

**ORIGINAL ARTICLE**

## Association Between Depression, Functional Capacity, Cognitive Status and the Consumption of Fruits and Vegetables in Elderly in Joinville/SC-Brazil

Luana Alberti Noronha<sup>1</sup>; Eloá Angélica Koehnlein<sup>2</sup>; Camila Tureck<sup>3</sup>  
Sabrina Gauto Silveira Fagundes<sup>4</sup>; Ana Paula de Mello<sup>5</sup>

**Highlights:**

- (1). Elderly individuals without depressive symptoms and lacking functional dependency demonstrated a higher propensity for regular fruit consumption.
- (2). Elderly individuals without functional dependency demonstrated a higher propensity for regular fruit consumption.
- (3). Elderly individuals with functional dependency showed a higher incidence of depressive symptoms and cognitive decline.

**ABSTRACT**

The consumption of fruits and vegetables seems to contribute to the prevention and/or delay of depression, cognitive decline and, indirectly, to functional dependence, at the same time that it can be influenced by these clinical conditions. The objective of this study was to verify the association between depression, functional capacity, cognitive status and consumption of fruits and vegetables in elderly people in Joinville-SC. A study with secondary data collection carried out in 2021 that assessed depressive symptoms using the Geriatric Depression Scale, functional capacity using the PFEFFER Functional Activities Questionnaire, and cognitive status using the Mini-Mental State Examination. Consumption of fruits and vegetables (FV) was quantified using a food frequency questionnaire and was classified according to regularity. A total of 61 elderly were evaluated, of which 23% had depressive symptoms, 18% functional dependence in instrumental activities of daily living, 14.8% cognitive decline. A low frequency of elderly people with regular consumption of vegetables (36.1%), as well as associated fruits and vegetables (29.5%) was identified. On the other hand, the frequency of regular fruit consumption was high (73.8%) and was associated with a lower frequency of depressive symptoms and functional dependence. It was observed that elderly people with depressive symptoms, functional dependence and cognitive decline consumed FV irregularly.

**Keywords:** Aging; Depression; Functional Status; Cognition; Diet.

### ASSOCIAÇÃO ENTRE DEPRESSÃO, CAPACIDADE FUNCIONAL, ESTADO COGNITIVO E O CONSUMO DE FRUTAS E HORTALIÇAS EM IDOSOS DE JOINVILLE/SC-BRASIL

**RESUMO**

O consumo de frutas, legumes e verduras (FLV) parece contribuir para a prevenção e/ou retardo da depressão, declínio cognitivo e, indiretamente, para a dependência funcional, ao mesmo tempo em que pode ser influenciado por essas condições clínicas. O objetivo deste trabalho foi verificar a associação entre depressão, capacidade funcional, estado cognitivo e o consumo de FLV em idosos de Joinville-SC. Estudo com coleta de dados secundários que foi realizado em 2021 e avaliou sintomas depressivos por meio da Escala de Depressão Geriátrica, capacidade funcional por meio do Questionário de Atividades Funcionais de PFEFFER e estado cognitivo pelo Minixame do Estado Mental. O consumo de FLV foi quantificado por questionário de frequência de consumo alimentar e classificado de acordo com a regularidade. Foram avaliados 61 idosos, e, destes, 23% apresentaram sintomas depressivos, 18% dependência funcional nas atividades instrumentais de vida diária e 14,8% declínio cognitivo. Identificou-se baixa frequência de idosos com consumo regular de legumes e verduras (36,1%), assim como consumo de FLV associados (29,5%). Por outro lado, a frequência de consumo regular de frutas foi elevado (73,8%) e associou-se com menor frequência de sintomas depressivos e de dependência funcional. Observou-se que idosos com sintomas depressivos, dependência funcional e declínio cognitivo consumiram FLV irregularmente.

**Palavras-chave:** Envelhecimento; Depressão; Estado funcional; Cognition; Dieta.

<sup>1</sup> Federal University of Fronteira Sul. Realeza/PR, Brazil. <https://orcid.org/0000-0002-1437-6792>

<sup>2</sup> Federal University of Fronteira Sul. Realeza/PR, Brazil. <https://orcid.org/0000-0001-6836-7309>

<sup>3</sup> Avantis University Center. Brusque/SC, Brazil. <https://orcid.org/0000-0002-5672-1400>

<sup>4</sup> Dona Helena Hospital. Joinville/SC, Brazil. <https://orcid.org/0000-0002-8851-7252>

<sup>5</sup> San José Municipal Hospital, Joinville/SC, Brazil. <https://orcid.org/0000-0001-9977-3887>

## INTRODUCTION

The elderly population has been growing rapidly all over the world and, after many years, most people are able and expect to live longer<sup>1</sup>. It is estimated that by 2025 the elderly population it will increase by more than one million per year. Given this situation, it is expected that the country will undergo major changes with greater occurrences of pathologies related to aging, such as dementia<sup>2</sup>.

Mild cognitive decline (MLD) is the fine line between healthy aging, with modest cognitive changes, and dementia. This term was created from the understanding that there is a line that differentiates both, the importance of dementia for public health and the need for an early diagnosis to treat and prevent the complications of this pathology<sup>3</sup>.

Dementia is a set of signs and symptoms caused by diseases that affect the brain and impair cognitive functions: memory, language, attention, logic, intervening in daily activities, affecting mood, behavior, social and professional performance, and are usually worsened over time, being one of the main causes for disability and dependence among the elderly<sup>4</sup>.

Depression is another condition that commonly affects the elderly. This psychic disorder has non-specific clinical presentations and depressive symptoms tend to have greater physical, social and functional impairment, negatively affecting life quality and food intake<sup>5</sup>.

