning the high intake of the at-risk food pattern, an inverse association with age was observed.

The prevalence of the high intake of this type of food pattern was greater in accordance with the level of education and among those who reported a regular consumption of alcoholic beverages. By contrast, the high intake of the Brazilian food pattern demonstrated an inverse association with the increase in the level of education, which proved to be more prevalent among non-white

Table 1. General characteristics of the sample and prevalence of high intake (\geq percentile 75) of the food patterns (FPs) – healthy, at-risk, and Brazilian – according to demographic, socioeconomic, behavioral characteristics and psychosocial aspects in adult women from Southern Brazil, 2015 (n = 1,128).

| Characteristics | Healthy FP | | At-risk FP | | Brazilian FP | | |
|---|------------|------------|----------------------|------------|----------------------|------------|----------------------|
| | n (%) | n (%) | p-value ^a | n (%) | p-value ^a | n (%) | p-value ^a |
| Demographic | | | | | | | |
| Age (years) | | | < 0.001 | | < 0.001 | | 0.132 |
| 20 to 29 | 216 (19.1) | 29 (13.4) | | 105 (48.6) | | 45 (20.8) | |
| 30 to 39 | 244 (21.6) | 43 (17.6) | | 80 (32.8) | | 58 (23.8) | |
| 40 to 49 | 276 (24.5) | 66 (23.9) | | 55 (19.9) | | 79 (28.6) | |
| 50 to 59 | 228 (20.2) | 80 (35.1) | | 25 (11.0) | | 53 (23.3) | |
| 60 to 69 | 164 (14.5) | 64 (39.0) | | 17 (10.4) | | 47 (28.7) | |
| Skin color | | | 0.040 | | 0.875 | | 0.027 |
| White | 840 (74.5) | 223 (26.6) | | 209 (24.9) | | 196 (23.3) | |
| Other | 288 (25.5) | 59 (20.5) | | 73 (25.4) | | 86 (29.9) | |
| Marital status | | | 1.000 | | 0.886 | | 0.152 |
| With partner | 720 (63.8) | 180 (25.0) | | 181 (25.1) | | 190 (26.4) | |
| Without partner | 408 (36.2) | 102 (25.0) | | 101 (24.8) | | 92 (22.6) | |
| Socioeconomic | | | | | | | |
| Level of education (years of study) (n = 1,110) | | < 0.001 | | < 0.001 | | < 0.001 | < 0.001 |
| < 4 | 102 (9.2) | 22 (21.6) | | 12 (11.8) | | 42 (41.2) | |
| 4 to 7 | 339 (30.5) | 66 (19.5) | | 60 (17.7) | | 116 (34.2) | |
| 8 to 10 | 199 (17.9) | 44 (22.1) | | 52 (26.1) | | 50 (25.1) | |
| \geq 11 | 470 (42.3) | 146 (31.1) | | 155 (33.0) | | 64 (13.6) | |
| Social class (ABEP) ^b (n = 1,122) | | 0.371 | | 0.305 | | 0.186 | 0.186 |
| A and B (higher) | 390 (34.8) | 102 (26.2) | | 101 (25.9) | | 84 (21.5) | |
| C | 596 (53.1) | 149 (25.0) | | 151 (25.3) | | 163 (27.4) | |
| D and E (lower) | 136 (12.1) | 30 (22.1) | | 28 (20.6) | | 33 (24.3) | |

it continues

Table 1. General characteristics of the sample and prevalence of high intake (\geq percentile 75) of the food patterns (FPs) – healthy, at-risk, and Brazilian – according to demographic, socioeconomic, behavioral characteristics and psychosocial aspects in adult women from Southern Brazil, 2015 (n = 1,128).

