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LIFESTYLE PATTERNS AMONG PORTUGUESE YOUNG ADULTS: CHARACTERIZATION AND ASSOCIATION WITH HEALTH OUTCOMES

PADRÕES DE ESTILO DE VIDA NOS JOVENS ADULTOS PORTUGUESES: CARACTERIZAÇÃO E ASSOCIAÇÃO COM ASPETOS RELACIONADOS COM A SAÚDE

A.O.
ARTIGO ORIGINAL

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ABSTRACT

INTRODUCTION: Unhealthy lifestyle factors tend to co-occur and are associated with an increased risk of non-communicable diseases.
OBJECTIVES: To assess lifestyle patterns of Portuguese young adults and its associations with nutritional status and self-perceived health.
METHODOLOGY: The study sample comprises young adults (18-35 years) from the National Food, Nutrition and Physical Activity Survey of the Portuguese population, 2015-2016 (n=1026). Computer-assisted personal interviews were performed to collect dietary intake (non-consecutive 2*24h recalls), alcohol consumption (food propensity questionnaire), physical activity (IPAQ and sitting time), sleep time, and smoking habits. A Healthy Eating Index was defined based on World Health Organization recommendations. Latent class analysis was executed to identify lifestyle patterns. Logistic regression models were used to estimate associations between patterns and outcomes (self-perceived health, overweight/obesity, waist-to-hip ratio).
RESULTS: Two latent classes were identified: LC1- "Healthier diet, alcohol, and tobacco behaviors" (63.3% females; 53.4% 26-35yrs) and LC2- "Less sedentary and unhealthier alcohol and tobacco behaviors" (lower sitting time, higher probability of smoking and drinking alcoholic beverages) (42.4% females; 61.2% 26-35yrs). Individuals in the LC2 pattern have increased odds of higher protein, trans fatty acids, saturated fatty acids, and sodium intake, however, these associations are energy dependent. After adjustment for confounders and age-stratified analysis, individuals aged 18-to-25yrs in the LC2 pattern reported poorer perceived health (OR=3.20, 95%CI:1.97;5.24) and increased odds of central obesity (OR=2.44, 95%CI:1.16;5.24). However, adults aged 26-to-35yrs presented lower odds of overweight/obesity (OR=0.67; 95%CI=0.47;0.95).
CONCLUSIONS: These findings highlight how lifestyles cluster in Portuguese young adults, showing differential aggregation of diet and physical activity with the remaining behaviors. Also, less sedentary individuals aged 18-to-25 years with unhealthier alcohol and smoking behaviours presented more central adiposity and worse perceived health. However, the 26-to-35-year age group in the same pattern was less frequently obese.

KEYWORDS
Adiposity, Lifestyle patterns, Self-perceived health, Young adults

RESUMO

INTRODUÇÃO: Os comportamentos de estilo de vida considerados menos saudáveis tendem a co-ocorrer e associar-se a maior risco de desenvolver doenças crónicas.
OBJETIVOS: Identificar padrões de estilo de vida nos jovens adultos portugueses e a sua associação com o estado nutricional e de saúde auto-percecionada.
METODOLOGIA: Este estudo incluiu 1026 adultos jovens (18-35 anos) avaliados no Inquérito Alimentar Nacional e de Atividade Física 2015/2016. Entrevistas assistidas por computador foram realizadas para avaliar: consumo alimentar (2*24h), bebidas alcoólicas (questionário de propensão alimentar), atividade física (IPAQ e tempo sentado), sono e tabagismo. O *Healthy Eating Index* foi definido seguindo recomendações da Organização Mundial da Saúde. Realizou-se análise de classes latentes para identificar padrões de estilo de vida e modelos de regressão logística para estimar associações entre padrões e saúde auto-reportada, excesso de peso/obesidade e razão cintura/anca.
RESULTADOS: Identificaram-se 2 padrões: LC1 – "Comportamentos alimentares, de álcool e tabaco mais saudáveis" (63,3% Mulheres; 53,4% 18-25 anos) e LC2 – "Menos sedentários e comportamentos de álcool e tabaco menos saudáveis" (42,4% Mulheres; 61,2% 18-25 anos). Os indivíduos do padrão LC2 apresentam maior consumo de proteína, sódio, gorduras trans e saturadas, no entanto, estas associações são dependentes da ingestão energética. Após ajuste para confundidores e estratificação por idade, observou-se que os indivíduos dos 18-25 anos do padrão LC2 reportaram pior saúde (OR=3,20, 95%CI:1,97;5,24) e maior obesidade central (OR=2,44, 95%CI:1,16;5,24). No entanto, indivíduos dos 26-35 anos apresentaram menor excesso de peso/obesidade (OR=0,67; 95%CI=0,47;0,95).
CONCLUSÕES: Estes resultados descrevem uma agregação diferencial das dimensões da dieta e atividade física com os restantes comportamentos, nos adultos jovens portugueses. Além disso, os indivíduos menos sedentários, mas que bebem e fumam mais, com idades entre os 18-25 anos, apresentavam maior adiposidade central e pior estado de saúde auto-percecionado. Contudo, o grupo etário dos 26-35 anos do mesmo padrão era menos frequentemente obeso.

