

Are clusters of physical activity, diet and sedentary behavior associated with mental health in Brazilian older adults?

Agrupamentos de atividade física, dieta e comportamento sedentário estão associados à saúde mental em idosos brasileiros?

¿Las combinaciones de actividad física, dieta y comportamiento sedentario están asociadas con la salud mental en los ancianos brasileños?

Carla Elane Silva dos Santos <https://orcid.org/0000-0002-3659-6921>¹; Adalberto Aparecido dos Santos Lopes <https://orcid.org/0000-0002-3001-6412>²; Joel de Almeida Siqueira Junior <https://orcid.org/0000-0002-2368-0446>¹; Eleonora d'Orsi <https://orcid.org/0000-0003-2027-1089>³; Thiago Sousa Matias <https://orcid.org/0000-0003-0241-3776>¹; Cassiano Ricardo Rech <https://orcid.org/0000-0002-9647-3448>¹

Abstract This study described the clustering of physical activity (PA), diet quality and sedentary behavior (SB), and examined the associations between these clusters and depressive symptoms and Mild Cognitive Impairment (MCI) in Brazilian older adults. The sample consisted of 1,261 subjects (≥ 60 years; 63% women) of EpiFloripa Aging Study (2017-2019). Depressive symptoms e MCI were screened by the Geriatric Depression Scale and Mini Mental State Examination, respectively. Weekly frequency of moderate-to-vigorous PA, diet and time spent on SB, were assessed by questionnaires. Two-step cluster analysis was used to identify patterns of behavior, and binary logistic regression was used to test the association between variables. Four clusters were identified: inactive/poor diet; inactive/healthy diet; sedentary/healthy diet and more active/healthy diet. Older adults with a "more active/healthy diet" profile were less likely to have mild cognitive impairment (OR: 0.48; 95%CI: 0.24-0.97) and depressive symptoms (OR: 0.36; 95%CI: 0.16-0.78) compared to the "inactive/poor diet" cluster. The analytical and conceptual cluster model suggested a beneficial association between the "more active/healthy diet" profile and mental health.

Key words Mental health, Aged, Healthy lifestyle

Resumo Este estudo descreveu agrupamentos de atividade física (AF), qualidade da dieta e comportamento sedentário (CS), e analisou as associações entre os agrupamentos e sintomas depressivos e comprometimento cognitivo (CCL) em idosos brasileiros. A amostra foi composta de 1.261 participantes (≥ 60 anos; 63mulheres) do estudo EpiFloripa Idoso. Sintomas depressivos e CCL foram rastreados pela Escala de Depressão Geriátrica e Mini Exame do Estado Mental, respectivamente. A frequência semanal de atividade física moderada-a-vigorosa, qualidade da dieta e tempo despendido em CS foram mensurados por questionários. Análise de agrupamento em duas etapas foi usada para identificar os padrões do estilo de vida, e a regressão logística binária foi usada para testar as associações entre as variáveis. Quatro agrupamentos foram identificados: inativo/dieta pobre; inativo/dieta saudável; sedentário/dieta saudável e mais ativo/dieta saudável. Idosos com perfil "mais ativo/dieta saudável" tiveram menos chance de CCL (OR: 0,48; IC95%: 0,24-0,97) e sintomas depressivos (OR: 0,36; IC95%: 0,16-0,78) quando comparados ao agrupamento "inativo/dieta pobre". O modelo de agrupamento analítico e conceitual sugeriu associação benéfica entre o perfil "mais ativo/dieta saudável" e saúde mental.