| Characteristics | Healthy FP | | At-risk FP | | Brazilian FP | | |
|---------------------------------|------------|------------|----------------------|------------|----------------------|------------|----------------------|
| | n (%) | n (%) | p-value ^a | n (%) | p-value ^a | n (%) | p-value ^a |
| Behavioral | | | | | | | |
| Smoking habit | | | < 0.001 | | 0.274 | | 0.001 |
| Non-smoker | 661 (58.6) | 167 (25.3) | | 164 (24.8) | | 141 (21.3) | |
| Ex-smoker | 259 (23.0) | 86 (33.2) | | 58 (22.4) | | 70 (27.0) | |
| Smoker | 208 (18.4) | 29 (13.9) | | 60 (28.9) | | 71 (34.1) | |
| Alcohol consumption | | | 0.240 | | < 0.001 | | < 0.001 |
| No | 834 (73.9) | 201 (24.1) | | 174 (20.9) | | 232 (27.8) | |
| Yes | 294 (26.1) | 81 (27.6) | | 108 (36.7) | | 50 (17.0) | |
| Physical activity | | | 0.769 | | 0.624 | | 0.624 |
| Physically active | 162 (14.4) | 42 (25.9) | | 38 (23.5) | | 43 (26.5) | |
| Insufficiently active | 966 (85.6) | 240 (24.8) | | 244 (25.3) | | 239 (24.7) | |
| Psychosocial^c | | | | | | | |
| Informal social control | | | 0.002 | | 0.539 | | 0.010 |
| Low (< 15) | 294 (26.1) | 58 (19.7) | | 71 (24.2) | | 63 (21.4) | |
| Medium (15 to 20) | 740 (65.6) | 191 (25.8) | | 185 (25.0) | | 185 (25.0) | |
| High (\geq 21) | 94 (8.3) | 33 (35.1) | | 26 (27.7) | | 34 (36.2) | |
| Social cohesion | | | < 0.001 | | 0.101 | | 0.008 |
| Low (< 15) | 317 (28.1) | 62 (19.6) | | 93 (29.3) | | 68 (21.5) | |
| Medium (15 to 19) | 610 (54.1) | 153 (25.1) | | 141 (23.1) | | 149 (24.4) | |
| High (\geq 20) | 201 (17.8) | 67 (33.3) | | 48 (23.9) | | 65 (32.3) | |
| Collective efficacy | | | < 0.001 | | 0.550 | | 0.003 |
| Low (< 30) | 286 (25.4) | 57 (19.9) | | 75 (26.2) | | 57 (19.9) | |
| Medium (30 to 38) | 629 (55.8) | 148 (23.5) | | 156 (24.8) | | 158 (25.1) | |
| High (\geq 39) | 213 (18.9) | 77 (36.2) | | 51 (23.9) | | 67 (31.5) | |

^a P-value for the Pearson chi-square test for the heterogeneity of proportions (categorical variables) and linear tendency (ordinal variables); ^b ABEP – Brazilian Association of Research Companies. Brazilian Criteria for Economic Classification. Available at: <http://www.abep.org/novo/Content.aspx?ContentID=301>; ^c Variables categorized in quartiles and classified as low (\leq percentile 25), medium (25 < percentile < 75), and high (\geq percentile 75).

Source: Authors.

women who were smokers and did not report a regular consumption of alcoholic beverages (Table 1).

As regards the association between the food patterns and psychosocial aspects (main exposure in question), it was found that the prevalence of high consumption of the healthy and Brazilian food patterns were significantly higher among the women who reported higher levels of informal social control, social cohesion, and collective efficacy (social capital). Nevertheless, no significant results were observed for the at-risk food pattern (Table 1). The gross prevalence ratios (Model I) for the respective associations are presented in Table 2.

After adjustments for potential confounding factors (Model III), we observed an independent effect of the psychosocial aspects (social capital) on the adherence to healthy and Brazilian food patterns (Table 2). A 44% greater probability was found for adherence to the healthy pattern (PR = 1.44; 95%CI: 1.01 – 2.03; p = 0.040) and 71% greater for adherence to the common Brazilian pattern (PR = 1.71; 95%CI: 1.18 – 2.47; p = 0.004) among women who reported a higher level of collective efficacy, when compared to the low level of collective efficacy. Between the two psychosocial aspects evaluated and related to the collective efficacy construct (social capital), a greater magnitude of association was observed for the

Table 2. Gross and adjusted prevalence ratios (PRs) for the association between psychosocial aspects and high intake (\geq percentile 75) of the food patterns (FPs) – healthy, at-risk, and Brazilian – among women in Southern Brazil, 2015 (n = 1,128).

