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Association of higher education attendance with food consumption and weight changes of young adults: a prospective cohort study

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Associação entre a frequência do ensino superior e o consumo alimentar e alterações de peso de jovens adultos: um estudo de coorte prospetivo

Association of higher education attendance with food consumption and weight changes of young adults: a prospective cohort study

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Resumo

Introdução: A entrada na vida adulta é vista como um período de risco para o desenvolvimento de hábitos alimentares pouco saudáveis que muitas vezes se traduzem em aumento de peso. Esta tendência encontra-se especialmente bem descrita entre os jovens que frequentam o ensino superior. Contudo, existem lacunas na literatura no que diz respeito às alterações no consumo alimentar e no peso dos jovens adultos que não ingressam no ensino superior.

Objetivo: Este estudo teve como objetivo identificar como o consumo alimentar e o peso de jovens adultos matriculados no ensino superior diferem de seus pares que não frequentam o ensino superior. Além disso, avaliou se os hábitos alimentares dos adolescentes evoluem de forma diferente consoante a sua frequência no ensino superior.

Metodologia: Este trabalho baseou-se em dados recolhidos na coorte de base populacional EPITeen, que recrutou adolescentes nascidos em 1990, que frequentam as escolas do Porto em 2033/2004. O consumo alimentar foi avaliado através de um questionário de frequência de consumo alimentar (QFA) aplicado aos 13 e 21 anos de idade, e os participantes foram classificados de acordo com o tercil de consumo para cada grupo alimentar. A altura e o peso foram avaliados objetivamente por profissionais treinados, em ambas as idades. Odds ratio (OR) e respetivos intervalos de confiança de 95% (IC95%) foram calculados com base em modelos de regressão multinomial para avaliar a associação entre frequência à universidade (exposição) e mudanças nos tercis de consumo alimentar entre os 13 e 21 anos de idade (desfecho), em 891 participantes. Outro modelo de regressão multinomial foi calculado para avaliar a associação entre frequência universitária (exposição) e mudanças nas categorias de índice de massa corporal (IMC) durante

o mesmo período. Os resultados foram ajustados para o sexo, uso de tabaco, exercício físico e escolaridade dos pais.

Resultados: Aos 21 anos de idade, os estudantes do ensino superior (67,8%) apresentavam um consumo mediano superior de pescado, arroz, massas e batatas, hortícolas, fruta, café e chá e bebidas alcoólicas e um menor consumo de *fast food* e bebidas açucaradas, em comparação com jovens adultos que não frequentavam o ensino superior. Em relação às mudanças no consumo alimentar entre 13 e 21 anos de idade, após ajuste, os participantes do ensino superior apresentaram menor *odds* de manter um consumo elevado de bebidas açucaradas (OR=0,39 IC 95% 0,22-0,69) do que manter um consumo baixo, quando comparados aos participantes que não frequentavam o ensino superior. Em relação ao consumo de álcool, os participantes do ensino superior apresentaram maior *odds* de pertencer ao segundo (OR=1,99 IC 95% 1,30-3,03) e terceiro tercis de consumo (OR=2,70 IC 95% 1,69-4,31) do que ao primeiro, quando comparados aos participantes que não frequentavam o ensino superior. No que diz respeito às alterações do IMC, verificou-se uma tendência menor dos participantes do ensino superior aumentarem a sua categoria de IMC do que manterem um peso normal, quando comparados com os jovens que não frequentavam o ensino superior, apesar desta diferença não ser estatisticamente significativa (OR=0,55 IC 95% 0,29-1,02).

Conclusão: Aos 21 anos, os jovens que frequentavam ou tinham frequentado o ensino superior apresentavam um consumo alimentar tendencialmente mais saudável. Em relação às mudanças no consumo alimentar entre 13 e 21 anos, houve um maior aumento no consumo de bebidas alcoólicas entre os jovens que ingressaram no ensino superior e um aumento no consumo de bebidas açucaradas

entre os que não o fizeram. Em relação ao peso, não existiu uma relação clara entre mudanças na categoria de IMC e frequência do ensino superior. Mesmo após ajuste para fatores socioeconómicos, foram encontradas diferenças na evolução do consumo alimentar de acordo com a frequência no ensino superior, que devem ser consideradas na implementação de medidas de saúde pública que visam promover uma alimentação saudável entre os jovens adultos.

Palavras-Chave: jovens adultos; ensino superior; consumo alimentar; aumento de peso

Abstract

Introduction: Entering adulthood is seen as a period of risk for the development of unhealthy eating habits which often translate into weight gain. This trend is especially well described among young adults attending higher education. However, there is still a gap in the literature regarding changes in food consumption and weight of young adults who do not enroll in higher education.

Aim: This study aimed to identify how the food consumption and weight of young adults enrolled in higher education differ from their peers who did not pursue it. In addition, it also assessed whether the eating habits of adolescents evolve differently according to higher education attendance.

Methodology: This work was based on data collected from the EPITeen population-based cohort, which recruited adolescents born in 1900 and enrolled at Porto school in 2003/2004. Food consumption was assessed through a food frequency questionnaire (FFQ), applied at 13 and 21 years of age, and participants were classified according to their tertile of consumption for each food group. Height and weight were objectively assessed by trained professionals, at both ages. Odds ratios (OR) and respective 95% confidence intervals (95% CI) were computed through multinomial regression models to assess the association between attendance at university (exposure) and changes in tertiles of food consumption between 13 and 21 years of age (outcome), in 891 participants. Another multinomial regression model was computed to assess the association between higher education attendance (exposure) and changes in body mass index (BMI) categories during the same time period. The results were adjusted for sex, tobacco use, physical exercise, and parental education.

Results: At 21 years, higher education students (67.8%) had a higher median consumption of seafood, rice, pasta and potatoes, vegetables, fruit, coffee and tea, and alcoholic beverages and a lower consumption of fast food and sugary drinks, compared to young adults who did not attend higher education young adults. Regarding changes in food consumption between 13 and 21 years of age, after adjustment, higher education participants had lower odds of maintaining a high consumption of sugary drinks (OR=0.39 95% CI 0.22-0.69) than maintaining a low consumption, when compared to participants who did not attend higher education. Regarding alcohol consumption, higher education participants were more likely to belong to the second (OR=1.99 95% CI 1.30-3.03) and third tertiles of consumption (OR=2.70 95% CI 1.69-4.31) than the first, when compared to those not attending higher education. Regarding changes in BMI, there was a tendency for participants who attend or have attended higher education to present lower odds of increasing their BMI category than to maintain a normal weight, when compared to young people who do not attend higher education, although not statistically significant (OR=0.55 95% IC 0.29-1.02).