Palavras-chave Saúde mental, Idoso, Estilo de vida saudável

Resumen Este estudio describió grupos de actividad física (AF), calidad de la dieta y comportamiento sedentario (CS), y analizó las asociaciones entre estos grupos y los síntomas depresivos y el deterioro cognitivo (DC) en brasileños mayores. La muestra consistió en 1.261 participantes (≥ 60 años; 63 mujeres) del estudio EpiFloripa Idoso. Los síntomas depresivos y el DC se evaluaron utilizando la Escala de Depresión Geriátrica y el Mini-Examen del Estado Mental, respectivamente. La frecuencia semanal de actividad física moderada a vigorosa, la calidad de la dieta y el tiempo dedicado al CS se midieron mediante cuestionarios. Se utilizó un análisis de grupos de dos etapas para identificar patrones de estilo de vida, y se utilizó una regresión logística binaria para probar las asociaciones entre las variables. Se identificaron cuatro grupos: dieta inactiva/mala; dieta inactiva/saludable; dieta sedentaria/saludable; y dieta más activa/saludable. Los adultos mayores con una dieta más activa/saludable presentaron una menor probabilidad de deterioro cognitivo leve (OR: 0,48; IC del 95 %: 0,24-0,97) y síntomas depresivos (OR: 0,36; IC del 95 %: 0,16-0,78) en comparación con el grupo con una dieta inactiva/mala. El modelo de agrupamiento analítico y conceptual sugirió una asociación beneficiosa entre la dieta más activa/saludable y la salud mental.

Palabras clave Salud mental, Adultos mayores, Estilo de vida saludable

¹ Programa de Pós-Graduação em Educação Física, Universidade Federal de Santa Catarina. Campus Universitário Reitor João David Ferreira Lima, Prédio administrativo, Centro de Desportos, sala 200, 2º andar, Trindade. 88040-900 Florianópolis SC Brasil. carlaef_uesb@hotmail.com

² Programa de Pós-Graduação em Ambiente e Saúde, Universidade do Planalto Catarinense. Lages SC Brasil.

³ Programa de Pós-Graduação em Saúde Coletiva, Universidade Federal de Santa Catarina. Florianópolis SC Brasil.

Background

The world's population is aging rapidly, and with it the concern for the mental health of older people is growing¹. It is estimated that depressive symptoms affect around 28.4% of the older population worldwide², while the prevalence of mild cognitive impairment (MCI) ranges from 5% to 41%³. Evidence indicates that adopting healthy behaviors, including regular physical activity (PA), consuming a healthy diet and reducing time sedentary behavior (SB), contributes to reducing the risks of depressive symptoms^{4,5} and MCI in older adults^{6,7}.

While the underlying mechanisms of these mental conditions are not fully understood, studies show that engaging in physical activity alone improves cognitive outcomes by reducing pro-inflammatory cytokines, such as tumor necrosis factor- α and interleukin-6, commonly known in neurodegenerative diseases⁸. PA triggers an increase in levels of brain-derived neurotrophic factor and contributes to the release of hormones associated with well-being, such as noradrenaline and serotonin⁹. This process promotes improvement in depression symptoms⁹. Additionally, physical activity can boost self-esteem and self-confidence among older adults⁹.

The literature also observes gains in memory and attention with the intake of nutritious foods¹⁰. Consuming fish¹¹, flavonols, and monomeric teaflavins, mainly from teas¹², as well as having a higher dietary quality, is related to a lower likelihood of depressive symptoms in older adults¹³. There's potential synergy between consuming antioxidant-rich foods and engaging in physical activity for cognitive health¹⁴.

On the other hand, sedentary behavior (SB) is associated with elevated inflammatory status indicated by biomarkers such as C-reactive protein^{15,16} and interleukin-6¹⁶, as well as white matter hyperintensity¹⁷. These factors are considered causal influencers of depressive symptoms¹⁸ and MCI¹⁹. However, older adults who spend less than four hours per day in sedentary behavior show less cognitive impairment²⁰.