| Psychosocial aspects ^a | Model I | | Model II | | Model III | |
|-----------------------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|
| | PR (95%CI) | p-value ^b | PR (95%CI) | p-value ^b | PR (95%CI) | p-value ^b |
| Healthy FP | | | | | | |
| Informal social control | | 0.008 | | 0.066 | | 0.083 |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Medium | 1.31 (0.98 – 1.76) | | 1.19 (0.88 – 1.60) | | 1.17 (0.87 – 1.57) | |
| High | 1.78 (1.16 – 2.73) | | 1.51 (0.98 – 2.32) | | 1.48 (0.96 – 2.28) | |
| Social cohesion | | 0.003 | | 0.103 | | 0.138 |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Medium | 1.28 (0.95 – 1.72) | | 1.11 (0.82 – 1.49) | | 1.09 (0.81 – 1.47) | |
| High | 1.70 (1.21 – 2.41) | | 1.34 (0.94 – 1.92) | | 1.31 (0.92 – 1.87) | |
| Collective efficacy | | 0.001 | | 0.028 | | 0.040 |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Medium | 1.18 (0.87 – 1.60) | | 1.09 (0.80 – 1.49) | | 1.07 (0.79 – 1.46) | |
| High | 1.81 (1.29 – 2.55) | | 1.47 (1.03 – 2.08) | | 1.44 (1.01 – 2.03) | |
| At-risk FP | | | | | | |
| Informal social control | | 0.594 | | 0.159 | | 0.211 |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Medium | 1.04 (0.79 – 1.36) | | 1.14 (0.87 – 1.51) | | 1.12 (0.84 – 1.47) | |
| High | 1.15 (0.73 – 1.79) | | 1.38 (0.87 – 2.17) | | 1.35 (0.85 – 2.12) | |
| Social Cohesion | | 0.155 | | 0.789 | | 0.613 |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Medium | 0.79 (0.61 – 1.02) | | 0.92 (0.71 – 1.21) | | 0.94 (0.72 – 1.23) | |
| High | 0.81 (0.57 – 1.15) | | 1.10 (0.77 – 1.57) | | 1.15 (0.80 – 1.65) | |
| Collective efficacy | | 0.605 | | 0.450 | | 0.420 |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Medium | 0.95 (0.72 – 1.25) | | 1.04 (0.78 – 1.37) | | 1.02 (0.77 – 1.35) | |
| High | 0.91 (0.64 – 1.30) | | 1.16 (0.81 – 1.67) | | 1.18 (0.82 – 1.70) | |
| Brazilian FP | | | | | | |
| Informal social control | | 0.025 | | 0.018 | | 0.010 |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Medium | 1.17 (0.88 – 1.55) | | 1.17 (0.87 – 1.57) | | 1.21 (0.90 – 1.63) | |
| High | 1.69 (1.11 – 2.56) | | 1.77 (1.16 – 2.72) | | 1.86 (1.21 – 2.85) | |
| Social cohesion | | 0.021 | | 0.035 | | 0.030 |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Medium | 1.14 (0.85 – 1.52) | | 1.16 (0.86 – 1.56) | | 1.17 (0.87 – 1.57) | |
| High | 1.51 (1.07 – 2.12) | | 1.48 (1.03 – 2.10) | | 1.49 (1.05 – 2.14) | |
| Collective efficacy | | 0.011 | | 0.007 | | 0.004 |
| Low | 1.00 | | 1.00 | | 1.00 | |
| Medium | 1.26 (0.93 – 1.71) | | 1.30 (0.96 – 1.78) | | 1.36 (1.00 – 1.85) | |
| High | 1.58 (1.11 – 2.25) | | 1.66 (1.15 – 2.39) | | 1.71 (1.18 – 2.47) | |

^a Variables categorized in quartiles and classified as low (\leq percentile 25), medium (25 < percentile < 75), and high (\geq percentile 75).

^b P-value for Wald test for linear tendency obtained by applying the Poisson regression with robust variance; Model I: gross analysis; Model II: adjusted analysis for demographic and socioeconomic characteristics with $p < 0.20$ in the gross analysis; Model III: analysis adjusted for model II and behavioral characteristics with $p < 0.20$ in the gross analysis; healthy FP: adjusted for age, skin color, level of education (Model II) + smoking habit (Model III); at-risk FP: adjusted for age and level of education (Model II) + alcohol consumption (Model III); Brazilian FP: adjusted for age, skin color, marital status, level of education, and social class (Model II) + smoking habit and alcohol consumption (Model III).

Source: Authors.

informal social control aspect as compared to social cohesion (Table 2).