PALAVRAS-CHAVE
Adiposidade, Padrões de estilo de vida, Saúde auto-percecionada, Jovens adultos

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INTRODUCTION

Modifiable lifestyle factors such as unhealthy diet, excessive alcohol consumption, physical inactivity, smoking, and inadequate sleep habits are public health concerns since they tend to co-occur (1) and are associated with the development of non-communicable diseases (2, 3). In addition, scientific evidence seems to indicate that engaging in a greater number of unhealthy lifestyle behaviors is related to higher mortality risk (4).

The aggregation of unhealthy lifestyle habits tends to be more prevalent in younger ages. Data from the United States reveals that young adults eat less fruit and vegetables than older adults (5) and consume more sugar-sweetened beverages (6) as well as fast food (7). Moreover, a high prevalence of physical inactivity was described for young adults, increasing with age (8, 9). Portuguese data shows that 35.6% of young individuals aged 15-to-21 years are considered physically active, however, this percentage decreases to 27.3% when considering adults aged 22-to-64 years (10, 11).

The transition from adolescence to young adulthood is described as one of the main life phases where individuals start to smoke (12) and drink alcoholic beverages (13). Portuguese young adults aged 25-to-34 years have a particularly high tobacco use (prevalence of 59.5%) and, even though women tend to smoke less than men, in this age group, no significant differences were found (14). Additionally, at least 20% of Portuguese young individuals (15-to-34 years) have had one or more episodes of binge drinking in the last year (14). Furthermore, in the Portuguese population aged above 15 years, 25.8% of men and 8.5% of women have a high or excessive consumption of alcoholic drinks (>12g/day for women and >24g/day for men) (10).

Additionally, sleep problems are growing among young people (15), especially university students, showing higher rates of insomnia than the general population (16).

Adiposity outcomes have been linked to lifestyle patterns, particularly with diet and physical activity dimensions. Hence, some studies suggest an inverse association between healthier lifestyle patterns and central adiposity measured by waist-hip ratio (17, 18). Moreover, people who are more engaged in general healthy habits tend to have lower odds of overweight or obesity compared with individuals belonging to patterns mainly characterized by "unhealthy" behaviors (19).

On the other hand, scientific evidence seems to suggest that lifestyle patterns defined by unhealthy behaviors (low-quality diet, excessive alcohol consumption, insufficient physical activity, high sedentary time, and poor sleep habits) are related to poorer self-reported health (20, 21). Self-reported health is frequently used as an overall health indicator and a good predictor of mortality risk, with several studies describing its validity and reliability (22).

Although previous studies focused more on health and lifestyle behaviors individually and independently, it is relevant to understand the clustering of these factors and their association with health outcomes. Analyzing lifestyle patterns using a posteriori approach can contribute to identifying the groups at risk as well as their needs, and to the development of effective intervention programs.

OBJECTIVES

The objective of the present study is to assess lifestyle patterns of Portuguese young adults and its associations with nutritional intake, adiposity, and perceived health status.