Functional capacity has its own implications around elderly quality of life, as it is related to the individual's independence to perform any task. The more functional dependencies, mainly related to cognitive decline, the more limitations the elderly find to perform their activities of daily living, increasing their dependence with interference in food intake. Nutrition is a risk factor associated with cognitive decline, a nutritional approach is a promising strategy to prevent, delay or stop associated diseases<sup>6</sup>. Among food with a potential beneficial effect, the fruits and vegetables (FV) group stand out, as it contains, among other substances, important antioxidant compounds to reduce the excessive production of reactive oxygen species, which are linked to aging and neurodegenerative diseases<sup>7</sup>.

Investigations on factors that could prevent and/or delay the depression progression, functional dependence and cognitive decline are relevant, as well as verifying whether these influences the FV consumption. Well, there seems to be a two-way street regarding the consumption of these food and the listed problems, since these groups can contribute to the prevention and/or delay the aforementioned conditions, and at the same time can be influenced by them. Thus, the objective of this study was to verify the association between depression, functional capacity, cognitive status and consumption of FV in elderly people in Joinville-SC.

## METHODS

This is a quantitative cross-sectional study, with secondary data collection from a research database carried out between March 2017 and September 2017 in the city of Joinville, Santa Catarina. The database contained information on individuals aged 60 years or older, males and females, selected by non-probabilistic convenience sampling, participants in health education groups, patients from the geriatric and neurology ambulatory, and volunteers from a public hospital in Joinville, Santa Catarina. The research had been approved by the Ethics Committee in Research with Human Beings from the Federal University of Fronteira Sul, under Registration No. 4,955,277.

For this research, the following exclusion criteria were used: individuals diagnosed with dementia, who hadn't reported their level of education, hadn't presented data from the application of the Geriatric Depression Scale (GDS) and who had reported use of oral anticoagulants. Also, individuals considered outliers in gram consumption of FV had been excluded.

The following information has been collected from the database: age, sex, years of schooling, monthly income per person, housing, marital status, weight and height (which resulted in nutritional status), comorbidities, previous stroke records (CVA), family records of dementia, smoking, alcohol consumption and physical activity. Nutritional status was evaluated according to the Body Mass Index (BMI), according to the classification by Lipschitz (1994)<sup>8</sup>, whit BMI <22 kg/m<sup>2</sup> underweight, BMI 22-27 kg/m<sup>2</sup> eutrophic and BMI >27 kg/m<sup>2</sup> overweight.

For assessing the elderly functional capacity, data from the application of the PFEFFER<sup>9</sup> Functional Activities Questionnaire (FAQ) had been used, validated for the Brazilian population<sup>10</sup>, which assesses the independence degree of the elderly to perform ten instrumental activities of daily living (IADL), the score varies between zero and 30, and the higher the score, the greater the dependence/disability that the individual presents. Scores equal to or greater than six is indicative of functional dependence<sup>10</sup>.

Identifying depressive symptoms in the elderly, had occurred by collecting data from the Geriatric Depression Scale<sup>11</sup> (GDS) application, validated for Brazilians<sup>5</sup>, which consists in 15 questions. Scores greater than five had been considered indicative of depressive symptoms.

For the identification of the cognitive state, data resulting from the application of the Mini Mental State Examination (MMSE) were used. A score below 13, for illiterates, has been considered an individual presenting cognitive decline, the same follows for scores below 18 for low and medium schooling (up to 11 years) and below 26 for high schooling (over 11 years)<sup>12</sup>.

For alcohol consumption, the daily consumption of a standard dose of alcohol (about 10g of ethanol) was considered as a reference, equivalent to a can of beer (350 ml), 1 glass of wine (150 ml) and 45 ml of distilled beverage such as cachaça, whiskey, gin and tequila.

The practice of physical activity (PA) was questioned with regards to carrying it out in a planned way during leisure periods. Activities performed in the context of domestic work, moving around and work were not considered.

Assessing the FV consumption frequency, had been possible by obtaining data from the Food Consumption Frequency Questionnaire (FCFQ) of the FV groups, which had been adapted with the addition of some regional foods: blackberry, fig, strawberry, nectarine, peach, pine nut, radite, avocado, persimmon and kiwi<sup>13,14</sup>.

Based on the FV food consumption frequency, the intake has been categorized as “regular” when the individual reported consuming at least one fruit and vegetable during five or more days a week, and “irregular” when consumption was less than five days a week<sup>15</sup>. The consumption of fruits and vegetables had been also analyzed separately, considering as “regular” the consumption of a fruit or a vegetable on five or more days of the week.

It is noteworthy that the PFEFFER FAQ and GDS questionnaires were applied by a trained profession in Nutrition, Psychology or Medicine. The MMSE was applied by a Psychology or Medicine professional, and the FCGQ was applied by a nutritionist.

The data had been analyzed using Microsoft Excel®2010 software and PSPP® statistical program. Descriptive and inferential analyses, frequency and chi-square, the Komogorov-Smirnov test for analysis of the normal distribution of the variables, in addition to the Student T-Test, Tukey and Mann Whitney were performed. As statistical significance,  $p \leq 0.05$  (5%) was considered.

## RESULTS

The evaluated sample consisted of 61 elderly people. The sociodemographic and clinical variables of the elderly are shown in Table 1. The majority (54.1%) were between 70 and 79 years

old, were female (77%), had low education and monthly income between 1 and 3 minimum wages (80.3%). The housing evaluation characteristics concerning the evaluated elderly showed that the majority (82%) reported living with a family member and 52.5% had been married.