Discussion

The present study aimed to explore the association between social capital and food patterns (healthy, at-risk, and Brazilian) in adult women, aged 20 to 69 years, from a population-based representative sample and who reside in Southern Brazil. Among the main findings, what stands out is that women with a high level of social capital demonstrated a high intake of healthy and Brazilian food patterns. The effect of the capital on the intake of food patterns appears to be independent, after adjustments for potential confounding factors. Significant results were not observed for the association between social capital and the intake of the at-risk food pattern (unhealthy pattern).

The healthy food pattern, identified in our sample, consisted of fresh fruit, leafy green vegetables, whole grain cereals, oilseeds, and low-fat animal foods. This composition is similar to other findings in the literature regarding a healthy food intake, comprised mainly of fruits and vegetables^{9,16,19}. Healthy food patterns were also reported among young and adult women from Ribeirão Preto, São Paulo, Brazil^{30,31}. Moreover, our findings corroborate with other studies that observe a greater healthy food intake with the advance in age among women who live in the region of Vale do Brazos, Texas/USA¹⁷, while younger individuals of an adult Lebanese sample tended to present an at-risk food pattern⁷, characterized by the presence of ultraprocessed foods that are high in sodium, sugar, and fat.

The present study revealed a greater probability of adherence to the healthy food pattern in direct proportion with an increase in social capital (informal social control, social cohesion, collective efficacy). After adjustments for behavioral characteristics and sociodemographic factors, women with a high level of social cohesion and collective efficacy maintained a higher probability to show an intake of the healthy food pattern. In a similar sense, a study by Johnson *et al.*¹⁷, conducted in the region of Vale do Brazos, Texas/USA, in a mostly female sample (74.7%), verified that the highest intake of fruits and vegetables was associated positively with the female gender and a greater social capital. By contrast, Xue and Cheng³⁴ highlighted a significant association between healthy food intake and the perception of trust and social relationships within the neighborhood in a nation-

ally representative sample of Chinese individuals, aged 16 to 102 years.

It was also observed that most studies evaluated the intake of fruits and vegetables as healthy food items with the intention of investigating the relation between the intake of these foods and social capital in different social contexts in Brazil^{9,16} and in other countries, such as the USA^{17,19,20}, Finland³³, China³⁴, Sweden²¹, Japan³² and the Netherlands¹³. Other studies contemplated different food groups, such as fast food and sugary drinks¹⁷, meats, and water¹³, as well as fruits and vegetables.

The social capital, identified in our study, was measured through the components of informal social control, social cohesion, and collective efficacy. These psychosocial aspects refer to the capacity of the group to apply social norms, express solidarity, and involve themselves in collective actions²⁵. The perception of the individual for situations that require the help of neighbors, along with their perception of trust, solidarity, and union concerning a common goal, tend to illustrate shared understandings of a group^{10,11}. This cognitive dimension is commonly explored in the studies of social capital in an isolated or a combined sense with structural aspects, which themselves refer to configurations and standards of established social relations³⁵.

It is important to highlight that no prior studies were found that evaluated the intake of food patterns identified for a specific sample as the outcome from the interest in the exposure of psychosocial aspects (social capital); however, we did find one study that investigated the interest in the intake of healthy food patterns³². In a study conducted by Motohashi *et al.*³², the reciprocity among residents of a rural town in the north of Japan and the sense of belonging to the community were the cognitive elements of social capital, used to verify the association among: interest in healthy food patterns, social capital, and psychological suffering. By contrast, Sorensen *et al.*²⁰ used both the cognitive and the structural dimension to examine the relation of factors within the social context and changes in the intake of fruits and vegetables, through two randomized clinical trials: one developed with patients from a health center and the other among workers from a small company in the metropolitan area of Boston (USA). Both studies emphasized that the largest social capital was associated with the intake of healthy foods.