It's important to consider that PA, dietary habits and SB don't occur in isolation in the lives of older adults but may depend on a lifestyle that interrelates favorable and unfavorable behaviors. Generally, behavioral patterns characterized by higher levels of PA and less time spent in SB are associated with a lower risk of metabolic syndrome^{21,22} and a body composition more conducive to health²³. Furthermore,

older adults who habitually consume fruits and vegetables most days of the week and engage in regular PA are more likely to report life satisfaction²⁴. Specifically, regarding mental health, greater involvement in PA compared to SB has shown significant benefits in cognitive function^{25,26}. However, there's no evidence of synergy between PA and a healthy diet in cognitive function²⁷. In terms of depressive symptoms, the unfavorable combination of not meeting PA guidelines and spending excessive time in SB increased the chances of adverse outcomes in older adults⁴.

Studies investigating the synergy between PA, diet and SB in the mental health of older adults have been limited to analyzing only two of these components, either the relationship between PA and diet²⁷ or between PA and SB⁴. However, considering that PA, SB, and dietary habits are behaviors shaped over a lifetime and susceptible to modifications²⁸, exploring these aspects collectively may provide valuable insights for mental health care²⁹.

The development of interventions considering multiple health behaviors requires a thorough understanding of how these behaviors cluster in different individual profiles. In this regard, cluster analysis is considered a multivariate data method recommended for its ability to group individuals into mutually exclusive sets, considering similar characteristics and behaviors³⁰. Previous studies with older adults have also employed cluster analysis as a clustering method^{22,23}. However, it is still not clear how lifestyle behaviors naturally cluster and whether they influence the risk of MCI and depressive symptoms in older adults.

Therefore, considering the potential of cluster analyses and the possibility of providing an integrated understanding of elderly care, the present study aimed to describe clusters of PA, dietary quality and SB, and examine the associations between these clusters and depressive symptoms and MCI in Brazilian older adults.

Methods

This is a cross-sectional study conducted by face-to-face interviews at the older adult's home, using data from the third wave (2017-2019) of the population-based cohort study entitled "EpiFloripa Aging Study - Health Conditions of Older Adults in Florianópolis, SC" (<https://epifloripaidoso.paginas.ufsc.br/#>). The sample consisted of older adults (≥ 60 years old) of

both sexes, living in the urban area of the city, capital of Santa Catarina state, southern Brazil. The city has a high Human Development Index (HDI) compared to the national average (0.847 *versus* 0.755), with the longevity dimension being the one that most contributed to the HDI, followed by income and education, with indices of 0.873, 0.870 and 0.800, respectively³¹. The study was approved by the Federal University of Santa Catarina's Research Ethics Committee involving human beings (approval No. 16731313.0.0000.0121).

Sampling and selection of participants

The sampling plan of the third wave carried out in 2017/2019 (1,335 older adults) was based on the sampling technique used in the first wave of the study, in 2009/2010 (1,702 older adults), then in 2013/2014 follow-up (1,197 older adults)³², as well as on demographic census data to guarantee the representativeness of the older adults residing in the urban area of the city. With the third wave, the cohort became open and included new older adults belonging to the census sectors of the first wave, and those who participated in the Epifloripa Adult (*EpiFloripa Adulto*) study (2009-2010), and who turned 60 years of age as of July 2018³³. Were included older adults (≥ 60 years) and were excluded institutionalized.

Outcomes

Presence of depressive symptoms was obtained by applying the Geriatric Depression Scale (GDS), validated and adequate for the Brazilian older adults³⁴. The original English version³⁵ was translated into Portuguese and then back-translated into English by an independent translator. The English back-translation was compared to the original instrument, and minor adjustments were made to produce the final Brazilian version of the scale³⁴. This instrument is composed of 15 questions and with answer options (yes/no). The instrument has a score that varies from zero (absence of depressive symptoms) to fifteen (maximum score of depressive symptoms). The cutoff point ≥ 6 points was considered indicative of the presence of depressive symptoms in older adults³⁴.

