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RISK FACTORS FOR ADOLESCENTS' NON-COMPLIANCE TO THE WORLD HEALTH ORGANIZATION RECOMMENDATION FOR FRUIT AND VEGETABLES DAILY INTAKE

A.O.
ARTIGO ORIGINAL

FATORES DE RISCO PARA O INCUMPRIMENTO DA RECOMENDAÇÃO DA ORGANIZAÇÃO MUNDIAL DA SAÚDE RELATIVA AO CONSUMO DIÁRIO DE FRUTAS E HORTÍCOLAS POR ADOLESCENTES

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RESUMO

Most often, youth don't eat at least 400 g/day of fruit and vegetables as recommended by the World Health Organization. Thus, this study aimed to identify risk factors associated with the adolescents' non-compliance to the World Health Organization recommendation for fruit and vegetables daily intake. The data was collected via a stratified one-stage cluster sampling of adolescents (10 to 19 years old) from a city in the north of Portugal, and logistic regression models were performed. Almost two-thirds of adolescents don't comply with the World Health Organization recommendation for fruit and vegetables daily intake. Low-to-moderate adherence to the Mediterranean Diet as well as lower mean daily energy intake are risk factors for adolescents don't comply with the World Health Organization recommendation.

PALAVRAS-CHAVE

Adolescents, Daily intake, Fruit, Risk factors, Vegetables

ABSTRACT

Na maioria das vezes, os jovens não comem pelo menos 400 g/dia de hortícolas e frutas conforme recomendado pela Organização Mundial da Saúde. Assim, este estudo teve como objetivo identificar os fatores de risco associados ao incumprimento da recomendação da Organização Mundial da Saúde para o consumo diário de hortícolas e frutas por adolescentes. Os dados foram recolhidos através de uma amostragem estratificada por conglomerados em um estágio de adolescentes (10 aos 19 anos) de uma cidade do norte de Portugal, e foram realizados modelos de regressão logística. Quase dois terços dos adolescentes não cumprem a recomendação da Organização Mundial da Saúde relativa à ingestão diária de hortícolas e frutas. Uma adesão baixa-moderada à Dieta Mediterrânea assim como uma menor ingestão energética média diária são fatores de risco para os adolescentes não cumprirem a recomendação da Organização Mundial da Saúde.

KEYWORDS

Adolescentes, Ingestão diária, Fruta, Fatores de risco, Hortícolas

INTRODUCTION

According to the World Health Organization (WHO), Fruit and Vegetables (FV) are an important component of a healthy diet. Its consumption has a protective effect in the prevention of noncommunicable diseases such as several types of cancer and cardiovascular diseases. The WHO recommends at least 400g (~5 servings) of edible FV per day to achieve this beneficial protection, including in children and adolescents (1-3).

Adolescence is a critical developmental stage marked by high nutrient demands to keep up with rapid growth. Dietary habits formed throughout adolescence can last into adulthood, therefore improving dietary habits at a young age has received a lot of attention (4, 5). In these age groups, FV consumption is notably low. Despite the required 5 servings of FV per day, European children and adolescents only eat on average 2–3 servings per day (6, 7).

Adolescents' consumption of FV is influenced by several factors (6). The adolescents' age seems to influence the consumption – FV consumption decreases with increasing age group – and boys, usually, consume less FV than girls (5). Besides that, a correlation was found between vegetables consumption in children and their parents' education level (6). It was also found in literature that overweight children and adolescents consumed less fruit than those with a normal weight (8).

In this alignment, the primary goal of this study was to identify risk factors associated with the adolescents' non-compliance to the WHO recommendation for FV daily intake (<400 g/day) in a sample of adolescents from a city in the north of Portugal.

METHODOLOGY

Study Design and Participants

This cross-sectional study comprised a final sample of

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140 adolescents (aged between 10 and 19 years old) attending the 5th to the 12th school year from a city in the north of Portugal. Non-Portuguese adolescents, adolescents with special educational needs, with specific diets (e.g., vegetarianism) or with diets conditioned by the presence of diseases (e.g., celiac disease or allergy to cow's milk protein) were excluded. Written informed consent requests were sent for 860 students, but only 240 students accepted to participate (27.9% participation rate). From those who accepted to participate, 140 adolescents met the selection criteria and completed all data collection steps (58.3% answer rate).