The Brazilian food pattern, identified in the sample of the present study, consisted of white rice, beans, refined grains, pasta, fried meats,

farofa, and red meats. These foods are considered to be typical of Brazilian cuisine, even in the southern regions of the country where this study was conducted. Other national studies, conducted in different regions of Brazil, have also identified similar food compositions, as evidenced mainly by the presence of rice and beans, even though the food pattern has been given a different name^{6,31,36-38}. A 71% higher probability of adherence to the intake of this food pattern was observed among women with a high level of social capital. One hypothesis for this finding is that the resources generated by the social capital reinforce the food characteristics of the social context marked by traditional food habits. In addition, when evaluating the food intake through the identification of food patterns, what has been considered is an analysis sensitive to the complexities of the context in which the individuals are inserted, primarily cultural, social, environmental, demographic, and economic factors^{3,4,39}. Due to the specificity of this food pattern and of the scarcity of studies on the issue of social capital in the Brazilian context, previous studies on this relationship have not been found in the scientific literature. Nonetheless, one can consider that the relation between psychosocial aspects and the intake of this food pattern can intertwine with the same concepts treated herein concerning the relation between social capital and the healthy food pattern, considering that the intake of this pattern can be seen as a marker for the intake of healthy foods.

The at-risk food pattern, by contrast, consisted predominantly of fried foods, fast food, sweet baked goods, chocolate and ice cream, mayonnaise, stuffed cookies, industrialized foods, baked snacks, barbecue, high-fat creams, soft drinks, and industrialized powdered fruit juices. The present study illustrates that the intake of this food pattern did not show a significant association with the level of social capital. In this sense, this finding corroborates with a previous investigation, conducted with a sample of residents from the region of Vale do Brazos, Texas/USA, in which no association between social capital and at-risk food patterns were observed, including the intake of fast food and sugary drinks, for example¹⁷.

Within the two psychosocial aspects evaluated and related to the construct of social capital, our study found a greater magnitude of association for the informal social control, when compared to social cohesion. The informal social control refers to the capacity of a group to reg-

ulate its members according to their own principles, whereas social cohesion refers to trust and solidarity among neighbors²⁵. Based on this difference, one can hypothesize that the broader aspects related to informal social control are those which lead to attitudes that influence the food pattern. In this light, Johnson et al.,¹⁷ found a greater intake of fruits and vegetables in high levels of social capital through a scale considering a dimension outside of the family based on inquiries that verified, at least in part, the attitude of the member of a given group in relation to the intervention in favor of the intake of fruits and vegetables.

The strong point of this study was that it was conducted with a large population base, contemplating a representative sample of adult women, and that it used previously tested and validated instruments to obtain the levels of the presence of the investigated psychosocial aspect (social capital), as well as to attain and define food patterns. Multivariate analyses were also performed to determine the association between social capital and food patterns, including the control for important confounding factors, which reinforces the methodological accuracy of this study. However, some limitations should be pointed out. One limitation of this study refers to its design, considering that cross-sectional studies are limited with regards to the establishment of causal relations. Moreover, a presence of reverse causality between social capital and a high intake of food patterns cannot be totally discarded either, given that both the exposure and the outcome were evaluated at the same time. In this light, although unfavorable psychosocial aspects tend to alter the intake of a given food pattern, these may also be merely consequences of their intake. In this sense, longitudinal studies become necessary to confirm the relations identified in this study. Another limitation refers to the external validity of this study, that is, this study was conducted with a sample of women who reside in an urban area of a city in Southern Brazil. Thus, this study's findings should be considered for similar populational groups, mainly due to the fact that this study's sample did not include men and did not represent the population in general. Considering these aspects, this limitation could be overcome by conducting population-based studies, including men and women. Furthermore, new studies could contribute to better elucidate the theme of this study through the comparison of the relation between social capital and food intake among the residents of both urban and rural areas, for example.

In conclusion, the present study revealed an important relation between psychosocial aspects and food intake. Women with higher levels of social capital demonstrated a high intake of healthy food patterns. In this manner, our results suggest that that produced in the social environment, based on trust, identity, and belonging, tend to have a positive impact on the intake of healthy

foods. This study's findings, therefore, indicate that an agenda geared toward the proposal of strategies, actions, and public policies for eating habits and nutrition in order to promote health and prevent diseases in the population should consider the improvement of psychosocial aspects, both individually and collectively.

Collaborations

L Caetano, A Garcez and MTA Olinto participated in the study conception, data analysis and interpretation, article writing, critical review of the content, and final manuscript approval. FS Barros and JSD Costa participated in the study conception, critical content review, and final manuscript approval.

Funding

Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq (Processo n. 457235/2014-4).