Conclusion: At the age of 21, young people who attended higher education had a generally healthier food intake. Regarding food consumption changes between 13 and 21 years, there was a larger increase in alcoholic beverages intake among young people who were enrolled in higher education and an increase in the consumption of sugary drinks among those not enrolled in higher education. In relation to weight, there was not a clear relationship between changes in BMI categories and higher education attendance. Even after adjustment for socioeconomic factors, there were differences in changes in food consumption according to higher education attendance, which should be considered when

implementing public health measures that aim to promote healthy eating among young adults.

Keywords: young adults; higher education; food consumption; weight gain

Table of contents

List of tables

Paper - Association of university attendance with eating habits and weight of young adults: a prospective cohort study

Background

From a social point of view, it is difficult to define at what age a teenager becomes an adult. Entry into adulthood happens gradually, and socially a young person typically comes to be considered an adult when he becomes capable of making decisions independently, becomes responsible for himself and gains financial independence [1, 2]. Nowadays, all this can be delayed due to professional and social factors such as the need to pursue a higher education, the normalization of pre-marital sexual relations and the later entry into married life [3]. Taking all this into consideration Arnett proposed the establishment of the concept of emerging adulthood as a transitional life phase between adolescence and adulthood, contemplated between the ages of 18 and 29 [4]. In addition to social factors, this concept is also supported by neurological aspects. At the end of adolescence, brain development is not yet complete, and the areas of the brain responsible for impulsivity and desires are more developed than those responsible for making decisions based on reason. The ability to make these types of decisions develops during the first years of adulthood [3]. All this contributes to the establishment of emerging adulthood as a unique and critical period of development.

Furthermore, emerging adulthood appears as an important period in the establishment of health-promoting behaviors. Although young adults have a low prevalence of chronic health conditions such as diabetes, hypertension and hypercholesterolemia, it is during this phase that behaviors and factors responsible for future health problems are established. Among these factors, weight gain, poor eating habits, physical inactivity and alcohol intake are the most frequent [5].

Weight changes in young adulthood

Weight gain is a growing problem among young adults. A review of the literature related to weight gain among young women highlighted that over the last few decades the age group between 16 and 34 years old have been the ones who experienced a greater increase in body mass index (BMI) [6]. In the United States between 1960 and 2002, the BMI of women between the ages of 20 and 29 rose by 4.6 kg/m^2, while the average increase for all women up to the age of 74 was just 3.3 kg/m^2. In England, between 1993 and 2017, the prevalence of excess weight (BMI equal to or greater than 25 kg/m^2) among women aged 25 to 34 increased from 36% to 56%. The age group between 16 and 14 years old increased from 27% to 42%. These values were verified through national surveys carried out in the respective countries. Data from the Behavioral Risk Factor Surveillance System carried out in the United States led to similar conclusions: despite a generalized increase in the prevalence of obesity, the age group between 18 and 29 years was the one with largest increase, with an obesity prevalence that went from 7.1% in 1991 to 12.1% in 1998 [7].

In Brazil, data from the Surveillance of Risk and Protective Factors for Chronic Diseases by Telephone Survey showed an increase in the average weight gain from 20 years of age between 2006 and 2012. The greatest increase was seen among the ages of 21 and 29 years old. Among the age group between 21 and 24 years, the average increase in weight since the age of 20 was 3.4 kg, and between this age group and the next, from 25 to 29 years old, there was an additional average increase of 5.1 kg. This study concluded that Brazilians tend to gain weight progressively during adulthood, especially in the first decade after the age of 20 [8]. Associated with this, it is also important to highlight that adolescents and

young adults who have overweight or obesity tend to remain with the condition until later in life [9-11]. A cross-sectional study in the same country, which used data from the National Health Survey, found that less than 40% of Brazilians with normal weight at age 20 (retrospectively reported) remained with normal weight at age 30. In addition, 60% of participants with obesity at age 20 maintained the condition later in life [11]. Zhao *et al.* [9] reported agreeing results in a longitudinal study that followed 4454 participants from adolescence to early adulthood. At baseline, the participants were aged between 12 and 19 years old, and in the last evaluation they were between 25 and 32 years old. The initial prevalence of overweight and obesity was of 15.3% and 10.3% respectively, and in the last evaluation these values increased to 31.6% and 37.6%. It is also important to highlight that only 1.5% of participants classified as overweight during the first assessment were able to reverse this trend in adult life [9]. This study, once again, highlights the tendency to gain weight with the entry into adulthood and shows the difficulty in reversing this problem.

Different characteristics and exposures in the young adults may impact the changes in weight they experience. A systematic review and meta-analysis regarding changes in weight and adiposity among young adults who attended higher education concluded that there are significant changes and that higher education students gain an average of 1.55 kg and 1.17% of body fat throughout higher education [12]. Pope *et al.* [13] followed 86 students from the beginning of the freshman year of college to the end of their senior year. At the end of the investigation, there was a significant increase in the body mass index and weight of the participants. Weight increased by an average of 2.94 kg at the end of the first year and 4.38 kg throughout the entire study, which took place over the

period of 4 years. In addition, the study also reported an increase in the prevalence of overweight/obese students, which rose from 23% to 41% [13]. These results are consistent with the previously mentioned review.

In another longitudinal study, 340 Belgian university students were also followed from the beginning of university until the end of their fifth year, with the aim of assessing their evolution in terms of weight, height, body mass index, fat mass, lean mass and waist circumference [14]. Deliens *et al*. reported significant changes between each follow-up period and baseline. Over the 5 years of the study, 53% of the students experienced a weight gain greater than 5% of their initial body weight, which can be considered clinically relevant. The study also showed that the periods in which students gained more weight and fat mass were the first semester of freshman year and the last year of university [14]. These data show that weight gain at university does not occur exclusively in the first year, which is typically considered a year of change and adaptation where students are more vulnerable to weight changes. The study carried out by Derfoche *et al*. [15] followed the participants from their last year of high school until the end of their second year of higher education. This design allowed them to fully assess the transition period between these educational stages. Once again, the results were consistent with the rest of the literature, with students gaining an average of 2.7 kg over the course of the study. In addition, the prevalence of overweight doubled over the 3 years, from 6% to 12% [15].