Mild cognitive impairment was assessed using the Mini-Mental State Examination (MMSE), which is considered a cognitive assessment test that covers the domains of temporal and spatial orientation, recent and recall

memory, calculation, comprehension and writing³⁶. The MMSE score can range from 0 to 30 points, and the presence of cognitive decline was considered when the older adults without schooling achieved scores < 19 , while < 24 points were considered among those with some educational level³⁷. The MMSE presented a sensitivity of 80.0% and a specificity of 70.9% for the diagnosis of dementia among older adults without schooling; and 77.8% and 75.4% of sensitivity and specificity, respectively, for those with school history³⁷.

Exposure

The behavioral cluster, considered as the exposure variable, was built taking the following variables into account: 1) the weekly frequency of moderate to vigorous physical activity (MVPA) during leisure time, measured with the long version of the International Physical Activity Questionnaire (IPAQ), adapted and validated for Brazil's older population (36 women and 29 men)^{38,39}; 2) sedentary behavior (min/day), operationally obtained by self-reporting of average screen time (watching television or using the computer), performed in the sitting, lying or reclining position⁴⁰. The instrument used to measure sedentary behavior (Measure of Older Sedentary Time) demonstrated consistent test-retest reliability, making it suitable for use with older adults⁴⁰. The cross-culturally adapted for Brazilian older adults also showed appropriate psychometric properties for assessing sedentary behavior⁴¹; and 3) food consumption (weekly frequency)⁴², obtained by self-reporting of the frequency of days of the week (0-7 days) in which the following foods are consumed: 3.1) vegetables (raw or cooked with food or in soup, except for potatoes, cassava or yam); 3.2) fruits (fresh); 3.3) beans; 3.4) whole grains (containing ingredients such as oatmeal, flaxseed, quinoa, granola, brown rice, whole wheat pasta, etc.); 3.5) fried foods (foods with a lot of fat in their preparation); 3.6) sugary drinks (soda and artificial juice), and 3.7) sweets (ice cream, cake, chocolates, cookies and pastries). The first four food groups were considered unprocessed/minimally processed⁴³, and the other items, as ultra-processed. A score was created based on the frequency of consumption of the seven types of food to identify the nutritional diet quality. For the group of unprocessed/minimally processed foods, the scale ranged from 0 (no consumption) to 7 (every day); and for the ultra-processed group, the scale ranged from 7

(no consumption) to 0 (every day). Thus, the total score can range from 0 to 49 points, being that the higher the score the better the nutritional quality of the diet⁴⁴.

Control variables

We selected covariates identified in the literature as relevant to the relationship between outcomes and exposure⁴⁵⁻⁵¹: sex (male and female), age (completed in years), education (completed years) and living alone (yes/no) variables were included. Self-reported presence of diabetes and history of stroke were identified by the question “Has any doctor or health professional ever said that you currently have/have had?”, with yes/no as answer options. Functional dependence was assessed using the Brazilian Multidimensional Functional Assessment Questionnaire, adapted from the Old Americans Resources and Services, validated for Brazil⁵². The variable was categorized into no functional dependence (absence of dependence), mild dependence (dependence in one to three activities) and moderate/severe (dependence in four or more activities) within a set of 15 activities⁵².

Statistical analysis

Descriptive analyses were performed, including mean and standard deviation, relative and absolute frequencies, and 95% confidence intervals. Two-step cluster analysis³⁰ was used to form a cluster based on three variables: 1) MVPA (frequency/week); 2) sedentary behavior (min/week), and 3) diet (consumption/no consumption of unprocessed, minimally processed and ultra-processed foods). The number of clusters was based on the best combination of low Bayesian Information Criterion (BIC), the high proportion of distance measures, and the high proportion of BIC changes, as well as significant conceptual considerations. Cluster quality in the total dataset was analyzed by silhouette coefficient indicating cohesion and separation (silhouette ranging from -1 to +1; a high value indicates that the object matches well with its own cluster and poorly with neighboring clusters). The relative importance of each variable in the model was also observed. The importance of the predictor ranges from 0 to 1 (values close to 1 mean relatively greater importance). All three variables reached values equal to 1. Four clusters were identified in the sample of this study and labeled in accordance with the most pronounced behavioral profile.