METHODOLOGY

Design and Participants

The data used was obtained from the National Food, Nutrition and Physical Activity Survey of the Portuguese population 2015-2016 (Portuguese acronym: IAN-AF 2015-2016) (23, 24). Briefly, a representative sample of the Portuguese general population, aged between 3 months and 84 years, was recruited regarding the National Health Registry by multistage sampling, in each of the seven geographical regions (NUTS II) and weighed according to sex and age groups. Data collection occurred between October 2015 and September 2016 by trained professionals using an electronic platform (You eAT&Move). More information about the design and methods of the IAN-AF 2015-2016 survey can be found elsewhere (23, 24).

The survey included a total of 6553 participants who only completed the first interview and 5811 individuals who finished two interviews. For the current analysis, data from 1026 Portuguese adults aged between 18 and 35 years, with complete information, was analyzed.

Data Collection

Sociodemographic Data

Information about participants' sex, age, household composition, and level of education was collected. Moreover, geographical regions were defined according to NUTS II and also to the Portuguese National Institute of Statistics' classification of urban areas (25), and the region where participants lived was categorized into three different types: predominantly urban area, medium urban area, or predominantly rural area.

Dietary Data

For adults, the dietary intake was obtained by two non-consecutive 24h recalls, using the "eAT24" module in the software "You Eat&Move" (26). All foods, beverages, and dietary supplements ingested 24h prior to the interview were registered and quantified per eating occasion. Moreover, participants revealed whether the reported day was representative of their usual or unusual intake (describing reasons for unusual intake, such as illness or holiday) or if they follow a special diet (such as vegetarian or diabetic).

A Healthy Eating Index, previously applied in a sample of Portuguese children and adolescents (27), was used to assess participants' adherence to a healthy eating pattern, based on the World Health Organization recommendations. This index comprises nine food groups, including fruit and vegetables, cereals and potatoes, dairy products, white meat, fish and eggs, red meat and processed meat, salty snacks, sugar-sweetened beverages, sweets and cakes, sugar, and honey. A score ranging from 1 to 4 points was attributed to each food group, according to the respective quartiles, separated by age group. Food groups considered healthier (fruit and vegetables, cereals and potatoes, dairy products, white meat, fish, and eggs) had higher scores for higher consumption. For the other groups (red and processed meat, salty snacks, sugar-sweetened beverages, sweets, sugar, and honey) lower scores were attributed to higher consumption. The final score ranged from 9 to 36, with higher scores representing a greater level of adherence to a healthier eating pattern.

Alcohol Intake and Smoking Habits

The intake of alcoholic beverages was assessed using a Food Propensity Questionnaire. Participants were classified into three categories: 1. Non-drinkers - Adults who did not report any intake of alcoholic beverages; 2. Drinks <1 time/week - Young adults who consumed alcoholic beverages less than once a week; 3. Drinks ≥ 1 time/week - Participants drinking one or more times a week.

Regarding smoking habits, participants were categorized as: 1. "Never smokers"; 2. "Ex-smokers" if they smoked (daily or frequently) in the past, but not anymore in the present; 3. "Non-daily smokers" if they claim to smoke but not on a daily basis; and 4. "Daily smokers" if they report to smoke every day.

Physical Activity and Sleep Time

The short version of the International Physical Activity Questionnaire (IPAQ) (28) was used to measure the time spent, per week, in several dimensions of physical activity (e.g.: walking and moderate to vigorous physical activity), and in sedentary behaviors (e.g.: sitting time). According to IPAQ's scores, participants were classified as low active, moderately active, or highly active.

The questionnaire also considered questions to estimate sleep time, which was registered on weekdays and weekends. Regarding the American National Foundation's recommendations (29), three categories were created: 1. < 7h/day; 2. 7-9h/day (considered as the more adequate for this age group); 3. ≥9h/day.