Table 1 – Elderly studied sociodemographic and clinical characteristics, Joinville (2017)

<b>Variable</b>	<b>n</b>	<b>%</b>
<b>Age (years)</b>		
60-69	22	36.1
70-79	33	54.1
80-89	6	9.8
<b>Gender</b>		
Male	14	23.0
Female	47	77.0
<b>Education (years)</b>		
1-4	30	49.2
5-8	18	29.5
More than 9	13	21.3
<b>Income (minimum wage*)</b>		
Less than 1	5	8.2
1-3	49	80.3
4 or more	7	11.5
<b>Housing</b>		
Alone	11	18.0
With family	50	82.0
<b>Marital Status</b>		
Married	32	52.5
Widow(er)	22	36.1
Single/Divorced	7	11.5
<b>Nutritional status</b>		
Eutrophy	25	41.0
Overweight	30	49.2
Underweight	6	9.8
<b>Comorbidity</b>		
No	5	8.2
Yes	56	91.8
<b>Stroke records</b>		
No	54	88.5
Yes	7	11.5
<b>Family records of dementia</b>		
No	42	68.9
Yes	19	31.1

<b>Smoking</b>		
No	59	96.7
Yes	2	3.3
<b>Use of alcohol</b>		
No	61	100.0
Yes	0	0.0
<b>Physical activity (practice during leisure time)</b>		
No	33	54.1
Yes	28	45.9
<b>Functional dependency</b>		
Without	50	82.0
With	11	18.0
<b>Cognitive decline</b>		
Without	52	85.2
With	9	14.8
<b>Depressive symptoms</b>		
Without	47	77.0
With	14	23.0

\*Minimum wage in 2017: R\$937,00.

It has been identified that 49.2% of the elderly were overweight and the majority reported having some comorbidity. Regarding risk factors for cognitive decline, 11.5% reported a previous stroke record and 31.1% a family record of dementia. Regarding risk factors related to lifestyle, only two elderly people reported smoking, no elderly person reported alcohol consumption three or more times a week and 45.9% practiced physical activity in their free time.

The elderly functional capacity evaluation showed that 18% were functionally dependent on performing IADL (finance, locomotion, preparing food). Regarding cognitive status, 14.8% had cognitive decline and with regard to the presence of depressive symptoms, 23% had depressive symptoms.

When analyzing the association between the frequency of depressive symptoms in the elderly evaluated with the clinical and sociodemographic variables (Table 2), it had been possible to perceive an association with the practice of PA in free time ( $p=0.001$ ), functional dependence ( $p<0.001$ ) and previous stroke ( $p=0.005$ ). For the variables: age, sex, education, housing, nutritional status, comorbidities and family dementia records associations couldn't be identified.

Table 2 – Frequency of depressive symptoms, cognitive decline, functional dependency in the elderly and association with sociodemographic and clinical variables, Joinville (2017)

Characteristics sociodemographics	Depressive symptoms			Cognitive decline			Functional dependency		
	Whitout n (%)	Whit n (%)	p	Whitout n (%)	Whit n (%)	p	Whitout n (%)	Whit n (%)	p
<b>Age (years)</b>									
60-69	14 (23.0)	8 (13.1)	0.108	16 (26.2)	6 (9.8)	0.093	17 (27.9)	5 (8.2)	0.771
70-79	27 (44.3)	6 (9.8)		31 (50.8)	2 (3.3)		28 (45.9)	5 (8.2)	
≥80	6 (9.8)	0 (0.0)		5 (8.2)	1 (1.6)		5 (8.2)	1 (1.6)	
<b>Gender</b>									
Male	9 (14.8)	5 (8.2)	0.196	12 (19.7)	2 (3.3)	1.000	10 (16.4)	4 (6.6)	0.266
Female	38 (62.3)	9 (14.8)		40 (65.6)	7 (11.5)		40 (65.6)	7 (11.5)	
<b>Education (years)</b>									
1-4	21 (34.4)	9 (14.8)	0.278	26 (42.6)	4 (6.6)	0.506	22 (36.1)	8 (13.1)	0.219
5-8	14 (23.0)	4 (6.6)		14 (23.0)	4 (6.6)		16 (26.2)	2 (3.3)	
≥9	12 (19.7)	1 (1.6)		12 (19.7)	1 (1.6)		12 (19.7)	1 (1.6)	
<b>Housing</b>									
Alone	9 (14.8)	2 (3.3)	1.000	9 (14.8)	2 (3.3)	0.659	10 (16.4)	1 (1.6)	0.670
With family	38 (62.3)	12 (19.7)		43 (70.5)	7 (11.5)		40 (65.6)	10 (16.4)	
<b>Physical activity (practice during leisure time)</b>									
No	20 (32.8)	13 (21.3)	0.001	25 (41.0)	8 (13.1)	0.031	22 (36.1)	11 (18.0)	0.001
Yes	27 (44.3)	1 (1.6)		27 (44.3)	1 (1.6)		28 (45.9)	0 (0.0)	
<b>Nutritional status</b>									
Eutrophy	21 (34.4)	4 (6.6)	0.205	22 (36.1)	3 (4.9)	0.397	23 (37.7)	2 (3.3)	0.200
Overweight	23 (37.7)	7 (11.5)		26 (42.6)	4 (6.6)		23 (37.7)	7 (11.5)	
Underweight	3 (4.9)	3 (4.9)		4 (6.6)	2 (3.3)		4 (6.6)	2 (3.3)	
<b>Comorbidity</b>									
No	5 (8.2)	0 (0.0)	0.580	3 (4.9)	2 (3.3)	0.300	5 (8.2)	0 (0.0)	0.574
Yes	42 (68.9)	14 (23.0)		49 (80.3)	7 (11.5)		45 (73.8)	11 (19.6)	