Changes in the diet of young adults

As described above, there is evidence that the prevalence of obesity among young adults has been increasing in the last few decades [6-8]. We also know that

young adults entering higher education tend to gain weight and body fat [12, 14-16]. This phenomenon seems to be related to the fact that most young people adopt unhealthy lifestyles, which include an unhealthy diet. Vinke *et al.* [17] used data from the Dutch population-base Lifelines Cohort to assess the association between diet quality and weight changes over the period of 4 years. The diet of 85,618 participants was evaluated using the Lifeline Diet Score, which assesses the intake of 9 food groups with a positive impact on health, namely vegetables, fruit, whole grain products, legumes and nuts, fish, oils and soft margarines, sugar-free dairy products, coffee, and tea; and 3 groups with a negative impact on health, namely red meat, butter and hard margarines, and sugary drinks. The study concluded that the association between poor diet quality and weight gain was strongest among young adults aged 18 to 29 years. In addition, it was also possible to verify that the association between an unhealthy diet and changes in weight gradually lost strength with increasing age [17]. This study highlighted the importance that eating habits can have on weight gain in young adults. A systematic review of longitudinal studies that evaluated the relationship between diet and body fat in adolescents and young adults found 10 studies that showed an association between some aspect of diet and the amount of fat mass of the participants. The heterogeneity between the methods used in the different studies made it impossible to draw clear conclusions regarding these two topics. However, most of the existing evidence seems to point towards a positive association between the consumption of energy-dense and nutrient-poor foods and a higher amount of body fat [18].

It thus seems safe to conclude that the literature points to a positive association between poor eating habits, weight gain and higher levels of body fat

[17, 18]. Therefore, it is not surprising that obesity levels among young adults have been increasing, since eating habits among this age group are also reported to not be ideal. A longitudinal study assessed the dietary intake of 246 young adults between the ages of 19 and 28 and compared it with data collected when the participants were 10 years old. Dietary intake was assessed through interviews using the 24-hour dietary recall method. The collected data was later used to assess the consumption of 17 different food groups. It was possible to verify that between childhood and the beginning of adult life the intake of mixed meats, desserts, fruit and fruit juices, milk and candy decreased. On the other hand, there was an increase in the consumption of poultry meat, sugary drinks, seafood, salty snacks, cheese, beef, and condiments. Therefore, there was a decrease in the quality of the diet between these two stages of life [19].

Gil *et al*. studied whether there were differences in the eating habits of young people of different genders. In total, the eating habits of 467 young people with an average age of 22 years were evaluated. With regard to the consumption of less healthy foods, it was found that 14.2% of women and 26.3% of men reported consuming fast food once a week. 51.1 % of women and 45.3% of men reported consuming fried products several times a week. More than half of the women, 50.5%, also reported consuming sweets several times a week, with only 27.4% of men reporting the same. On the other side of the scale, consumption of fish and fish products was very low, with only 8.3% of women and 11.6% of men reporting consuming these products several times a week. Dishes made with legumes were also little consumed, with most of the sample reporting a frequency of consumption of 1 to 3 times a month. Regarding fruit and vegetables, only 22.3% of women and 30.5% of men reported consuming fruit daily, while for vegetables

these values were 18.5% and 13.7% respectively. It is important to highlight that only 4% of the women and none of the men met the recommendations of 5 servings of fruits and vegetables per day [20]. Although there are differences between genders, both groups appear to have poor eating habits with a record of low intake of fish, legumes, fruit and vegetables and a higher than ideal consumption of fast food, sweets and fried foods. A longitudinal study, carried out in Portugal, assessed how food intake at age 13 was in agreement with food intake at age 21. In both assessments, food frequency questionnaires were administered. At age 13, the results of the food frequency questionnaire were used to categorize participants according to their dietary patterns. 4 dietary patterns were defined, namely "Healthier", "Dairy Products", "Fast Food & Sweets" and "Lower intake". Participants who had a healthier eating pattern at age 13 had the highest consumption of fish, fruit, vegetables and legumes, and vegetable soup at age 21. Consistently, those who were initially classified as having a "Fast Food & Sweets" eating pattern had the highest consumption of fast food and soft drinks. The study concluded that eating habits in adolescence appear to be maintained throughout early adulthood [21].

Studies focused only on higher education students showed similar results regarding changed in eating habits in young adulthood. Ramón-Arbués *et. al*, Monteiro *et al*. and Llanaj *et al*. carried out investigations among university students from Spain, Brazil and Albania, respectively, and despite evaluating different aspects, they reached similar conclusions [22-24]. Ramón-Arbués *et al*. evaluated the eating habits of 1055 university students using the Spanish Healthy Eating Index. In addition, they also assessed the degree to which these students complied with the dietary recommendations provided by the Spanish Society for

Community Nutrition. The majority of participants did not comply with dietary recommendations regarding the consumption of fruit, vegetables, bread and cereals, and meat, and that on the other hand, consumption of processed meat (cold cuts) and sweets was higher than recommended. According to the Spanish Healthy Eating Index, only 17.4% of the sample had a healthy diet while the majority (75.6%) had a diet in need of improvement [22]. Monteiro *et al*. evaluated the diet of 2163 young Brazilians in a cross-sectional study, and the regular consumption of vegetables and fruits (at least 5 days a week) and regular consumption of legumes were considered markers of a healthy diet. While regular consumption of meat with excess fat, whole milk and sugary drinks were considered unhealthy diet markers. Regular consumption of fruit, raw salad and vegetables was reported by approximately half of the sample. Among women these values were 52.4%, 41.7% and 51.9% respectively, while for men the values were 50.9%, 43.7% and 53.3%. With regard to the consumption of soft drinks and meat with excess fat, approximately one third of the sample reported doing so at least 5 times a week, namely 28.1% and 32.2% of women and 31.5% and 32.1% of men. On the positive side, 71.1% of women and 75.3% of man reported consuming legumes regularly, which is not surprising considering the Brazilian gastronomic culture [23]. In a different approach, Llanaj *et al*. [24] focused on assessing the intake of food prepared at home and away from home by university students, as well as their nutritional contribution to the daily diet. All meals purchased from restaurants and street vendors, as well as meals prepared at home using ready-to-eat products, were considered meals prepared outside the home. Meals prepared outside the home accounted for an average of 46.9% of the participants' daily energy intake, and in terms of energy intake, vegetables, fruit, meat,

poultry, fish, eggs, nuts, seeds and dairy products were mostly consumed in home-cooked meals. With regard to nutritional value, the greater the contribution of meals prepared outside the home to the daily energy value, the greater the nutritional density of fats, saturated fats, cholesterol, carbohydrates, protein, sodium and calories [24]. These results support that home-cooked meals are healthier than pre-prepared or out-of-home alternatives. These studies point to the fact that young university students do not comply with nutritional recommendations, especially regarding the consumption of fruit and vegetables and that a large portion of their meals are not homemade, tending to be more caloric, higher in fat and sodium and lower in fiber.