Data Collection

The data was collected via a stratified one-stage cluster sampling, between January and March 2020 wherein 3-days Dietary Records (DR) were delivered to be filled in by each participants; additionally, a Portuguese version of the KIDMED Index (previously translated and cross-culturally adapted (9)) was directly applied.

The DR are open-ended questionnaires that require a minimum of 3 days (two weekdays and one weekend day) for participants to record all food and beverages intake over this period, using a kitchen weighing scale or estimating it with the help of standard household measures' images (10). Instructions on how to record daily intake were provided by trained staff and the fully filled DR were entered into the Eat24 Software program (11) for analysis. This Software allows obtaining the mean daily energy intake (kcal/day), as well as the mean daily intake of FV (edible g/day) per participant.

The KIDMED Index includes 16 closed-ended (yes-or-no) questions to assess the adherence to the Mediterranean Diet (MD) among children and adolescents. This index ranges from -4 to 12 and allows classifying the participants' adherence to the MD into three levels: low (≤3 points), moderate (4–7 points), and high (≥8 points). Due to the low number of participants in the "Low" category (n=4), the "KIDMED classification" variable was categorized only into 2 groups: "Low/Moderate" and "High" (12).

The personal data of each participant (namely, sex, age, self-reported weight and height, father's education level, and mother's education level) was initially collected in a separate section of the 3-days DR.

Given that adolescents often move on to high school (10th to 12th grades) at 15 years old, the adolescents' age was grouped into ≤15 years old and >15 years old. Moreover, using the self-reported weight and height data, Body Mass Index (BMI) was calculated using the following formula: [weight(kg) / height^2(m)]. After that, the BMI percentiles for sex and age (P) were determined according to the WHO reference growth curves (13) for children and adolescents aged between 5 and 19 years old. The adolescents' BMI was then classified as underweight (P<3rd), normal weight (P3rd-P85th) and overweight (P>85th). Due to the low number of participants in the "Underweight" category (n=1), "BMI classification" variable was categorized only into 2 groups: "Under/Normal Weight", "Overweight".

Regarding the mother and father's education level, participants had to indicate whether they had completed the 1st schooling cycle (1st to 4th grades), 2nd schooling cycle (5th to 6th grades), 3rd schooling cycle (7th to 9th grades), high school (10th to 12th grades), Bachelor degree, Master degree or Doctorate. The highest education level of both parents was selected, creating a new variable: the parents' education level. This variable was categorized into 3 groups: "Up to 9th grade", "10th to 12th grade" and "More than 12th grade".

Statistical Analysis

Statistical analysis was performed with the Software Package for Social Sciences (SPSS) Version 27.0 and the significance level was fixed at 0.05. Descriptive statistics included mean, standard deviation (SD), minimum (m) and maximum (M) for continuous variables, and absolute (n) and relative (%) frequencies for categorical variables.

Logistic regression models were performed to identify the relevant explanatory variables associated with the adolescents' non-compliance to the WHO recommendation for FV daily intake. Crude and adjusted Odds Ratios (OR) and respective 95% confidence intervals (95%CI) were obtained, and the final models were adjusted for sex, age, BMI classification, parents' education level, mean daily energy intake, and KIDMED classification. Regardless of their statistical significance, the variables sex, age, BMI classification and parents' education level are explanatory variables of know contextual importance and were therefore included in the model for controlling confounding.

Ethical Procedures

This research work used secondary data from the study "Reproducibility and validity of the Mediterranean Diet Quality Index (KIDMED Index) in a sample of Portuguese adolescents." (12), approved by the Ethic Committee from the Institute of Public Health of the University of Porto (reference CE19127), authorized by the Portuguese Government's Education General Direction through their Scholar Inquiries Monitorization system (registration number 0702600001) and conducted according to the guidelines laid down in the Declaration of Helsinki. Written informed consents from the adolescent's legal guardians, as well as authorization from the adolescents themselves were obtained, to rightfully proceed on gathering data. The participants had the right to leave the investigation at any given time, without any need for further explanation.