Anthropometric Data and Health Status

Weight and height were objectively measured by trained professionals according to standard procedures (30). Weight was measured to the nearest tenth of a kilogram, with participants in a stand position wearing light clothes and barefoot, using a digital scale (SECA® 813, Hamburg, Germany). Height was measured to the closest centimeter, in the same conditions, using a portable stadiometer (SECA® 213, Hamburg, Germany). Body mass index (BMI) was calculated, and categories were defined according to WHO parameters (31). Participants were classified as "Overweight" if their BMI was ranging between 25.0 and 29.9 Kg/m^2 and as "Obese" if BMI ≥ 30 Kg/m^2. Waist and hip circumferences were also assessed for young adults using a measuring tape (SECA, model 201). Waist circumference measurement was performed at the end of a regular expiration, at the level of the narrowest point between the lower costal border and the top of the iliac crest, perpendicular to the long axis of the trunk. Hip circumference was measured at the level of the greatest posterior protuberance of the buttocks, perpendicular to the long axis of the trunk. The waist-hip ratio was calculated, and the cut-offs associated with a substantially increased risk of metabolic complications were defined as ≥ 0.85 in women and ≥ 0.90 in men (32).

To collect information about health status, young individuals were questioned if they had been diagnosed with a disease/condition that requires regular health care. Additionally, participants rated their health using a Likert scale ranging between "very low" and "excellent" creating two groups: one comprising young adults who rated themselves as having excellent or good health, and the other one including people with fair to very low health perception.

Statistical Analysis

Latent Class Analysis (LCA) was conducted to identify classes within the study sample, using 6 variables regarding physical activity level, sitting time, diet quality (Healthy Eating Index), smoking status, alcohol consumption, and sleep time. A series of LCA with 1 to 4 classes were tested to determine the number of patterns that best fitted the data, identifying the fewest number of classes that best characterized the combination of lifestyle factors. The Bayesian information criterion (BIC) was used to define the most suitable model and, consequently, the model with the lowest BIC value was selected.

A chi-square test was performed to compare frequencies of socio-demographic characteristics according to the lifestyle patterns.

Geometrical means and the respective standard deviation of total energy and nutrients were calculated according to the lifestyle patterns since most of the nutrients included did not follow a normal distribution. Crude and adjusted relative differences (RD) were obtained using linear regression models for a log-transformed outcomes. Three models were considered: a crude model; model 1 adjusted for education level and sex; model 2 adjusted for the same confounders as model 1 and for total energy intake. An interaction effect for age groups in the association between lifestyle patterns and nutrients intake was tested, but no effect was found, consequently the analysis comprised the whole sample.

Logistic regression was performed to evaluate the association between lifestyle patterns and health outcomes (overweight/obesity, waist-hip ratio, chronic diseases, and self-reported health status), obtaining odds ratio (OR) and the respective 95% confidence intervals (95%CI). An interaction effect was found for age group and the latent class variable (lifestyle patterns) and, for that reason, the ORs and 95%CI were calculated separately for each age group (18-to-25 years and 26-to-35 years). The models were adjusted for the above mentioned confounders (except for waist-hip ratio because the cut-off values used were already sex-specific).

Statistical analysis was performed in R studio software version 3.4.1.

RESULTS

To identify the lifestyle patterns, models from 1-4 classes were tested and the respective BIC values were obtained: 11983, 11962, 11991 and 12064. The best-fitted model, which corresponds to the lowest BIC value, highlighted two latent classes. Table 1 describes the marginal probabilities of variables included in the final model: LC1 - "Healthier diet, alcohol and tobacco behaviors" class (59.6% of the sample) with the highest probability of following a healthy quality diet, not smoking, and not consuming any alcoholic beverages, or consuming less than once a week, but with the highest probability of being classified as low active and spend more time sitting daily;

Table 1

Characterization of latent classes variable (lifestyle patterns)

	LC1*	LC2**
IPAQ category		
Low	39.3	34.9
Moderate	34.0	28.2
High	26.7	36.9
Sitting time		
First tercile	30.9	44.0
Second tercile	37.9	31.4
Third tercile	31.1	24.7
Healthy Eating Index		
First quartile	13.7	24.8
Second quartile	21.1	20.5
Third quartile	34.0	35.4
Fourth quartile	31.2	19.3
Smoking status		
Non-smoker	79.4	0
Ex-smoker	20	34.5
Non-daily smoker	0.7	13.8
Daily smoker	0	51.7
Alcohol consumption		
Non-drinker	30.4	4.1
<1 time/week	47.8	26.0
≥1time/week	21.8	69.9
Average night sleep time		
< 7 hours	19.6	24.3
[7-9[hours	69.7	67.2
≥ 9 hours	10.6	8.5