A systematic review from 2020 evaluated the adherence of university students to the Mediterranean dietary pattern [25]. This dietary pattern is widely recognized as health-promoting and it is characterized by a predominant consumption of plant-based foods, and the use of olive oil as the main culinary fat. Despite being recognized as a cultural heritage of humanity, most studies from this review have shown that young people have been moving away from this dietary pattern, with a reduction in the consumption of vegetables, fish, whole grains and olive oil and an increase in meat consumption. This trend is even seen among typically Mediterranean countries such as Cyprus, Spain and Italy [25]. In 2019, a study evaluated the eating habits and adherence to the Mediterranean dietary pattern of 91 Portuguese university students, and showed that, according to the PREDIMED questionnaire, only 33% of students had a high adherence to this dietary pattern. Almost half of the students (48.5%) reported consuming two or more servings of vegetables daily, while 38.1% reported consuming 3 or more servings of fruit per day. Regarding the consumption of fish, legumes and nuts,

the percentage of students who reported a frequency of 3 or more times a week were 59.8%, 86.6% and 35.1%, respectively. Concerning sweets and pastry products, 47.4% of the sample reported consuming less than 3 servings per week [26]. Although the results related to the consumption of legumes and fish seem encouraging, less than half of the students met the requirements regarding the consumption of vegetables, fruit, nuts and sweets.

It is possible to conclude that young adults do not seem to have healthy eating habits, and it is also possible to point to poor eating habits as one of the possible culprits for the increase in the rate of overweight among young people. Consumption of alcoholic beverages, and more specifically about binge drinking behaviors, is also a relevant exposure of the young adulthood. The National Institute of Alcohol Abuse and Alcoholism classifies binge drinking as the intake of 4 or more, or 5 or more alcoholic drinks on a single occasion of consumption for women and men, respectively [27]. This trend is well documented among young people attending higher education. Messina et al. [28] evaluated the alcohol intake of 1928 students from 17 Italian universities, using the Alcohol Use Disorder Identification Test Consumption (AUDIT-C). This tool assesses the level of health risk associated with alcohol consumption using 3 short questions, and a final score equal to or greater than 4 for men, or 3 for women, indicates the existence of health risks associated with the ingestion of alcoholic beverages. The AUDIT-C score identified 7% of participants as non-drinkers, 39.5% as low-risk drinkers, and 53.3% as high-risk drinkers. With regard to binge drinking episodes, the authors also reported that 13.1% of the participants had this type of behavior once a month [28]. In Portugal, a study evaluated the alcohol intake patterns of 259 young adults between 20 and 30 years old [29]. The complete version of the AUDIT was used,

which is composed of 10 questions. The results showed that 10.8% of the sample had hazardous or harmful patterns of consumption. Among the participants who reported drinking alcohol in the last 12 months, 61.3% reported having had an episode of binge drinking, with 12.9% reporting doing it monthly and 4.8% doing it weekly [29].

Patrick *et al.* [27] used data from the Monitoring the Future study to assess the evolution of alcohol intake among young Americans between the ages of 18 and 26. The frequency of binge drinking and high-intensity drinking episodes were used as evaluation parameters. Binge drink, as in the previously mentioned study, was classified as the intake of 5 or more alcoholic drinks on a single occasion of consumption, while high-intensity drinking was classified as the intake of 10 or more drinks. The results showed that the prevalence of high-intensity drinking episodes rose from 8.9% at 18 years old to 13.8% at 21-22 years old, and subsequently decreased to 12.1% at 25-26 years old. The frequency of binge drinking episodes rose from 19.1% to 32.9% between 18 and 21-22 years old and then remained unchanged. The study also found that participants who reported episodes of binge drinking but not high-intensity drinking had done so 1 to 2 times in the last 2 weeks. On the other hand, participants who reported both types of behavior had had 3 to 5 episodes of binge drinking in the last 2 weeks. It is also important to highlight that there were differences in the evolution of alcohol intake between higher education students and young adults who did not attend higher education. The frequency of binge drinking or high-intensity drinking episodes did not show significant changes associated with age among young adults who did not attend university. In contrast, the frequency of this type of episodes was higher among students and reached its peak in the early 20s, after which it

reduced to levels similar to those who did not attend college [27]. In a similar way, a cross-sectional study used data from the National Epidemiologic Survey on Alcohol and Related Consitions-III to assess whether there were differences in alcohol consumption between college and non-college students [30]. Data referring to 2213 young adults who reported consuming alcohol were used. Among the participants, 38.6% reported attending college. Based on the frequency of drinking alcohol in the previous 12 months, 38.01% of college were classified as high-intensity drinkers, while 25.34% and 24.16% were classified as occasional light drinkers and frequent drinkers with occasional binging, respectively. In the case of non-college young adults, the most prevalent category was occasional light drinkers with 32.81% of the sample, followed by high-intensity drinkers and frequent drinkers with occasional binging with 27.22% and 21.3% respectively. Statistical analysis showed that college students, when compared to young adults who did not attend college, were less likely to be classified as occasional light drinkers or infrequent drinkers with occasional binging than as high-intensity drinkers. Classification as a college student was also found to be significantly associated with classification as a drinker [30]. These studies show that although excessive alcohol intake seems to be widespread among all young adults, those who attend higher education seem to be a higher risk group.