RESULTS

Almost two-thirds (62.9%) of adolescents did not comply with the WHO recommendation for FV daily intake (Table 1). Adolescents whose parents had completed up to 9th grade were more likely to not comply with the WHO recommendation for FV daily intake than those whose at least one parent had completed more than 12th grade (OR = 3.079, 95%CI = 1.228, 7.721). However, after adjusting for adolescents' sex, age, BMI classification, KIDMED classification and mean daily energy intake, the parents' education level loses its statistical significance in the model.

Furthermore, the odds of non-compliance to the WHO recommendation for FV daily intake among adolescents with low-to-moderate adherence to MD is 3.600 times the odds among those with high adherence to this healthy and sustainable dietary pattern, after adjusting for adolescents' sex, age, BMI classification, parents' education level, and mean daily energy intake. Additionally, whenever daily consumption increases by 100 kcal, the odds of non-adherence to the WHO recommendation decreases by approximately 10%. As a result, a low-to-moderate adherence to MD as well as a low mean daily energy intake showed to be risk factors for adolescents not eating at least 400 g/day of FV.

The final model's goodness-of-fit did not seem to be compromised (Hosmer Lemeshow test; p = 0.384). Moreover, the model has a fair predictive ability – R2 Nagelkerke = 0.280, sensitivity = 79.7%, specificity = 46.9%, area under the ROC curve = 0.771 (95%CI = 0.691, 0.851).

DISCUSSION OF THE RESULTS

In a sample of adolescents from a city in the north of Portugal, low or moderate adherence to the MD and lower mean daily energy intake are risk factors associated with the adolescents' non-compliance to the WHO recommendation for FV daily intake (<400 g/day).

Table 1

Sample characterization, total and according to adolescents' compliance with the World Health Organization recommendation for fruit and vegetables daily intake, together with the estimates from the logistic regression models

	TOTAL	ADOLESCENTS WHO DID NOT COMPLY WITH THE WHO RECOMMENDATION (<400G/DAY OF FV) (N=88)	ADOLESCENTS WHO COMPLIED WITH THE WHO RECOMMENDATION (≥400G/DAY OF FV) (N=52)	OR (95% CI) *	
	n (%)	n (%)	n (%)	CRUDE EFFECTS	ADJUSTED EFFECTS
Age (n=140)					
≤ 15 years old	96 (68.6)	60 (68.2)	36 (69.2)	ref	ref
> 15 years old	44 (31.4)	28 (31.8)	16 (30.8)	1.050 (0.501, 2.201)	1.315 (0.528, 3.273)
BMI classification (n=131)					
Under/Normal weight	81 (61.8)	55 (67.1)	26 (53.1)	ref	ref
Overweight	50 (38.2)	27 (32.9)	23 (46.9)	0.555 (0.269, 1.147)	0.475 (0.200, 1.129)
KIDMED classification (n=140)					
Low/Moderate	84 (60.0)	65 (73.9)	19 (36.5)	4.908 (2.346, 10.268)	3.600 (1.543, 8.401)
High	56 (40.0)	23 (26.1)	33 (63.5)	ref	ref
Parents' education level (n=137)					
Up to 9th grade	47 (34.3)	35 (41.2)	12 (23.1)	3.079 (1.228, 7.721)	1.827 (0.608, 5.493)
10th to 12th grade	53 (38.7)	32 (37.6)	21 (40.4)	1.608 (0.689, 3.755)	1.297 (0.476, 3.536)
More than 12th grade	37 (27.0)	18 (21.2)	19 (36.5)	ref	ref
Sex (n=140)					
Male	53 (37.9)	34 (38.6)	19 (36.5)	1.094 (0.538, 2.222)	1.776 (0.725, 4.348)
Female	87 (62.1)	54 (61.4)	33 (63.5)	ref	ref
	MEAN (SD) m, M	MEAN (SD) m, M	MEAN (SD) m, M	CRUDE EFFECTS	ADJUSTED EFFECTS
Energy intake, kcal/day (n=140)	1805 (546) 663, 3933	1699 (485) 663, 3163	1984 (599) 1151, 3933	0.999 (0.998, 1.000)	0.999 (0.998, 0.999)

*From Binary logistic regression models. Models were adjusted for sex, age, BMI classification, parents' education level, KIDMED classification, and mean daily energy intake.
95% CI, 95% Confidence Interval

BMI: Body Mass Index
FV: Fruit and vegetables
OR:Odds Ratio
Ref: Reference

Moreover, 62.9% of the participants did not eat at least 400 edible g/day of FV as recommended by the WHO. Although this prevalence is considerably high, it is lower than the 91% of inadequate FV intake among Portuguese adolescents (10 to 17 years old), reported in the National Food, Nutrition, and Physical Activity Survey – IAN-AF 2015/2016 (14). At national level, the adolescents' mean daily intake of fresh FV were, respectively, 97 and 133 edible g/day (14) – clearly below the WHO recommendation.