* LC1: "Healthier diet, alcohol and tobacco behaviors"

** LC2: "Less sedentary and unhealthier alcohol and tobacco behaviors"

IPAQ: International Physical Activity Questionnaire

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LC2 - "Less sedentary and unhealthier alcohol and tobacco behaviors" class (40.4% of the sample) with the highest probability of spending less time sitting per day, smoke on a daily basis, drink alcoholic beverages once a week or more, and have a lower score on Healthy Eating Index. Individuals in the LC2 pattern tend to be more physically active and sleep fewer hours per night, however, these variables were not considered relevant to distinguish between the two classes.

A significantly higher percentage of women (63.3%) belong to the LC1 pattern, while men are predominant in the LC2 class (57.6%). Moreover, both patterns have a higher percentage of individuals aged 26-to-35 years (53.4% in LC1 and 61.2% in LC2) compared to young adults between 18-to-25 years. Regarding health outcomes, 23.6% of individuals in the LC2 class are classified as having central obesity compared with 13.9% from the LC1 pattern. Furthermore, in this class 78.4% of young adults reported an "Excellent or good" health status, contrasting with 71.5% belonging to the LC2 pattern (Table 2). The associations between lifestyle patterns and nutrient intake (LC1 as the reference class) are present in Table 3. Individuals in the LC2 pattern tend to have a higher energy intake, even after adjustment for education level and sex (RD=1.05, 95%CI:1.04;1.14). They also consume considerably more trans and saturated fatty acids, protein, and sodium compared with individuals in the LC1 pattern.

Table 2

Socio-demographic characteristics and health outcomes of young adults by lifestyle pattern

	LC1* n (%)	LC2** n (%)	p-VALUE
	611 (59.6)	415 (40.4)	
Sex			
Female	387 (63.3)	176 (42.4)	
Male	224 (36.7)	239 (57.6)	**<0.001**
Age group			
Young adults (18-25 years)	285 (46.6)	161 (38.8)	
Adults (26-35 years)	326 (53.4)	254 (61.2)	**0.015**
Education level			
None,1st, and 2nd cycle	19 (3.1)	22 (5.3)	
3rd cycle and high school	374 (61.2)	267 (64.3)	**0.066**
Higher education	218 (35.7)	126 (30.4)	
Household			
< 3 members	345 (56.9)	269 (65.9)	
3-4 members	175 (28.9)	102 (25.0)	**0.007**
≥ 5 members	86 (14.2)	37 (9.1)	
Region type			
Predominantly urban areas	464 (76.0)	306 (73.7)	
Medium urban areas	101 (16.5)	76 (18.3)	**0.714**
Predominantly rural areas	46 (7.5)	33 (8.0)	
Overweight/obesity			
Yes	232 (38.3)	164 (39.7)	
No	373 (61.7)	249 (60.3)	**0.710**
Waist-hip ratio			
Central obesity	81 (13.9)	77 (23.6)	
Without central obesity	501 (86.1)	249 (76.4)	**0.043**
Chronic disease			
Yes	96 (15.7)	63 (15.2)	
No	515 (84.3)	352 (84.8)	**0.886**
Self-reported health			
Excellent and good	457 (78.4)	294 (71.5)	
Fair, low, and very low	126 (21.6)	117 (28.5)	**0.016**

* LC1: "Healthier diet, alcohol and tobacco behaviors"
** LC2: "Less sedentary and unhealthier alcohol and tobacco behaviors"

Table 3

Geometrical mean of nutrients and associations between lifestyle patterns and nutrients consumption