Crude and adjusted logistic regression by covariates considered relevant in the literature⁴⁵⁻⁵¹ and their respective 95% confidence intervals (95%CI) were used to test the association between the outcomes (depressive symptoms and mild cognitive impairment) and the identified clusters (exposure). The significance level was set as $p < 0.05$ in all inferential statistics, considering the sample weights. Statistical analyses were performed using the Stata Statistical software (version 13; StatCorp LLC, College Station, TX), except for cluster analysis, which was performed using the Statistical Package for the Social Sciences software for Windows (version 23; SPSS Inc., Chicago, IL).

Results

A total of 1,335 older adults (between 60 and 108 years old) participated in the study. Of these, 53 interviews were considered losses because they were answered by caregivers, and 21 were due to incomplete data, an important condition for Two-Step cluster analysis. Thus, the final sample consisted of 1,261 older adults (age: 73.1 ± 7.7 , 63.1% women). In general, the older adults had 9.0 ± 6.1 years of schooling; 22.2% lived alone (95%CI: 19.6-24.1); performed MVPA less than one day/week (0.3 ± 0.8); spent >3 hours/day on sedentary behavior (220.6 ± 154.4); consumed vegetables (5.4 ± 2.2), fruits (6.3 ± 1.6), and beans (4.2 ± 2.5) most days of the week, and the average diet quality score was 26.5 (± 12.5). Among the older adults, 26% reported having diabetes (95%CI: 23.3-28.1), 8% had a history of stroke (95%CI: 7.6-10.8), and 38% had mild functional dependency (95%CI: 34.7-40.1). Presence of depressive symptoms and mild cognitive impairment stood at 14.7% (95%CI: 11.9-17.8) and 17.3% (95%CI: 14.1-21.1), respectively (Table 1).

Cluster profile description

Four behavioral clusters were identified in the sample of older adults and defined as “inactive/poor diet” (Cluster 1), “inactive/healthy diet” (Cluster 2), “sedentary/healthy diet” (Cluster 3), “more active/healthy diet” (Cluster 4), as shown in Figure 1. The “inactive/poor diet” profile (Cluster 1) profile represented a quarter of the sample (25.4%; 95%CI: 22.3-28.9) and was characterized by engagement in MVPA less than once/week; daily expenditure on sedentary behavior of approximately two hours, and worse diet quality score. The “inactive/healthy

diet” profile (Cluster 2) has the highest percentage of older adults (39.5%; 95%CI: 35.9-43.2), the lowest average weekly frequency of MVPA; high sedentary behavior (>3 hours/day), and better diet quality. The third cluster, “sedentary/healthy diet”, comprised 17.2% and included a weekly MVPA frequency of less than one day/week; more time spent on sedentary behavior (>8 hours/day), and a score of 25.3 points for diet quality. The “more active/healthy diet” profile (Cluster 4) accounted for 17.9 (95%CI: 15.4-20.6) of the sample and had the highest average weekly frequency of MVPA (1.7 days/week), daily expenditure of more than three hours/day on sedentary behavior, in addition to scoring 29.9 points on diet quality, which is above the group median (Table 2).

Association of cluster patterns and mental health

Table 3 shows that the older adults with a “more active/healthy diet” profile are less likely to have mild cognitive impairment (OR: 0.48; 95%CI: 0.24-0.97) and depressive symptoms (OR: 0.36; 95%CI: 0.16-0.78) compared to the “inactive/poor diet” risk cluster, after adjustment for confounding variables.