Functional dependence									
Without	44 (72.1)	6 (9.8)	<0.001	47 (77.0)	3 (4.9)	0.001	-	-	-
With	3 (4.9)	8 (13.1)		5 (8.2)	6 (9.8)		-	-	
Depressive symptoms									
Without	-	-	-	42 (68.9)	5 (8.2)	0.191	-	-	-
With	-	-		10 (16.4)	4 (6.6)		-	-	
Stroke records									
No	45 (73.8)	9 (14.8)	0.005	47 (77.0)	7 (11.5)	0.561	48 (78.7)	6 (9.8)	0.001
Yes	2 (3.3)	5 (8.2)		5 (8.2)	2 (3.3)		2 (3.3)	5 (8.2)	
Family records of dementia									
No	34 (55.7)	8 (13.1)	0.332	17 (27.9)	2 (3.3)	0.707	36 (59.0)	6 (9.8)	0.258
Yes	13 (21.3)	6 (9.8)		35 (57.4)	7 (11.5)		14 (23.0)	5 (8.2)	

Regarding the frequency for cognitive decline and possible association with clinical and demographic variables (Table 2), a statistically significant association had been also identified with leisure-time PA practice ( $p=0.031$ ) and functional dependence ( $p=0.001$ ). For the other variables (age, sex, schooling, housing, nutritional status, comorbidities, depressive symptoms, previous stroke and family dementia records) no associations had been found.

Concerning the analysis of the frequency of functional dependence associated with clinical and demographic variables (Table 2), associations had been identified with PA practice during leisure time ( $p=0.001$ ), depressive symptoms ( $p<0.001$ ) and previous stroke records ( $p=0.001$ ). For the variables age, sex, education, housing, nutritional status, comorbidities and family record of dementia, no associations had been seen.

Table 3 presents the FV consumption frequency and association with depressive symptoms, functional dependence and cognitive decline of the evaluated elderly. Most of the people evaluated (70.5%) had irregular FV consumption, that is, they hadn't been consuming a fruit plus a vegetable daily. However, when individually analyzing the fruits and vegetables consumption, it had been observed that the elderly presented regular fruits consumption more frequently (73.8%) than when compared to vegetables (36.1%). There has been a statistically significant association between regular fruit consumption and depressive symptoms ( $p=0.021$ ), as well as functional dependence ( $p=0.018$ ). For the consumption of vegetables, no association was identified with the clinical conditions studied.

Table 3 – Elderly consumption frequency of fruits and vegetables (FV) and association with depressive symptoms, cognitive decline and functional dependence, Joinville (2017)

Consumption	Depressive symptoms			Cognitive decline			Functional dependence			Total
	With Out n (%)	With n (%)	p	With Out n (%)	With n (%)	p	With Out n (%)	With n (%)	p	
<b>FV</b>										
Regularly	16 (26.2)	2 (3.3)	0.197	15 (24.6)	3 (4.9)	1.007	16 (26.2)	2 (3.3)	0.481	18 (29.5)
Irregularly	31 (50.8)	12 (19.7)		37 (60.7)	6 (9.8)		34 (55.7)	9 (14.8)		43 (70.5)
<b>Fruits</b>										
Regularly	38 (62.3)	7 (11.5)	0.021	40 (65.6)	5 (8.2)	0.224	40 (65.6)	5 (8.2)	0.018	45 (73.8)
Irregularly	9 (14.8)	7 (11.5)		12 (19.7)	4 (6.6)		10 (16.4)	6 (9.8)		16 (26.2)
<b>Vegetables</b>										
Regularly	19 (31.1)	3 (4.9)	0.225	19 (31.1)	3 (4.9)	1.000	20 (32.8)	2 (3.3)	0.299	22 (36.1)
Irregularly	28 (45.9)	11 (18.0)		33 (54.1)	6 (9.8)		30 (49.2)	9 (14.8)		39 (63.9)

## DISCUSSION

This cross-sectional study has evaluated the association of depressive symptoms, functional capacity and cognitive status with clinical and sociodemographic variables, in addition to FV consumption by the elderly in Joinville-SC. The findings indicated that the elderly who had reported practicing PA in their free time had depressive symptoms, cognitive decline and functional dependence in a lower frequency. In addition, it has been observed that the elderly with functional dependence had depressive symptoms with a higher frequency as well as cognitive decline. Regarding FV consumption, it has been observed that the regular consumption of fruits had been more frequent in the elderly without depressive symptoms and functional dependence. Thus, the findings demonstrate the importance of the existing link between consumption of FV-depressive symptoms-functional dependence.

The prevalence of depressive symptoms in the evaluated elderly has been similar to that found in other Brazilian studies. In a study with 557 elderly people treated at Family Health Units in Tangará da Serra-MT, it had been identified that 22.8% had depressive symptoms<sup>16</sup>. In Pelotas-RS, a study with 1,394 elderly people visited at home in the urban area had found out that 15.2% of the sample had depressive symptoms<sup>17</sup>.

In both studies mentioned previously, from Tangará da Serra-MT and Pelotas-RS, 24.4% and 34.7%, respectively, had showed functional dependence<sup>16,17</sup>. In the current research, a prevalence of dependence in performing IADL has been found in 18% of the elderly. Regarding the presence of



cognitive decline, the frequency identified in this study has been 14.8%. In the southwest of Paraná-BR, a study with 82 elderly people from three cities in the region, all who had been volunteers attending social and health care groups, had observed 20.7% of cognitive decline<sup>18</sup>.