It is important to evaluate this type of behavior since the consumption of alcoholic beverages can result in the development of several health problems. In fact, there is evidence that, like bad eating habits, excessive alcohol consumption may be associated with weight gain. One study used data from the National Longitudinal Study of Adolescent to Adult Health to assess the association between binge drinking episodes in early adulthood and weight gain. Participants who

reported binge drinking episodes at the third assessment point, when participants were between 18 and 26 years old, were 34% more likely to be overweight and 43% more likely to be obese. In addition, they had even higher odds of having excessive weight gain (more than 5 kg) in the fourth assessment, when participants were between 24 and 32 years old. A statistical model also allowed them to see that those who reported binge drinking episodes in the third assessment had a 41% greater risk of moving from the normal weight category to being overweight, and 36% more risk of moving from the overweight category to obesity in the fourth assessment compared to those who did not drink regularly [31].

Physical Exercise changes in young adulthood

Like eating habits, another aspect that is closely linked to weight management is exercise. One study used data from 4454 adolescents from the US National Longitudinal Study of Adolescent Health to assess the effect of weight changes between adolescence and early adulthood on the risk of developing hypertension and diabetes mellitus. One of the covariates evaluated in the investigation was the practice of physical activity. During the first evaluation, when the participants were between 12 and 19 years old, 4.8% of the participants did not perform physical activity, 22.7% did it 3 times or less a week, 27.9% did it 4 to 6 times a week and 44.7% did it 7 or more times a week. In the last evaluation, when the participants were between 25 and 32 years old, these values decreased to 14.3%, 24.3%, 20.4% and 41% respectively. It was found that the level of physical activity in adolescence was inversely associated with the body mass index at the same time and in adulthood. The same tendency was verified for the level of physical activity in the last evaluation and the body mass index of young adults

[9]. This study shows that adolescents and young adults who exercise less tend to have a higher body mass index and that there seems to be a decrease in the practice of physical activity in the transition from adolescence to adult life.

Winpenny *et al*. [32] evaluated changes in physical activity, diet, and weight of adolescents across the education and employment transitions associated with early adulthood through a systematic review and meta-analysis. They identified 12 studies that evaluated the evolution of physical activity between leaving high school and/or entering university, being that 7 of these studies reported a reduction in the level of physical activity. The results of the meta-analysis showed that leaving high school was associated with a decrease in physical activity of 7.04 minutes per day, with this decrease being more marked among men. When only studies that evaluated the transition between high school and university were considered, this value increased to 11.42 minutes. Data referring to leaving high school and starting work are scarce and not so unanimous, but also seem to point to a reduction in physical activity [32].

Another longitudinal study, based on data from the National Longitudinal Study of Adolescent Health, evaluated how the practice of physical activity and the time spent watching TV, using the computer and/or playing video games evolve between adolescence and the beginning of adult life. Adolescents who practiced 5 or more bouts of moderate to vigorous physical activity per week and spent 14 hours or less per week watching TV, using the computer and/or playing video games were considered to meet the recommendations. The first evaluation wave was carried out between 1994 and 1995 while the second evaluation moment took place after 6 or 7 years in 2001. It was verified that most of the participants did not reach the recommendations in any of the evaluation periods. Among those

who initially reached the recommendations, only 4.4% maintain their physical activity levels and 37% their time spent on screens [33].

It is also important to highlight that the practice of physical activity, in addition to being related to weight, also seems to be related to eating habits. Mazurek-Kusiak *et al*. assessed the barriers to establishing good eating habits among young poles. In the scope of the investigation, they analyzed how the eating habits of young people varied according to their physical activity: very active participants and active participants had the best eating habits, while those who did not practice any type of physical activity had poor eating habits [34]. Accordingly, a cross-sectional study evaluated the weight, physical activity and eating habits of a group of 2163 Brazilian university students. Students who did not reach 150 minutes of moderate exercise per week or 75 minutes of vigorous exercise per week were more likely to have overweight. It was also found that the most active students consumed more fruit, salad, vegetables while the inactive ones consumed more soft drinks and meat with visible fat [23]. Once again, this study highlights the relationship between diet, weight and physical activity.

Barriers to development of good eating habits in young adulthood

Considering the changes in the health-related exposures in young adulthood discussed in the previous sections, it is also essential to understand what barriers exist to the development of healthy lifestyles among young adults. A 2016 scoping review aimed to assess the barriers and enablers of healthy eating habits among young adults [35]. Data from 34 studies was used. Among the main barriers detected were the easy access and low cost of unhealthy foods, lack of knowledge and skills to cook healthy meals, the lack of facilities to prepare and store healthy meals,

the bad eating habits of friends and family and the lack of motivation to eat healthily [35]. In 2021, Sexton *et al*. [36] used data from the Measuring Eating in everyday life study in order to evaluate the factors that influenced the eating habits of young adults. Participants were aged between 18 and 30 years old. The study concluded that young people with better eating habits were those who had better self-efficacy and a lower perception of lack of time and food insecurity [36]. Mazurek-Kusiak *et al*. [34] evaluated the eating habits and body composition of 399 young adults (18 to 26 years) in Poland, based on and interview. The interview was divided into three parts, one of which was intended to collect information regarding the eating habits of the sample, as well as what motivations and barriers exist to the acquisition of healthy eating habits. The biggest barriers to healthy eating found in the study were the lack of financial resources, the lack of time to prepare healthy meals and the lack of knowledge regarding the principles of healthy eating. Another barrier that was highlighted was the lack of skills to prepare meals. On the other hand, the intention to lose weight, a medical doctor's recommendation, and the desire to follow a trend were considered the biggest motivators to eat healthily [34].

Another study, this time in Germany, aimed to evaluate the eating habits of university students, including barriers to healthy eating [37]. The analysis was based on data from the Nutrition and Physical Activity Study, and included 689 participants. The majority of the sample, 66.1%, reported that they found it easy to have a healthy diet. The two main barriers that were detected included the lack of time to prepare healthy meals and the lack of healthy options on the university campus. It is also important to highlight that significant differences were found between sexes in the definition of barriers to healthy eating, with

more men highlighting the lack of motivation and the fact that they do not like eating healthy foods as an important or very important barrier [37]. We can see that the lack of time and culinary skills to prepare healthy meals appear to be important barriers to the development of good eating habits among this age group. Entry to higher education may be associated with these barriers, as many young higher education students end up leaving the family home to continue their studies. This assumption appears to be supported by the literature. A study with 84 university students in Greece that aimed to evaluate the eating habits of young people according to their residence (with or away from family) concluded that those who left home developed less favorable eating habits. [38] Barbara *et. al.* [26] reported concordant results. The author found that fish consumption decreased and *fast food* consumption increased among young displaced Portuguese university students, when compared to those who remained at their parents' home.