In this study, adolescents whose parents had completed up to 9th grade were more likely to eat less than 400 edible g/day of FV than those whose at least one parent had completed more than 12th grade. The association between parents' education level and better quality of diet has been already shown (4, 15, 16), and can be explained by the fact that higher education level may result into more health literacy – and, in particular, more food and nutritional literacy – as well as more financial availability to buy healthy food such as FV. Still, after controlling confounding, the parents' education levels were not considered risk factors.

There is evidence suggesting that a reduction in energy intake was associated with increased FV consumption (17), but there is also evidence in the literature showing no significant difference in measured change daily energy intake between "high" and "low" FV intake (18). Even though, in this study, results showed that increasing energy daily intake may increase the adolescents' compliance to the WHO recommendation for FV daily intake. One possible explanation could be that people who eat more, usually, tend to eat more of every kind of food group, including FV.

Results also showed that adolescents with low or moderate adherence to the MD had higher odds of eating less than 400 edible g/day of FV. Higher adherence to MD can be understood as higher consumption of healthy food such as FV (which is a predominant food group from this dietary pattern) (19, 20), but MD has been abandoned by young people (21, 22). Thus, MD should be promoted since decreased adherence to this traditional, healthy and sustainable dietary pattern seems to be a risk factors for the adolescents' non-compliance to the WHO recommendation for FV daily intake.

Limitations and Strengths

This is a cross-sectional study, so the associations reported should not be interpreted as causative. Further longitudinal research is necessary to determine the direction of any causal relation between FV daily intake and the factors under analysis.

Lack of participation was largely due to failure to return the written informed consent requests and a larger sample size will be necessary for the logistic regression models to be more robust. Nevertheless, the final sample was as heterogeneous as possible with adolescents of different school years (5th to 12th) and ages (10 to 19 years old).

The self-reported weight and height may have resulted in an underestimation of weight (23, 24) and overestimation of height, affecting the accuracy of adolescents' BMI classification (24). However, it was not possible to measure the height and weight of adolescents due to lack of human and material resources and time; and the prevalence of under/normal weight in this sample (61.8%) was quite similar to the prevalence of 67.7% in a national sample of Portuguese adolescents (25).

The 3-days DR used to collect dietary data are recognized as the gold standard of the dietary assessment methods (10). Additionally, the KIDMED Index was previously translated and cross-culturally adapted to the target population (9) and proved to be a valid instrument to assess the adherence to the MD among Portuguese adolescents (12).

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Finally, it should be noted that studies about risk factors for non-compliance to the WHO recommendation for FV daily intake in the young Portuguese population are still scarce. Thus, this research work contributes to generate hypotheses on this subject that can be used as baseline for further studies on this target group.

CONCLUSIONS

Almost two-thirds of adolescents did not comply with the WHO recommendation for FV daily intake. Low-to-moderate adherence to the MD as well as lower mean daily energy intake were presented as risk factors for adolescents not eating at least 400 g/day of FV. Thus, it is crucial to design and implement public health intervention programs to increase the FV daily intake among young populations, and this study helps to identify those who could benefit the most from these intervention programs.

CONFLICTS OF INTEREST

None of the authors reported a conflict of interest.

AUTHORS' CONTRIBUTIONS

MR: Contributed to the conception and design of the study, data collection and analysis, interpretation of results and writing of the manuscript; SC: Contributed to the conception and design of the study, interpretation of results and revision of the manuscript; RG: Contributed to data analysis, interpretation of results and revision of the manuscript; SR: Contributed to the conception and design of the study and revision of the manuscript. All authors read and approved the final version of the manuscript.

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