The practice of PA in free time has been associated with a lower frequency of depressive symptoms. In São Paulo-SP, a study with 361 elderly people assisted by a health plan operator and which considered the practice of PA to be that with 10 full minutes minimum duration of activity, from moderate to vigorous intensity, also had identified the same association<sup>19</sup>. In Novo Hamburgo-RS, a study with 379 elderly volunteers from the community had observed a lower prevalence of depressive symptoms in those elderly with a higher level of PA<sup>20</sup>.

An association has been also observed between the practice of PA during leisure time and a lower frequency of cognitive decline in the studied sample. A study in Balneário Arroio do Silva-SC, with 308 elderly people who had been registered in the Strategic Health Management System, had found that elderly people who remained sedentary (sitting) for 11 hours or more day to day had more chances of cognitive decline when compared to those who had had the behavior up to three hours<sup>21</sup>.

Nevertheless, it has been possible to verify in this study that elderly people who reported practicing PA in their leisure time had a lower frequency of functional dependence than those who hadn't had report the practice of it. In Curitiba-PR, a study with 214 long-lived elderly ( $\geq 80$  years) who had been registered in for Basic Health Units (BHU) in the city and which evaluated the functional capacity through the Functional Independence Measure (FIM), also had identified that elderly PA practitioners had higher FIM means than non-practitioners<sup>22</sup>. In Campina Grande-PB, a research with 420 elderly people who had registered in the Family Health Strategy (FHS), evaluated the regular practice of physical activity (exercise at least three times a week, for at least 30 minutes) and had identified that elderly people with irregular physical activity had a higher prevalence of functional disability<sup>23</sup>.

The link between PA practice during leisure time with the three other studied clinical variables and the findings of the other studies, corroborate that the regularity of a physical activity practice in different domains: free time or inserted in domestic activities, commuting or work helps to maintain functional capacity and improves the elderly quality of life, in addition, it promotes improvement in physical conditioning and social life.

When the regularly consumption of fruits is evaluated alone, the frequency is high (73.6%) unlike what has been found in a study with 416 elderly users of the Unified Health System residing in Goiânia-GO, where only 44% reported daily portion fruit consumption<sup>24</sup>. In Palmeira das Missões-RS, 43 elderly users of three BHU participating in the FHS, the frequency of day to day consumption of one or two fruit servings had been 48.8%<sup>25</sup>. While in São Caetano do Sul-SP, 295 elderly volunteers attending at the BHU and elderly groups had been evaluated at home, 58% had been consuming three or more day to day fruit servings<sup>26</sup>.

The low frequency of FV consumption found in this study had already been identified by previous research. In a share of 1,197 community-dwelling elderly people living in the urban area of Florianópolis-SC, 67.8% had low FLV consumption ( $\leq 4$  servings/day)<sup>27</sup>. Therefore, the findings have shown that the regularly consumption of fruits and greens alone or in combination is below the recommended<sup>15</sup>.

The link between regularly fruit consumption and the frequency of depressive symptoms had already been described in a national and international study. In Porto Alegre-RS, a study with 37 elderly people from the community, without psychological, psychiatric or food treatment, had identified a connexion between fruits and greens low consumption and a higher frequency of depressive symptoms<sup>28</sup>, as well as in a retrospective study which had been carried out in Spain, with 132 institutionalized elderly people from the Psychology and Neurology Center<sup>29</sup>.

Contrary to what had been found in the isolated regularly fruits consumption, the frequent intake of vegetables (greens) has been reported by just over a third of the evaluated elderly (36.1%). Corroborating findings from another study that had been carried out in the Brazilian Midwest, in which only 24% of respondents regularly ingested a portion of vegetables<sup>24</sup>.

The connection between isolated fruit consumption and functional dependence has been found out in the current study. The same has also been described by the research in Curitiba-PR, in which those elderly who had reported the habit of always consuming fruits had higher scores on the FIM<sup>22</sup>. The fruits and greens group deserve special attention regarding the elderly consumption, since at this stage of life they can be consumed less frequently, since dependence to acquire, prepare and even consume food can influence low consumption of this food group<sup>24</sup>.

The FV consumption in this study hasn't been significantly associated with cognitive decline. However, another Brazilian study<sup>27</sup> had identified a link between irregularly fruits and greens consumption ( $\leq 4$  servings/day) and lower MMSE scores, which indicates cognitive decline. Another study<sup>18</sup> has also found no connection between the fruits and greens consumption and cognitive status, but the irregularly consumption of greens (<1 daily serving) proved to be a risky factor for cognitive decline.

The Sabe study that had been carried out in São Paulo-SP, with 945 elderly people, identified a connection between depressive symptoms and performance in IADL, individuals who hadn't presented any depressive symptoms had less impairment in IADL performance<sup>30</sup>, similar to the present study. This significant link shows the impact that depressive symptoms can have on the elderly functional capacity, or vice versa, making them increasingly dependent to perform basic activities.

The study carried out has presented a limitation regarding the small size of the sample and possible limitations of the elderly's memory when reporting the FV consumption. This study identified that the practice of physical activity during leisure time and functional independence were associated with the absence of depressive symptoms and cognitive decline. There was also a low frequency of regular FV and vegetables consumption. On the other hand, the frequency of regular fruit consumption was high and was associated with a lower frequency of depressive symptoms and functional dependence. Thus, there is a need for studies with larger samples in order to clarify and explain the probable and apparent two-way street in the consumption of FV and cognitive diseases, thus expanding the discussion on the consumption of this food group and neurodegenerative diseases in seniors. In addition, this study demonstrates the importance of public policies aimed at the well-being of the elderly, including strategies for mental health, physical activity and the promotion of healthy eating habits, which are so urgent in the current context of the epidemiology of aging.