Association between higher education attendance, weight, and food consumption of young adults

As discussed above, enrollment at higher education may be a relevant period with impact on food consumption of young adults and weight changes. There are several reasons why young adults at this stage have difficulty developing healthy eating habits, such as a lack of knowledge and cooking skills, as discussed previously. A cross-sectional study based on data from the Behavioral Risk Factor Surveillance System also collected information regarding educational level, and participants were classified as not having completed high school, having completed high school, having attended university for some time and having finished university or a higher degree. All educational levels registered an increase

in the prevalence of obesity between 1991 and 1998, however this increase was more marked in participants who had attended or finished university (increase of 67.5% and 62.9% respectively) than in those who had finished high school or less (46.1% and 46% respectively) [7]. These data seem to point to a tendency towards weight gain during early adult life, with this risk appearing to be more noticeable among young people entering higher education. More recently, in 2020, a literature review with the aim of evaluating the factors associated with weight gain among young women, also mentioned before, highlighted entering university as an life event that is associated with weight gain[6]. Kärkkäinen *et al.* [39] had discordant results. Their longitudinal study, carried out in Finland, aimed to evaluate which factors at age 24 were associated with weight maintenance (±5% baseline BMI) after 10 years. It was found that in the case of men, a higher level of education was associated with successful weight maintenance. It was not possible to make the same association in the case of women, which may be due to the fact that in general, women in the sample were more educated than men. If, on the one hand, as we saw previously, there is evidence that young people who enter higher education gain weight, it also makes sense that higher levels of education are associated with better eating habits and consequently better weight management. To our knowledge, there is still a lack of studies that assess the impact of attending higher education on the weight and diet of young people. A systematic scoping review of longitudinal studies, aimed at evaluating changes in diet between adolescence and early adulthood, showed us that in general there is still a lack of longitudinal information regarding the diet of people between 13 and 30 years of age [40]. Another review revealed similar results. Stock *et. al.* [41] evaluated 18 studies that presented original research on the factors associated

with changes in eating habits during the transition period between adolescence and adult life. Of the 18 studies, 12 focused only on university students. The review concluded that there are several gaps in the literature and that more studies are needed with larger samples that expand beyond university students and that take modifiable factors into account [41]. It is highlighted that there are many young people who do not go on to higher education after finishing high school. It is expected that the transition to adulthood for these young people will have different characteristics and consequently a different impact on their weight and food consumption than that of university students. Therefore, it is necessary to study, with a prospective approach, whether the food consumption and weight of young adults who attend higher education evolve differently from those who do not pursue higher education.

Aim

This work aims to fill the gap in the literature and evaluate the differences in the changes of food consumption and weight status of young adults, according to higher education attendance. It also aims to assess whether at age 21 there were differences in food consumption between young people who attend or have already attended higher education and those who have not pursued higher education, using data from the EPITeen, a population-based cohort of participants followed from adolescence to young adulthood.

Paper

Association of higher education attendance with food consumption and weight changes of young adults: a prospective cohort study

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Abstract

Introduction: Changes in food consumption in higher education students have been well described, but differences to those not pursuing higher education are not known.

Aim: This study aims to identify how the food consumption and weight of young adults enrolled at higher education differ from their peers who did not pursue higher education, and whether the eating habits of adolescents change differently according to higher education enrollment.

Methodology: Data from 891 participants from the EPITeen cohort was used. Food intake was evaluated through a semiquantitative food frequency questionnaire (FFQ) applied at 13 and 21 years of age, and participants were classified according to their tertile of consumption for each food group. Height and weight were objectively assessed by trained professionals, at both ages. Odds ratios (OR) and respective 95% confidence intervals (95% CI) were computed through multinomial regression models to assess the association of attendance at university (exposure) with changes in tertiles of food consumption and changes in BMI categories between 13 and 21 years. The results were adjusted for sex, tobacco use, physical exercise and parental education.

Results: We found that at 21 years higher education participants (67.8%) had a higher median consumption of seafood, rice, pasta and potatoes, vegetables, fruit, coffee and tea, and alcoholic beverages and a lower consumption of fast food and sugary drinks, compared to non- higher education participants. In the adjusted models and compared to those not attending higher education participants, university participants had lower odds of maintaining a high consumption of sugary drinks (OR=0.39 95% CI 0.22-0.69) from 13 t 21 years than

maintaining a low consumption, and were more likely to belong to the 2nd (OR=1.99 95% CI 1.30-3.03) or 3rd tertiles (OR=2.70 95% CI 1.69-4.31) of consumption than the 1st when it comes to the consumption of alcoholic beverages. Regarding BMI changes, although higher education participants tended less frequently to increase their BMI category, when compared to young people who do not attend higher education, the association was not statistically significant (OR=0.55 95% IC 0.29-1.02).

Conclusion: At the age of 21, young people who attended higher education had a healthier food intake. Between 13 and 21 years, there was a larger increase in alcoholic beverages and a decrease in sugary drinks intake among higher education participants, compared to those not pursuing higher education.

Introduction

Early adulthood is described as a risky period to the development of unhealthy lifestyles. The literature suggests that during this period young adults are more likely to decrease their physical activity, develop poor eating habits and obesity [1]. A longitudinal study with European, American and African-American participants showed that, in general, there is a decrease in the quality of the diet during this transition period, namely a decrease in the consumption of mixed meats, desserts, candy, fruit/fruit juices and milk, and an increase in the consumption of sugary drinks, poultry meat, beef, savory snacks, cheese and condiments [2]. Furthermore, excessive consumption of alcoholic beverages also seems to be a cause for concern [3].