	MEAN (S.D) a.	CRUDE RD*** (95%CI)	MODEL 1 b. RD*** (95%CI)	MODEL 2 c. RD*** (95%CI)
Adults (18-35 years)				
Energy (Kcal)				
LC1*	1814 (1.39)	Ref.	Ref.	-
LC2**	2016 (1.46)	**1.11 (1.06; 1.16)**	**1.05 (1.01; 1.09)**	-
Protein (g)				
LC1*	83.10 (1.47)	Ref.	Ref.	Ref.
LC2**	90.41 (1.52)	**1.09 (1.04; 1.14)**	1.01 (0.97; 1.06)	0.96 (0.93; 1.00)
Fiber (g)				
LC1*	15.94 (1.51)	Ref.	Ref.	Ref.
LC2**	15.74 (1.56)	0.99 (0.94; 1.04)	0.95 (0.90; 1.00)	**0.91 (0.87;0.94)**
Trans fatty acids (g)				
LC1*	0.76 (2.15)	Ref.	Ref.	Ref.
LC2**	0.90 (2.14)	**1.18 (1.07; 1.3)**	**1.11 (1.01; 1.22)**	1.04 (0.96; 1.13)
Saturated fatty acids (g)				
LC1*	19.76 (1.59)	Ref.	Ref.	Ref.
LC2**	22.84 (1.70)	**1.16 (1.09; 1.23)**	**1.10 (1.04; 1.17)**	1.03 (0.99; 1.07)
Free sugars (g)				
LC1*	35.21 (2.84)	Ref.	Ref.	Ref.
LC2**	38.71 (3.49)	1.10 (0.95; 1.27)	1.06 (0.92; 1.22)	0.97 (0.85; 1.10)
Sodium (mg)				
LC1*	2748 (1.48)	Ref.	Ref.	Ref.
LC2**	3053 (1.54)	**1.11 (1.06; 1.17)**	1.04 (0.99; 1.10)	0.99 (0.96; 1.02)

* LC1: "Healthier diet, alcohol and tobacco behaviors"
** LC2: "Less sedentary and unhealthier alcohol and tobacco behaviors"
*** RD: Relative differences
a. Geometrical mean and standard deviation
b. Model 1: adjusted for education level and sex
c. Model 2: Adjusted for model 1 confounders and total energy intake

However, after adjustment for education and sex, only the fatty acids differences remained significant. When further adjusting for energy intake, all nutrients lost statistical significance, however, a lower probability for fiber consumption arises in this group (RD=0.91, 95%CI:0.87;0.94).

Associations between lifestyle patterns and health outcomes, using the LC1 as the reference class, can be found in Table 4. After age-stratified analysis and adjustment for education level, sex, and energy intake, younger individuals in the LC2 class have increased risk of central obesity defined by waist-hip ratio (OR=2.44, 95%CI:1.16;5.24). Nevertheless, adults in the 26-to-35-year age group belonging to the LC2 pattern show lower odds of overweight/obesity when the model is adjusted for sex, level of education and total energy (OR=0.67, 95%CI:0.47;0.95). Furthermore, individuals aged 18-to-25 years in the LC2 pattern report more frequently a poorer health (OR=3.20, 95%CI:1.97;5.24).

DISCUSSION OF THE RESULTS

In this study performed in a sample of Portuguese young adults aged 18-to-35 years, two lifestyle patterns were identified by latent class analysis: a "Healthier diet, alcohol, and tobacco behaviors" (LC1) pattern and a "Less sedentary and unhealthier alcohol and tobacco behaviors" (LC2) pattern. These classes show some similarities to others obtained in international studies analyzing adult populations

Table 4

Associations between lifestyle patterns and health outcomes, stratified by age group