Discussion

This study described clusters of PA, SB, and dietary quality, and analyzed their association with depressive symptoms and MCI in older adults. Four lifestyle profiles were identified, encompassing different behaviors in their compositions. The majority of older adults were grouped into subgroups recognized as more negative (inactive/poor diet and inactive/healthy diet), while a smaller proportion (35.1%) exhibited more positive profiles: “sedentary/healthy diet” and “more active/healthy diet”.

Indeed, older adults are one of the age groups facing significant socioeconomic challenges, exposed to low levels of adherence to healthy behaviors, and consequently more susceptible to the onset of non-communicable chronic diseases, including mental health issues⁵³. At least two risk factors are present in the lifestyle of older adults^{54,55}. However, previous studies have emphasized the importance of considering both the presence of positive and negative behaviors in analytical models, as they coexist among older adults^{22,23}. Additionally, a combination of multiple behaviors will better predict the overall

Table 1. Characteristics of the participants of the EpiFloripa Aging Study, 2017-2019 (n=1,261).

Variables	Total	95% CI
Sociodemographic		
Women [n (%)]	774 (63.1)	58.6-64.0
Age (years) [†]	73.1 (±7.7)	
Schooling (years) [†]	9 (±6.1)	
Living alone [†]	275 (22.2)	19.6-24.1
Behavioral[†]		
MVPA (weekly frequency)	0.3 (±0.8)	
Sedentary behavior (min/day)	220.6 (±154.4)	
Food consumption (weekly frequency)		
Vegetables	5.4 (±2.2)	
Fruits	6.3 (±1.6)	
Bean	4.2 (±2.5)	
Integrals	3.4 (±3.2)	
Fried Foods	1.2 (±1.6)	
Sugary drinks	1.5 (±2.4)	
Candies	2.4 (±2.6)	
Diet quality	26.5 (±12.5)	
Health conditions [n (%)]		
Presence of depressive symptoms		
No	1,009 (85.3)	83.3-87.4
Yes	171 (14.7)	11.9-17.8
Presence of mild cognitive impairment		
No	1,044 (82.7)	81.1-85.2
Yes	209(17.3)	14.1-21.1
Stroke	115 (8.1)	7.6-10.8
Diabetes	324 (26)	23.3-28.1
Functional dependency		
No dependency	396 (30.2)	29.3-34.5
Mild	464 (38)	34.7-40.1
Moderate/severe	380(31.8)	28.1-33.2

[†] Value expressed as mean and standard deviation; MVPA: moderate to vigorous physical activity; CI: Confidence Interval.

Source: Authors.

lifestyle of older adults, providing a more realistic view for healthcare interventions^{22,23}.

In this study, only the older adults with a “more active/healthy diet” profile were less likely to have MCI. Although the mechanisms underlying these mental conditions are not fully understood, studies show that adopting a diet rich in healthy foods not only reduces the presence of inflammatory markers⁷, but also regulates BDNF⁵⁶, leading to significant improvements in memory and attention¹⁰. In addition, MVPA recognized as an ally in maintaining cognitive function^{50,57}, has been shown to increase brain cortical plasticity, improve neurological con-