References

1. Organização Pan Americana de Saúde (OPAS). *Modelo de Perfil Nutricional da Organização Pan-Americana da Saúde*. Washington, DC: OPAS; 2016.
2. Centers for Disease Control and Prevention (CDC). U.S Department of Health and Human Services. *National Diabetes Statistics Report, 2020* [Internet]. 2020. [cited 2020 dez 3]. Available from: <https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf>
3. World Health Organization (WHO). *Dieta, Nutrição y Prevención de Enfermedades Crónicas*. Geneva: WHO; 2003.
4. Panagiotakos D. α -priori versus α -posterior methods in dietary pattern analysis: a review in nutrition epidemiology. *Nutr Bull* 2008; 33(4):311-315.
5. Polo TCF, Corrente JE, Miot LDB, Papini SJ, Miot HA. Dietary patterns of patients with psoriasis at a public healthcare institution in Brazil. *An Bras Dermatol* 2020; 95(4):452-458.
6. Olinto MT, Willet WC, Gigante DP, Victora CG. Sociodemographic and lifestyle characteristics in relation to dietary patterns among young Brazilian adults. *Public Health Nutr* 2011; 14(1):150-159.
7. Naja F, Nasreddine L, Itani L, Chamieh MC, Adra N, Sibai AM, Hwalla N. Dietary patterns and their association with obesity and sociodemographic factors in a national sample of Lebanese adults. *Public Health Nutr* 2011; 14(9):1570-1578.
8. Yun-Hsuan W, Moorea S, Dubeb L. Social capital and obesity among adults: Longitudinal findings from the Montreal neighborhood networks and healthy aging panel. *Prev Med* 2018; 111:366-370.
9. Pattussi MP, Olinto MTA, Canuto R, Silva Garcez A, Paniz VM, Kawachi I. Workplace social capital, mental health and health behaviors among Brazilian female workers. *Soc Psychiatr Epidemiol* 2016; 51(9):1321-1330.
10. Carrillo-Álvarez E, Riera RJ. Measuring social capital: further insights. *Gac Sanit* 2017; 31(1):57-61.
11. Putnam RD, Leonardi R, Nanetti RY. *Making democracy work: civic traditions in modern Italy*. Princeton: Princeton University Press; 1993.
12. Xin Y, Ren X. Social capital as a mediator through the effect of education on depression and obesity among the elderly in China. *Int J Environ Res Public Health* 2020; 17(11):3977.
13. Kamphuis CBM, Groeniger JO, Poelman MP, Beenackers MA, Lenthe FJ. How does bridging social capital relate to health-behavior, overweight and obesity among low and high educated groups? A cross-sectional analysis of GLOBE-2014. *BMC Public Health* 2019; 19:1635.
14. Duke NN, Borowsky IW, Pettingell SL. Parent perceptions of neighborhood: relationships with US youth physical activity and weight status. *Matern Child Heal J* 2012; 16(1):149-157.
15. Yang Y, Wang S, Chen L, Luo M, Xue L, Cui D, Mao Z. Socioeconomic status, social capital, health risk behaviors, and health-related quality of life among Chinese older adults. *Health Qual Life Outcomes* 2020; 18(1):291.
16. Loch MR, Souza RKT, Mesas AE, González AD, Rodríguez-Artalejo F. Associação entre capital social e autopercepção de saúde em adultos brasileiros. *Rev Saude Publica* 2015; 49:53.
17. Johnson CM, Sharkey JR, Dean WR. Eating Behaviors and Social Capital are Associated with Fruit and Vegetable Intake Among Rural Adults. *J Hunger Environ Nutr* 2010; 5(3):302-315.
18. Kritsotakis G, Chatzi L, Vassilaki M, Georgiou V, Kogevinas M, Philalithis AE, Koutis A. Social capital, tolerance of diversity and adherence to Mediterranean diet: the Rhea Mother-Child Cohort in Crete, Greece. *Public Health Nutr* 2015; 18(7):1300-1307.
19. Litt JS, Soobader Mah-J, Turbin MS, Hale JW, Buchenau M, Marshall J. The influence of social involvement, neighborhood aesthetics, and community garden participation on fruit and vegetable consumption. *Am J Public Health* 2011; 101(8):1466-1473.
20. Sorensen G, Stoddard AM, Dubowitz T, Barbeau EM, Bigby J, Emmons KM, Berkman LF, Peterson KE. The influence of social context on changes in fruit and vegetable consumption: results of the healthy directions studies. *Am J Public Health* 2007; 97(7):1216-1227.
21. Lindström M, Hanson BS, Wirfält E, Ostergren PO. Socioeconomic differences in the consumption of vegetables, fruit and fruit juices. The influence of psychosocial factors. *Eur J Public Health* 2001; 11(1):51-59
22. Instituto Brasileiro de Geografia e Estatística (IBGE). Cidades@: São Leopoldo/RS [Internet]. [acessado 2020 nov 15]. Disponível em: <http://www.cidades.ibge.gov.br/xtras/perfil.php?lang=&codmun=431870&search=riogrande-do-sul|sao-leopoldo>. Acessado em: 25 de novembro 2015
23. Instituto Brasileiro de Geografia e Estatística (IBGE). Cidades: São Leopoldo/RS [Internet]. 2020. [acessado 2020 set 30]. Disponível em: <http://www.ibge.gov.br/cidadesat/painel/painel.php?codmun=432200>
24. Ternus DLuisa, Henn RL, Bairros F, Costa JS, Olinto MTA. Padrões alimentares e sua associação com fatores sociodemográficos e comportamentais: Pesquisa Saúde da Mulher 2015, São Leopoldo (RS). *Rev Bras Epidemiol* 2019; 22:e190026.
25. Sampson RJ, Raudenbush SW, Earls F. Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science* 1997; 277(5328):918-924.
26. Associação Brasileira de Empresas de Pesquisa (ABEP). Critério de Classificação Econômica - 2015 [Internet]. 2015. [acessado 2020 set 30]. Disponível em: <https://www.abep.org/criterio-brasil>
27. Matsudo S, Araújo T, Matsudo V, Andrade D, Andrade E, Oliveira LC, Braggion G. Questionário internacional de atividade física (IPAQ): estudo de validade e reprodutibilidade no Brasil. *Rev Bras Ativ Fis Saude* 2001; 6(2):5-18.
28. Barros AJD, Hirakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. *BMC Med Res Methodol* 2003; 3(1):21.
29. 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):224-227.