## REFERENCES

- <sup>1</sup> Organização Mundial da Saúde. Relatório Mundial de Envelhecimento e Saúde. [internet]. Genebra: OMS; 2015 [cited Feb. 12<sup>nd</sup> 2021]. Available from: [https://apps.who.int/iris/bitstream/handle/10665/186468/WHO\\_FWC\\_ALC\\_15.01\\_por.pdf%3Bjse](https://apps.who.int/iris/bitstream/handle/10665/186468/WHO_FWC_ALC_15.01_por.pdf%3Bjse)
- <sup>2</sup> Boff MS, Sekyia FS, Bottino CSMC. Prevalence of dementia among brazilian population: systematic review. *Rev Med.* 2015 July/Sept.;94(3):154-161. DOI: <http://dx.doi.org/10.11606/issn.1679-9836.v.94i3p154-161>. Available from: [https://www.researchgate.net/profile/Cassio-Bottino/publication/292213494\\_Revisao\\_sistematica\\_sobre\\_prevalencia\\_de\\_demencia\\_entre\\_a\\_populacao\\_brasileira/links/56b894dd08ae44bb330d3202/Revisao-sistematica-sobre-prevalencia-de-demencia-entre-a-populacao-brasileira.pdf](https://www.researchgate.net/profile/Cassio-Bottino/publication/292213494_Revisao_sistematica_sobre_prevalencia_de_demencia_entre_a_populacao_brasileira/links/56b894dd08ae44bb330d3202/Revisao-sistematica-sobre-prevalencia-de-demencia-entre-a-populacao-brasileira.pdf). Access at: May 15<sup>th</sup> 2020.
- <sup>3</sup> Petersen RC, Caracciolo B, Brayne C, Gauthier S, Jelic V, Fratiglioni L. Mild cognitive impairment: a concept in evolution. *J Intern Med.* 2014 May;275(3):214-228. DOI: <https://doi.org/10.1111/joim.12190>. Available from: <https://onlinelibrary.wiley.com/doi/epdf/10.1111/joim.12190>. Access at: Feb. 18<sup>th</sup> 2021.
- <sup>4</sup> Organização Mundial da Saúde. Dementia. [internet]. 2020. [cited Apr. 14<sup>th</sup> 2021]. Available from: <https://www.who.int/news-room/fact-sheets/detail/dementia>.