Diet changes in young adults are especially noticeable when entering adulthood coincides with enrollment at higher education [4, 5]. Several studies, carried out among university students, reported a low intake of fruits and vegetables and high consumption of alcohol and highly processed foods [6-12]. A review that included 18 studies that evaluated adherence to the Mediterranean dietary pattern among university students concluded that the eating habits of this population have been moving away from this dietary pattern. Most studies, including those carried out in Mediterranean countries such as Cyprus, Spain and Italy, reported that less than half of their samples consumed 2 or more servings of fruit and/or vegetables per day [6]. In Portugal, a cross-sectional study with 97 participants enrolled at university showed similar results. Bárbara *et al*. reported that only 48.5% of the sample consumed 2 or more servings of vegetables per day while only 38.1% consumed 3 or more servings of fruits per day [8]. Additionally, upon entering university, displaced students increased their consumption of fast

food and decreased their consumption of fish. The same trend was not observed among students who continued to live with their families [8]. Another study, in Germany, showed that only 13% and 37.6% of participants met the national recommendations for vegetable and fruit consumption, respectively [7]. In addition, 20.8% of the sample reported eating one or more portions of sweet or savoury snacks per day [7]. Regarding alcohol consumption, a study with 1928 Italian university students found that 53.3% of the participants were high-risk drinkers according to the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) [10]. Similar results were also reported in countries like Spain and Portugal [11, 12]. In Portugal, 13% of men and 8% of women had hazardous drinking patterns, and 50.6% of the participants reported having already experienced binge drinking episodes [12].

Several barriers to the development of healthy eating habits by this population have been described, such as lack of time, easy access to convenience foods and lack of skills in planning and preparing healthy meals [8, 13, 14]. Leaving the parents' house also seems to exacerbate this situation, with displaced students developing worse habits than those who continue to live with their families [6, 8, 15].

As would be expected, these poor eating habits appear to be associated with a greater likelihood of weight gain [16]. This weight gain seems to occur cumulatively over all university years and not just in the freshman year. Associated with weight gain, there are also records of an increase in fat mass among this population [17, 18]. A systematic review including results of 49 studies that evaluated the changes in weight and fat mass during the first year of university and showed that university students gained an average of 1.55 kg and

increased their fat mass by 1.17% throughout university [17]. A longitudinal study in the United States of America found that participants gained an average of 2.1 kg of body weight over a period of 3 years. This weight gain was reflected in an increase in body mass index (BMI) of 0.7 kg/m^2. In addition, it was also reported that at the end of the study the percentage of participants classified as being overweight increased from 15% to 24% [17]. This increase is in line with the recorded increase in fat mass since throughout the study the number of women with a fat mass greater than 30% doubled and the number of men with a fat mass greater than 20% increased 5 times [18]. This is of particular concern as weight gain during early adulthood appears to be associated with increased mortality [19]. Another unhealthy habit developed at this stage is physical inactivity, with fewer young adults meeting the recommendations for exercise than adolescents [20].

Although all this information is essential to the perception of the importance of this stage of life in the establishment of health-promoting habits, it is important to emphasize that most studies only focus on university students. Therefore, it is difficult to understand whether young adults who do not pursue higher education also undergo these changes [21]. To the best of our knowledge, only one study looked at differences between the eating habits of young adults in university and non-students, using cross-sectional data from the USA, collected in between 1993 and 1994 [22], and concluded that the eating habits of university students were not representative of their age group, with non-university participants presenting higher intake of fat and lower fiber [22]. Therefore, with this study we aim to fill a gap in the current literature and identify how the eating habits and weight of young adults enrolled at higher education differ from their peers who did not pursue higher education. In addition, we also intend to assess whether the eating

habits of adolescents evolve differently according to whether they enrol at higher education. In this way, it will be truly possible to understand whether entering higher education can be considered a risk or protective factor for the development of healthy eating habits.

Methods

Participants

This study was based on data collected from the EPITeen (Epidemiological Health Investigation of Teenagers in Porto) cohort which was implemented in the school year of 2003/2004. At baseline, all adolescents born in 1990 and attending public or private schools in the city of Porto were considered eligible for participation. Among these, 2159 (77.5%) agreed to participate. In the school year of 2007/2008, when the participants were on average 17 years old, a second assessment was carried out. At this stage 738 new students were integrated in the cohort as they moved to the city of Porto after the first assessment. Therefore, the entire cohort comprises of 2942 adolescents. A third data collection wave took place between 2011 and 2013, when the participants were on average 21 years old (n=1764). For our study, data from 891 participants were used, representing all participants with valid information on weight, height and food consumption at 13 and 21 years of age.

Data Collection

Data was collected through structured questionnaires with closed and open questions. In the first two assessment waves, at ages 13 and 17, two self-administered questionnaires were applied and a physical evaluation was

performed. One questionnaire was completed at the school while the other was sent home and completed with the help of their parents or legal guardians. In the third assessment, at age 21, participants were invited to visit Department of Public Health and Forensic Sciences and Medical Education at the Faculty of Medicine of the University of Porto, where they were interviewed and completed another self-administered questionnaire and physical evaluation.

Food Consumption

Food consumption was evaluated through a food frequency questionnaire (FFQ) in the first and third assessments. In the first evaluation an adapted form of the Portuguese FFQ was used [23]. The adapted FFQ included the foods most frequently consumed by adolescents [24]. The questionnaire was completed by the participants with the help of their parents or legal guardians. The questionnaire referred to the last 12 months of consumption and included 91 different items. Consumption frequency was assessed on a 9-point scale from never to six or more times a day. In addition, the questionnaire also included an open section where participants could add food or drinks consumed at least once a week and that were not included in the initial version. In the third assessment, the semi-quantitative FFQ for adults, validated for the Portuguese adult population [23], was applied through a face-to-face interview. The adult FFQ comprised 86 items, with the 9-options frequency scale and it also included an open section. The portion consumed was evaluated as smaller, equal, or larger than the standard portion defined. The evaluated foods and beverages were categorized into fifteen groups (dairy, seafood, red meat, white meat, eggs, cereals, rice, pasta and potatoes, soup, vegetables, fruit, added fats, fast food, sweets and pastry products, sugary

drink, coffee and tea) according to their nutritional value and cultural context, as previously described [25]. A sixteenth group was also analysed in order to evaluate the total consumption of alcoholic beverages. This group included beer, wine and distilled spirits.

Additionally at 21 years, it was also assessed how many times a week participants ate not home-made meals, including meals made in canteens, take-away and pre-prepared meals consumed at home.

Anthropometrics

A physical evaluation was performed by trained professionals in the three evaluations. It included an assessment of height (cm) using a stadiometer, as well as assessment of weight (kg) using a digital scale – Tanita®. These values were used to calculate the body mass index (BMI) (weight divided by squared height). At 13 and 17 years, participants were classified as having underweight, normal weight, overweight or obesity, according to the World Health Organization sex- and age-specific growth references [26], while at 21 years the WHO adult cut-offs were used [27, 28].