	OW/OB OR (95% CI)	WAIST-HIP RATIO OR (95%)	CHRONIC DISEASE OR (95% CI)	SELF-REPORTED HEALTH OR (95% CI)
18-25 years				
Cases*, n (%)	126 (31.8)	32 (20.2)	60 (37.7)	91 (37.4)
Crude				
LC1**	Ref.	Ref.	Ref.	Ref.
LC2***	**1.55 (1.01,2.36)**	**2.49 (1.21,5.24)**	0.95 (0.53,1.66)	**3.01 (1.88,4.86)**
Model 1[a.]				
LC1**	Ref.	Ref.	Ref.	Ref.
LC2***	1.41 (0.92,2.17)	**2.44 (1.18,5.13)**	1.00 (0.55,1.78)	**3.09 (1.91,5.05)**
Model 2[b.]				
LC1**	Ref.	Ref.	Ref.	Ref.
LC2***	1.54 (0.99,2.40)	**2.44 (1.16,5.24)**	1.02 (0.56,1.81)	**3.20 (1.97,5,24)**
26-35 years				
Cases*, n (%)	270 (68.2)	126 (79.8)	99 (62.3)	152 (62.6)
Crude				
LC1**	Ref.	Ref.	Ref.	Ref.
LC2 ***	0.76 (0.55,1.06)	1.07 (0.72,1.59)	0.93 (0.60,1.44)	0.86 (0.59,1.25)
Model 1[a.]				
LC1**	Ref.	Ref.	Ref.	Ref.
LC2***	**0.65 (0.46,0.92)**	0.99 (0.66,1.48)	1.00 (0.63,1.57)	0.85 (0.56,1.27)
Model 2[b.]				
LC1**	Ref.	Ref.	Ref.	Ref.
LC2***	**0.67 (0.47,0.95)**	0.80 (0.52,1.22)	1.04 (0.66,1.64)	0.86 (0.57,1.29)

*Cases: OW/OB – being overweighted or obese; Waist-hip ratio - having increased risk of metabolic complications defined according to the World Health Organization criteria (waist-hip ratio ≥ 0.85 in women and ≥ 0.90 in men); Chronic disease – having a chronic disease; Self-Reported Health - having worse health status.

** LC1: "Healthier diet, alcohol and tobacco behaviors"

***LC2: "Less sedentary and unhealthier alcohol and tobacco behaviors"

[a.] Model 1: Adjusted for education level and sex (except for waist-hip ratio)

[b.] Model 2: Adjusted for model 1 confounders and total energy intake

(19-21, 33, 34), except for physical activity dimension. Most studies found an "unhealthier" pattern characterized by the clustering of smoking, alcohol intake, low-quality diet, and physical inactivity (1, 35), which was expected since scientific evidence commonly shows a co-occurrence effect between these risky behaviors (35). A "healthier" pattern is also usually observed associated with healthy behaviors, including high levels of physical activity and low levels of sedentary time. However, in the current analysis comprising young adults, the pattern with general healthy behaviors also includes individuals with lower levels of physical activity and greater sedentary time. This could be due to the type of career occupation of young adults since nowadays there is a tendency for highly sedentary jobs (36). Additionally, a considerable number of young adults are still completing their higher education degrees. University students usually spend most of the day attending classes or studying, which are extremely sedentary activities (37). Furthermore, it is also described that this age group has sedentary leisure time activities, such as playing video games or updating social media (38, 39). In addition, young adults who engage more in sedentary activities may try to make up for this unhealthy habit by adopting mainly healthy behaviors, including a high-quality diet, not drinking alcoholic beverages, and not smoking. Studies focusing on lifestyle patterns frequently find a "moderate" or "mixed" pattern comprising individuals with both healthy and unhealthy behaviors (19, 21, 33). Similarly, our findings seem to underline two "mixed" patterns, although the LC1 class is mainly characterized by healthy habits, it also comprises unhealthy physical activity behaviors.

Regarding sleep, contrary to expectations, our results did not show any significant differences between the two patterns. However, the association between lower sleep time and unhealthier lifestyles has been previously described (21).

A significantly higher percentage of women (63.3%) belong to the LC1 pattern compared to men. Women are often described as having healthier lifestyles (40), including better quality diet (41), smoking less (42), and drinking fewer alcoholic beverages (43). However, females also tend to be more physically inactive compared to males (39). Usually, young male adults engage in a greater number of risky behaviors (40), therefore it is expected that a larger percentage of young men fits in the class with a higher prevalence of unhealthy habits, which can be seen in our results.

Our findings show that a greater percentage of adults aged 26-to-35 years follow the LC2 class (61.2%) in comparison with individuals aged 18-to-25 years. In contrast with our results, scientific evidence seems to indicate that early adulthood is related with unhealthier lifestyle patterns (34, 41).