- <sup>5</sup> Almeida O, Almeida SA. Confiabilidade da versão brasileira da Escala de Depressão Geriátrica (GDS) versão reduzida. *Arq Neuro-Psiquiatr*. 1999 June;57(2):421-426. DOI: <https://doi.org/10.1590/S0004-282X1999000300013>. Available from: <https://www.scielo.br/j/anp/a/Bdpjn6hWZz45CbmLQTT95pw/abstract/?lang=pt>. Access at: apr 08<sup>th</sup> 2021.
- <sup>6</sup> Kagawa CA, Corrente JE. Análise da capacidade funcional em idosos do município de Avaré-SP: fatores associados. *RBGG*. 2015 July/Sept.;18(3):577-586. DOI: <http://dx.doi.org/10.1590/1809-9823.2015.14140>. Available from: [https://www.scielo.br/scielo.php?pid=S1809-98232015000300577&script=sci\\_arttext](https://www.scielo.br/scielo.php?pid=S1809-98232015000300577&script=sci_arttext). Access at: mar 02<sup>nd</sup> 2021.
- <sup>7</sup> Cardoso SA, Paiva I. Nutrição e Alimentação na prevenção e terapêutica da Demência. *Acta Port Nutr*. 2017;11:30-34. DOI: <http://dx.doi.org/10.21011/apn.2017.1105> versão *on-line*. Available from: <https://actaportuguesadenutricao.pt/wp-content/uploads/2018/01/n11a05.pdf>. Access at: Mar. 14<sup>th</sup> 2021.
- <sup>8</sup> Lipschitz, D. A. Screening for nutritional status in the elderly. *Prim Care*. 1994;21(1):55-67. DOI: [https://doi.org/10.1016/S0095-4543\(21\)00452-8](https://doi.org/10.1016/S0095-4543(21)00452-8). Available from: <https://www.sciencedirect.com/science/article/abs/pii/S0095454321004528>. Access at: Jun. 2023.
- <sup>9</sup> Pfeffer RI, Kurosaki TT, Harrah Jr CH, Chance JM, Filos S.. Measurement of functional activities in older adults in the community. *J gerontol*. 1982 May;37(3):323-329. DOI: <https://doi.org/10.1093/geronj/37.3.323>. Available from: <https://academic.oup.com/geronj/article-abstract/37/3/323/611005>. Access at: Mar. 2<sup>st</sup> 2021.
- <sup>10</sup> Sanchez MAS, Correa PCR, Lourenço RA. Cross-cultural adaptation of the “Functional Activities Questionnaire-FAQ” for use in Brazil. *Dement Neuropsychol*. 2011 Oct./Dec.;5(4):322-327. DOI: <http://dx.doi.org/10.1590/S1980-57642011DN05040010>. Available from: [https://www.scielo.br/scielo.php?pid=S1980-57642011000400322&script=sci\\_arttext](https://www.scielo.br/scielo.php?pid=S1980-57642011000400322&script=sci_arttext). Access at: Mar. 2<sup>nd</sup> 2021.
- <sup>11</sup> Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey, M *et al*. O. Development and validation of a geriatric depression screening scale: a preliminary report. *J psychiatr res*. 1982-1983;17(1):37-49, 1982-1983. DOI: [https://doi.org/10.1016/0022-3956\(82\)90.033-90.034](https://doi.org/10.1016/0022-3956(82)90.033-90.034). Available from: <https://www.sciencedirect.com/science/article/abs/pii/0022395682900334>. Access at: Mar. 2<sup>nd</sup> 2021.
- <sup>12</sup> Bertolucci PHF, Brucki S, Campacci SR, Juliano Y. O Mini-Exame do Estado Mental em uma população geral: impacto da escolaridade. *Arq NeuroPsiquiatr*. 1994;52(1):1-7. Available from: <http://www.scielo.br/pdf/anp/v52n1/01.pdf>. Access at: Apr. 12<sup>nd</sup> 2021.
- <sup>13</sup> Mannato LW. Questionário de frequência alimentar ELSA-Brasil: proposta de redução e validação da versão reduzida. [dissertation on internet]. Vitória-ES: Mestrado em Saúde Coletiva, Universidade Federal do Espírito Santo, Vitória, 2013. Available from: <http://repositorio.ufes.br:8080/bitstream/10/5682/1/Livia%20Welter%20Mannato.pdf>. Access at: Mar. 2<sup>nd</sup> 2021.
- <sup>14</sup> Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Alimentos regionais brasileiros. [internet] 2<sup>th</sup>. Brasília: Ministério da Saúde; 2015 [cited Apr. 10<sup>th</sup> 2021]. ISBN: 978-85-334-2145-5. Available from: [http://bvsm.sau.gov.br/bvs/publicacoes/alimentos\\_regionais\\_brasileiros\\_2ed.pdf](http://bvsm.sau.gov.br/bvs/publicacoes/alimentos_regionais_brasileiros_2ed.pdf)
- <sup>15</sup> Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças Não-Transmissíveis. Vigitel Brasil 2019: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. [internet]. Brasília, DF: Ministério da Saúde; 2020 [cited Apr. 20<sup>th</sup> 2021]. CDU: 616.039.33. Available from: [http://bvsm.sau.gov.br/bvs/publicacoes/vigitel\\_brasil\\_2019\\_vigilancia\\_fatores\\_risco.pdf](http://bvsm.sau.gov.br/bvs/publicacoes/vigitel_brasil_2019_vigilancia_fatores_risco.pdf)
- <sup>16</sup> Besspalhuk KTP, Ferreira LVC, Mendes PA, Reiners AAO, Azevedo RCS, Vendramini ACMG. Prevalência de sintomas depressivos em idosos atendidos em unidades de saúde de família e fatores associados. *Rev Enferm UFSM*. 2021;11:34. Available from: <https://periodicos.ufsm.br/reufsm/article/view/48484/html>. Access at: Mar. 5<sup>th</sup> 2022.
- <sup>17</sup> Hellwig N, Munhoz TN, Tomasi E. Sintomas depressivos em idosos: estudo transversal de base populacional. *Ciênc Saúde Colet*. 2016;21:3.575-3.584. DOI: <https://doi.org/10.1590/1413-812320152111.19552015>. Available from: <https://www.scielosp.org/article/csc/2016.v21n11/3575-3584/pt/>. Access at: Mar. 5<sup>th</sup> 2022.
- <sup>18</sup> Zionko JA, Scheid VN, Vieira GA, Naszeniak TF, Zanelatto C, Koehnlein EA. Consumo regular de alimentos ricos em compostos bioativos e nutrientes antioxidantes e estado cognitivo de idosos. *Demetra*. 2022;17:53955. DOI: 10.12957/demetra.2022.53955. Available from: <https://www.e-publicacoes.uerj.br/index.php/demetra/article/view/53955>. Access at: Mar. 5<sup>th</sup> 2022.
- <sup>19</sup> Oliveira HSB, Buffalob HC, Cierib IF, Nassifb LN, Fonaib VMA, Mansoa MEG. Baixos níveis de atividade física associados a declínio cognitivo, sintomas depressivos e dificuldade de mobilidade em idosos vinculados a uma operadora de saúde. *Geriatr Gerontol Aging* 2019 oct:205-10. DOI: 10.5327/Z2447-211520191900053. Available from: [https://cdn.publisher.gn1.link/ggaging.com/pdf/GGA\\_1900053\\_PT\\_AOP.pdf](https://cdn.publisher.gn1.link/ggaging.com/pdf/GGA_1900053_PT_AOP.pdf). Access at: Mar. 6<sup>th</sup> 2022.