30. Gimeno SGA, Mondini L, Moraes SA, Freitas ICM. Padrões de consumo de alimentos e fatores associados em adultos de Ribeirão Preto, São Paulo, Brasil: Projeto OBEDIARP. *Cad Saude Publica* 2011; 27(3):533-545.
31. Arruda SPM, da Silva AAM, Kac G, Goldani MZ, Bettiol H, Barbieri MA. Socioeconomic and demographic factors are associated with dietary patterns in a cohort of young Brazilian adults. *BMC Public Health* 2014; 14:654.
32. Motohashi K, Kaneko Y, Fujita K, Motohashi Y, Nakamura A. Interest in dietary pattern, social capital, and psychological distress: a cross-sectional study in a rural Japanese community. *BMC Public Health* 2013; 13:933.
33. Nieminen T, Prättälä R, Martelin T, Härkänen T, Hyyppä MT, Alanen E, Koskinen S. Social capital, health behaviours and health: a population-based associational study. *BMC Public Health* 2013; 13:613.
34. Xue X, Cheng M. Social capital and health in China: exploring the mediating role of lifestyle. *BMC Public Health* 2017; 17:863.
35. Moore S, Kawachi I. Twenty years of social capital and health research: a glossary. *J Epidemiol Community Health* 2017; 71(5):513-517.
36. Hoffmann M, Mendes KG, Canuto R, Garcez AS, Theodoro H, Rodrigues AD, Olinto MTA. Padrões alimentares de mulheres no climatério em atendimento ambulatorial no Sul do Brasil. *Cien Saude Colet* 2015; 20(5):1565-1574.
37. Selem SS, Castro MA, César CLG, Marchioni DML, Fisberg RM. Associations between dietary patterns and self-reported hypertension among Brazilian adults: a cross-sectional population-based study. *J Acad Nutr Diet* 2014; 114(8):1216-1222.
38. Sichieri R, Castro JFG, Moura AS. Fatores associados ao padrão de consumo alimentar da população brasileira. *Cad Saude Publica* 2003; 19(1):S47-S53.
39. Hu FB. Dietary pattern analysis: a new direction in nutritional epidemiology. *Curr Opin Lipidol* 2002; 13(1):3-9.

Article submitted 06/07/2022

Approved 10/11/2022

Final version submitted 12/11/2022

Chief editors: Romeu Gomes, Antônio Augusto Moura da Silva