Younger individuals in the LC2 pattern also have an increased risk of metabolic complications according to the waist-hip ratio. Scientific evidence supports an association between a healthier lifestyle pattern and a lower cardiometabolic risk measured by waist-hip ratio (17, 44), which is also observed in our results. However, in contrast with our findings, these "healthier lifestyle" patterns also tend to include higher levels of physical activity coupled with a high-quality diet, not smoking, and not drinking alcoholic beverages.

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In the present study, individuals aged 26-to-35 years from the LC2 pattern showed lower odds of overweight or obesity. Similarly, a study carried out in Spain (19) highlights that male adults who engage in higher levels of physical activity and lower sedentary time show decreased odds of obesity. Additionally, a study performed in a sample of Brazilian young individuals supports an inverse association between physical activity and overweight/obesity (18). Although young adults in the LC2 pattern engage in a greater number of risky behaviors, they are also more physically active which can influence their weight status, making them less likely to have overweight or obesity. These results show that age and physical activity may influence the association between lifestyle patterns and adiposity outcomes.

Regarding the association between lifestyle patterns and self-reported health, after age-stratified analysis and adjustment for confounders, it is suggested that young adults aged 18-to-25 years in the LC2 pattern tend to classify themselves as having worse health. Some Australian and European studies underline similar results revealing that individuals belonging to lifestyle patterns with a greater number of unhealthy behaviors report poorer health (20, 21). Comparable to the LC2 class, those "unhealthier lifestyle" patterns are characterized by low-quality diet, greater intake of alcoholic beverages, and smoking habits. However, these patterns also tend to include physically inactive adults, which refutes our results since the LC2 class comprises non-sedentary young adults.

This study has some strengths and limitations that should be highlighted. First, to our knowledge, this is one of the first studies investigating lifestyle patterns among Portuguese young adults. Also, the inclusion of a national representative sample of young adults and the fact that the results were weighted for the distribution of the Portuguese population are considered main strengths. Moreover, standardized procedures were employed regarding the EFSA's EU-Menu guidelines (45). Dietary data were evaluated using a previously validated software (eAT24) and physical activity was assessed applying the short version of IPAQ which is a validated questionnaire widely used in this context. Although all quality control processes were ensured, a self-reported bias could not be discarded. It is expected that young adults underreport unhealthier habits, nevertheless, since data collection was integrated into a broader questionnaire performed by trained interviewers, it was possible to minimize this error. Additionally, anthropometrics were objectively measured following standardized procedures. The cross-sectional design can be considered a limitation since it does not guarantee that exposure precedes the outcome. Moreover, exposures can change according to the analyzed outcomes, underlining a possibility of reverse causality.

CONCLUSIONS

These results emphasize how lifestyle factors cluster in Portuguese young adults, showing differential aggregation of diet and physical activity with the remaining behaviours, such as alcohol consumption and smoking. Young adults with healthier dietary habits also tend to drink fewer alcoholic beverages and smoke less, however, less sedentary individuals drink and smoke more.

Our results also support a distinctive effect of age on the association between lifestyle patterns, adiposity, and perceived health status. In early young adulthood (18-25 years), less sedentary individuals with unhealthier alcohol and smoking behaviours presented higher odds of central adiposity and reported worse perceived health status. On the other hand, the 26-to-35-year age group was less frequently obese.

Having this information in mind, public health programs should consider the existing differences regarding age to make more effective intervention programs. Thus, young adults that fit in the LC2 pattern would benefit from interventions focused on smoking cessation efforts, but also in the promotion of healthy eating practices and the reduction in the intake of alcoholic beverages. Young adults in the LC1 pattern should be encouraged to engage more in physical activity and spend less time in sedentary activities. The results of this research underline the importance of implementing intervention programs targeting multiple harmful health habits, considering lifestyle patterns and the co-occurrence of risky behaviours with different approaches regarding age.

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CONFLICTS OF INTEREST

None of the authors reported a conflict of interest.

AUTHORS' CONTRIBUTIONS

IJ: Participation in the formulation of research objectives and question, study design, data analysis, interpretation of results and the manuscript writing; DC: Participation in the study design, statistical analysis of data, interpretation of results and in the manuscript review process; CL: Coordination of the initial process of data collection, participation in the formulation of objectives and research question, study design, data analysis, interpretation of results and the manuscript review.

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