- <sup>20</sup> Reichert CL, Diogo CL, Vieira JL, Dalacorte RR. Atividade física e sintomas depressivos em idosos sul-brasileiros da comunidade. *Braz J Psychiatry*. 2011 Jun.;33(2):165-170. DOI: <https://doi.org/10.1590/S1516-44462011005000006>. Available from: <https://www.scielo.br/j/rbp/a/F5tyDSwXtQyp7vdyN5D9xXp/?lang=en#>. Access at: Mar, 6<sup>th</sup> 2022.
- <sup>21</sup> Horacio PR, Avelar NCP, Danielewicz AL. Comportamento sedentário e declínio cognitivo em idosos comunitários. *RBAFS*. 2021;26:1-8. DOI: 10.12820/rbafs.26e0190. Available from: <https://rbafs.org.br/RBAFS/article/view/14468/11148>. Access at: Mar. 6<sup>th</sup> 2022.
- <sup>22</sup> Ribeiro DKDMN, Lenardt MH, Michel T, Setoguchi LS, Grden CRB, Oliveira ESD. Fatores contributivos para a independência funcional de idosos longevos. *Rev Esc Enferm USP*, 2015 nov;49:89-96. DOI: 10.1590/S0080-623420150000100012. Available from: <https://www.scielo.br/j/reeusp/a/6YwPgbHx4S5Dq8dqXbNd76C/?format=pdf&lang=pt>. Access at: Mar. 6<sup>th</sup> 2022.
- <sup>23</sup> Brito KQD, Menezes TND, Olinda RAD. Incapacidade funcional: condições de saúde e prática de atividade física em idosos. *Rev Bras Enferm*. 2016 Sept./Oct.;69:825-832. DOI: <https://doi.org/10.1590/0034-7167.2016690502>. Available from: <https://www.scielo.br/j/reben/a/PdZPJSHkXpyzYhwhVmV4ffP/?format=html&lang=pt>. Access at: Mar. 6<sup>th</sup> 2022.
- <sup>24</sup> Silveira EA, Martins BB, Abreu LRS, Cardoso CKD. Baixo consumo de frutas, verduras e legumes: fatores associados entre idosos de uma cidade do Centro-Oeste brasileiro. *Ciênc Saúde Colet*. 2015;20(12). DOI: 10.1590/1413-812320152012.07352015. Available from: <https://www.proquest.com/openview/c6a6f78a913e6e4b83a7c0682cb79d20/1?pq-origsite=gscholar&cbl=2034998>. Access at: Mar. 1<sup>st</sup> 2022.
- <sup>25</sup> Silva ADM, Palma SW, Rosa M, Dallepiane LB. Marcador Inflamatório, Consumo de Energia, Frutas, Legumes e Verduras em Idosos. *Rev Contexto Saúde*. 2020;20(41):54-61. DOI: <https://doi.org/10.21527/2176-7114.2020.41.54-61>. Available from: <https://revistas.unijui.edu.br/index.php/contextoesaude/article/view/10604>. Access at: Feb. 18<sup>th</sup> 2022.
- <sup>26</sup> Secafim MV, Previdelli NA, Marques KM, Ferreira MPN, Freitas TI, Goulart RMM. Avaliação do consumo de frutas por idosos de São Caetano do Sul, São Paulo, Brasil. *Geriatr Gerontol Aging*. 2016 Mar.;10(2):57-63. DOI: 10.5327/Z2447-211520161021. Available from: [https://cdn.publisher.gn1.link/ggaging.com/pdf/GG\\_0001021.pdf](https://cdn.publisher.gn1.link/ggaging.com/pdf/GG_0001021.pdf). Access at: Feb. 26<sup>th</sup> 2022.
- <sup>27</sup> França VF, Barbosa AR, D'Orsi E. Cognição e indicadores de hábitos alimentares em idosos do sul do Brasil. *PLoS One*. 2016 Feb.;11(2):e0147820. DOI: <https://doi.org/10.1371/journal.pone.0147820>. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0147820>. Access at: Mar. 12<sup>nd</sup> 2022.
- <sup>28</sup> Dausacker UP, Barbiero SM, Lockmann AS, Rosa LHT, Ferreira LF. Relação entre a qualidade alimentar e sintomas depressivos em idosos de Porto Alegre: estudo transversal. *SDH*. 2020 Sept.;8(3):149-54. DOI: 10.18316/sdh.v8i3.7015. Available from: [https://www.researchgate.net/publication/347659780\\_Relacao\\_entre\\_a\\_qualidade\\_alimentar\\_e\\_sintomas\\_depressivos\\_em\\_idosos\\_de\\_Porto\\_Alegre\\_estudo\\_transversal](https://www.researchgate.net/publication/347659780_Relacao_entre_a_qualidade_alimentar_e_sintomas_depressivos_em_idosos_de_Porto_Alegre_estudo_transversal). Access at: Feb. 26<sup>th</sup> 2022.
- <sup>29</sup> Grases G, Colom MA, Sanchis P, Grainhas F. Possible relation between consumption of different food groups and depression. *BCM Psychology*. 2019 Mar.;(14). Available from: <https://bmcpyschology.biomedcentral.com/articles/10.1186/s40359-019-0292-1>. Access at: Feb. 28<sup>th</sup> 2022.
- <sup>30</sup> Mendes-Chiloff CL, Lima MCP, Torres AR, Santos JLF, Duarte YO, Lebrão ML *et al*. Sintomas depressivos em idosos do município de São Paulo, Brasil: prevalência e fatores associados (Estudo SABE). *Rev Bras Epidemiol*. 2019 Feb.;21:e180014. DOI: <https://doi.org/10.1590/1980-549720180014.supl.2>. Available from: <https://www.scielo.org/article/rbepid/2018.v21suppl2/e180014/>. Access at: Feb. 26<sup>th</sup> 2022.

Received: March 27, 2023

Accepted: September 19, 2023

Published: March 27, 2024

#### Authors' Contributions:

Luana Alberti Noronha: Conceptualization, investigation, formal analysis, writing – original draft, review & editing.

Eloá Angélica Koehnlein: Conceptualization, formal analysis, project administration, supervision, writing – original draft & review.

Camila Tureck: Conceptualization, data curation, investigation, writing – original draft.

Sabrina Gauto Silveira Fagundes: Data curation, investigation.

Ana Paula de Mello: Data curation, investigation.

**Conflict of interest:** There are no conflicts of interest.

**Financing:** Does not have financing.

**Corresponding Author:**

Eloá Angélica Koehnlein

Federal University of Fronteira Sul

Campus Realeza/PR. Brazil Rodovia PR 182 – Km 466. Avenida Edmundo Gaievski, 1000. Cx Postal 253,  
CEP 85770-000

eloa.koehnlein@uffs.edu.br

**Editor:** Dr. Giuseppe Potrick Stefani

**Editor-in-chief:** Dr. Adriane Cristina Bernat Kolankiewicz

This is an open access article distributed under the terms of the Creative Commons license.