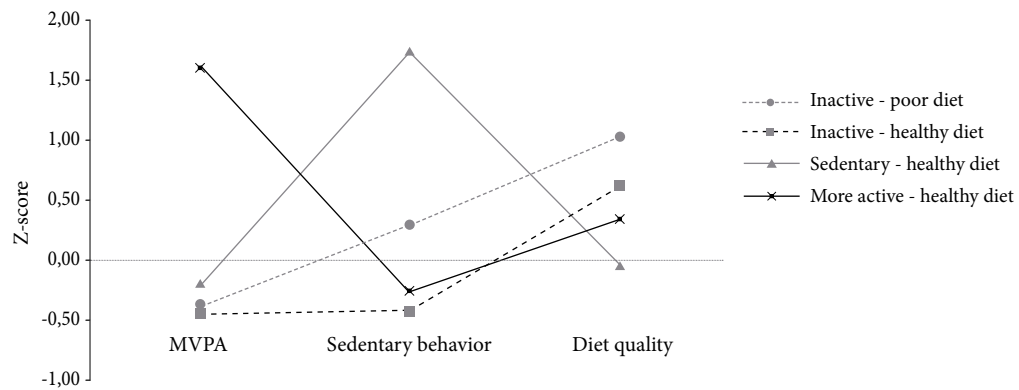


Figure 1. Mean z-score of moderate-to-vigorous physical activity, sedentary behavior and diet quality according to cluster profiles in older adults Brazilians. EpiFloripa Aging Study, 2017-2019 (n=1,261).

Note: MVPA: moderate to vigorous physical activity.

Source: Authors.

Table 2. Cluster profiles according to the frequency of physical activity, sedentary behavior and diet quality in older adults Brazilians. EpiFloripa Aging Study, 2017/2019 (n=1,261).

Exposure	Cluster 1	Cluster 2	Cluster 3	Cluster 4
	Inactive-poor diet (n=348)	Inactive-healthy diet (n=460)	Sedentary-healthy diet (n=213)	More active-healthy diet (n=240)
	Mean±(SD)	Mean±SD	Mean±SD	Mean±SD
MVPA	0.03±(0.18)	0.00±(0.00)	0.18±(0.43)	1.70±(1.00)
Sedentary behavior	174.8±(92.9)	153.5±(79.2)	488.9±126.8	177.7±(94.8)
Diet quality	13.9±(5.8)	32.9±(7.28)	25.3±(12.1)	29.8±(9.9)

SD: standard deviation; MVPA: moderate to vigorous physical activity.

Source: Authors.

Table 3. Logistic regression of behavioral cluster profile and mental health in older adults. EpiFloripa Aging Study, 2017-2019 (n=1,261).

Cluster profiles	n (%)	Mild cognitive impairment		n (%)	Depressive Symptoms	
		Crude	Adjusted		Crude	Adjusted
		OR (CI95%)	OR (CI95%) [†]		OR (CI95%)	OR (CI95%) ^{††}
Inactive/ poor diet	83 (23.9)	1	1	64 (19.0)	1	1
Inactive/ healthy diet	69 (15.2)	0.48 (0.25-0.91)*	0.64 (0.33-1.23)	53 (12.3)	0.47 (0.26-0.83)*	0.54 (0.28-1.01)
Sedentary/ healthy diet	35(16.5)	0.67 (0.41-1.11)	0.69 (0.40-1.19)	41 (20.9)	0.09 (0.51-1.64)	0.89 (0.46-1.71)
More active/ healthy diet	22 (9.3)	0.20 (0.10-0.42)**	0.48 (0.24-0.97)*	13 (6.0)	0.21 (0.09-0.47)**	0.36 (0.16-0.78)*

n: absolute frequency; %: relative frequency; OR: odds ratio; CI95%: 95% confidence interval; *p<.005; **p<.001. [†]Adjusted for sex, age, years of schooling, stroke, diabetes and functional dependence. ^{††}Adjusted for sex, age, years of schooling, living alone, cognitive decline and functional dependence.

Source: Authors.

nectivity⁵⁸ and enhance cognitive performance over time⁵⁹. In addition, there appears to be a potential synergy between the consumption of antioxidant-rich foods and physical activity for cognitive health¹⁴. Despite the presence of sedentary behavior (score below the sample average) that may reduce cognitive function⁵⁰ in the “more active/healthy diet” cluster, a reduction in the likelihood of MCI was observed. In this sense, a lifestyle associated with more positive factors seems to protect mental health. Therefore, healthcare should pay more attention to valuing different behaviors⁶⁰ to reduce the likelihood of MCI in older adults.

In this study, the older people with the “more active/healthy diet” profile also had a lower risk of depressive symptoms. Although there are no specific studies on the behavioral synergy of lifestyle in relation to depressive symptoms, it is known that regular physical activity is an ally in reducing depressive symptoms in the older adults. Apparently, physical activity triggers an increase in BDNF levels and, together with the release of hormones associated with well-being, such as noradrenaline and serotonin, contributes to an improvement in depressive symptoms⁹. PA can also increase self-esteem and self-confidence in older people⁹.

When performed in groups, PA still promotes the formation of bonds and a broader support network, leading to a reduction in depressive symptoms^{61,62}. On the other hand, the unfavorable combination of non-compliance with physical activity guidelines and excessive sedentary behavior increases the risk of negative outcomes in older adults⁴. Fish consumption¹¹ and a high-quality diet are associated with a lower likelihood of depressive symptoms in older adults¹³. Considering lifestyle behavioral synergy in the development of public policies may be an effective strategy to promote mental health in older adults.

Given the significant influence that lifestyle clusters exert on MCI and depressive symptoms among older adults, the development of health interventions with an interprofessional team and a multi-component approach appears promising. Initiatives such as memory workshops⁶³ and cognitive stimulation programs⁶⁴ not only stimulate cognition but also promote socialization^{63,64} and engagement in PA⁶³ among older adults. Organizing social groups for older adults in Primary Health Care with a focus on various leisure activities can foster the building

of bonds and autonomy in living⁶⁵. Additionally, interventions with participatory approaches can guide lifestyle changes, including diet and physical activity, providing mental health benefits for older adults⁶⁶.

When interpreting the results of this study, some limitations must be considered and extrapolations should be made with caution. Due to the continental characteristics of Brazil, the findings may differ from the national scenario, as they reflect the contextual characteristics of a single city in the southern region of Brazil, which has a high HDI³¹. Survivorship bias may have reduced the prevalence of MCI and depressive symptoms, as these are directly related to mortality^{67,68}. Given that the sample predominantly consisted of older adults who self-identified as white (88%), the race/color variable was not considered in the study analysis due to its limited contribution. The lack of research on the relationship between lifestyle clusters and mental health made it difficult to compare the findings. Furthermore, due to the cross-sectional design, it was not possible to draw causal conclusions between lifestyle clusters and MCI and depressive symptoms.

On the other hand, the methodology using representative data from the older adult population of a large city with over 485 thousand inhabitants³¹ allowed for greater statistical certainty in the formation of the clusters and the identification of coexisting lifestyle behaviors³⁰. We selected a set of behavioral variables relevant to mild cognitive impairment (MCI) and depressive symptoms. In addition, the organization of the design and data collection, including the standardized training of interviewers and the use of validated questionnaires for older adults³³, is considered a strength of the present study.

Conclusion

The lifestyle cluster characterized by a higher weekly frequency of MVPA, moderate time of sedentary behavior, and higher diet quality was inversely associated with MCI and depressive symptoms in older adults. The analytical and conceptual cluster model suggested a beneficial association between the “more active/healthy diet” profile and mental health. These findings reflect the need to value mental health interventions focused on a person-centered analysis rather than isolated behavioral patterns.

Collaborations

All authors made important contributions and met the criteria for authorship of this study. CES Santos was involved in all phases of the study design, data analysis, preparation of graphical representations, literature search, interpretation of results and writing of the manuscript. AAS Lopes contributed to the data analysis writing and provided critical manuscript review and critical review of the manuscript. JA Siqueira Junior contributed to the writing of the manuscript and provided critical manuscript review at all stages. E d'Orsi acted as senior reviewer, contributed to providing critical manuscript review at all stages. She was also responsible for the organization and coordination of the Epi-Floripa Aging study. TS Matias was involved in all phases of the study design, data analysis, preparation of graphical representations and interpretation of results. CR Rech acted as mentor and senior reviewer, contributed to the conceptualization and initial design of the study, and critically reviewed the manuscript throughout all stages.

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Data availability statement

The data sources adopted in the research are indicated in the article's body.

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