Covariates

Lifestyle habits such as alcohol and tobacco consumption and practice of physical exercise were also assessed throughout the evaluations. At 21 years, the participants were asked if they had ever smoked. If yes, frequency of consumptions and number of cigarettes smoked per day or week were recorded. Regarding alcohol consumption, all participants were asked if they had ever consumed any alcoholic beverages. Those who answered yes were also asked

about how often they ingested these drinks. These questions were applied in all assessments. At 21 years, participants who reported having consumed alcoholic beverages were also asked about how many times they had been drunk and how often they consumed more than 5 (in the case of men) or more than 4 (in the case of women) alcoholic drinks in the same consumption occasion.

With regard to physical exercise, at 13 and 17 years old, the participants were asked about how many times a week they practiced sports outside of school and the number of times they practiced sports for at least 20 minutes in a row. In the third evaluation participants were asked if they practiced any sport or physical exercise and the duration per week. At all assessments participants were also asked about how many hours they spent a day watching television and playing video games / being in the computer.

The level of parental education was defined as the highest number of years of schooling completed between both parents.

Statistical analysis

According to the Kolmogorov-Smirnov test, the quantitative variables under study did not present a normal distribution, and they were therefore summarized as medians and 25^{th} and 75^{th} percentiles (P25; P75). Categorical variables were described using absolute and relative frequencies.

For the assessment of changes of food consumption between the ages of 13 and 21, participants were classified according to their tertile of consumption for each food group at each age. Then, based on transitions of tertiles of food consumption from 13 to 21 years, participants were classified as maintaining low consumption, maintaining high consumption, increasing their consumption, or

decreasing their consumption. For participants who remained in the 1st tertile in both assessments, it was considered that their consumption remained low, while for those who remained in the 3rd tertile, it was considered that their consumption remained high. The classification of those who remained in the 2nd tertile of consumption varied according to the median consumption for each food group and the existing intake recommendations. For the group of seafood, red meat, cereals, rice, pasta and potatoes, vegetables, added fat, fast food, sweets and pastry products, sugary drinks and soup, maintenance in the 2nd tertile was considered to maintain high consumption, while for the remaining groups, it was considered to keep consumption low. To assess whether there were significant differences in the changes of food consumption according to higher education attendance, Mann-Whitney and Pearson chi-square tests were applied. Finally, odds ratios (OR) and respective 95% confidence intervals (95% CI) were computed through multinomial regression models to assess the association between attendance at higher education (exposure) and the transition of food tertiles between 13 and 21 years of age (outcome). The models were adjusted for sex, smoking habits, physical exercise and parental education. To assess the changes in BMI categories across the same time period, a similar procedure was carried out. Participants were classified as maintaining a normal weight, maintaining excess weight or obesity, gaining weight, or losing weight. Subsequently, a multinomial regression model was carried out to assess whether higher education attendance (exposure) was associated with BMI changes (outcome).

Statistical analysis of the data was carried out using the Statistical Package for Social Sciences (SPSS ®), version 29.0. The results were considered significant when $\rho<0.05$.

Results

The characteristics of the sample are described in Table 1. From the 891 young adults we evaluated, 67.8% attend or have attended higher education. A higher frequency of women, of those who were single and of those who lived with at least one parent attended higher education. Regarding anthropometric data, prevalence of overweight and obesity was lower in higher education participants compared to those who did not attend higher education, 15.9% vs. 24.0% (overweight) and 4.8% vs. 10.1% (obesity). There were more higher education participants reporting playing sports (55.3% vs 46.7%). Smoking was more prevalent among non-higher education participants (44.6% vs 31.2%), while the number of binge drinking episodes that occurred in the last 6 months was higher among participants who attend or have attended higher education (26.8% vs. 12.2% reporting more than 5 episodes). The median number of times participants ate a non-homemade meal during the week was 4 (P25; P75 2.0; 6.0) for higher education participants and 2 (0.0; 6.0) for the non-higher education counterparts. Supplementary table 1 describes the median weight, fat mass, lean mass and BMI of the participants at 13, 17 and 21 years of age, as well as their distribution by BMI categories. Non-higher education participants had a higher median weight and lean mass and a lower median fat mass at both 17 and 21 years of age.

Table 2 describes the median daily frequency consumption of food groups at 21 years of age, according to higher education attendance. Higher education participants had a higher median consumption of seafood, rice, pasta and potatoes, vegetables, fruit, coffee and tea, and alcoholic beverages and a lower

consumption of fast food and sugary drinks, compared to non-higher education participants.

Differences in food group consumption between 13 and 21 years of age were analyzed both as a continuous difference between food consumption at each age (Supplementary Table 2), and as the transition of tertiles of food intake (Table 3). When evaluated as continuous variables, sugary drinks stood out as being the group where there was a larger difference in the evolution of consumption between 13 and 21 years old. Higher education participants recorded a median difference of -0.21 daily frequency consumption (P25; P75 -0.77; 0.15) pointing to a reduction in consumption, while non-higher education participants showed a median of 0.67 (P25; P75 -0.70; 0.72) pointing to an increase in consumption (Supplementary Table 2). Regarding changes in tertiles of consumption (Table 3), there were significant differences between higher education participants and young adults who did not attend higher education for the food groups of seafood, rice, pasta and potatoes, soup, fast food, sugary drinks, and coffee and tea. Some of the largest differences were found in the rice, pasta and potatoes group where a greater proportion of participants who attended higher education maintained a high consumption, compared to non-higher education attendees (24.5% vs 16.7%). In the vegetable soup group, there were significantly more non-higher education participants who maintained a low consumption (41.5% vs 27.2%) and, conversely, more higher education participants maintained a high consumption (23.0% vs 15.0%). For the fast food and sugary drinks group, the opposite trend was observed, with higher education participants keeping consumption low (22.5% vs 7.0%; 19.9% vs 8.7%, respectively). Still for sugary drinks, it is noteworthy that a greater proportion of non-higher education participants increased their

consumption (36.9% vs 24.0%). In the coffee and tea group there was a greater proportion of higher education participants increasing their consumption (32.6% vs 20.6%). For alcohol consumption, the association was analyzed for tertiles of consumption at 21 years, and not for differences between 13 and 21 years of age, since reported consumption at 13 years was very low. The proportion of participants in the highest tertile of consumption was significantly higher in the higher education, compared to non-higher education participants (40.7% vs. 28.9%). Regarding changes in BMI categories between 13 and 21 years, there was a smaller proportion of higher education participants who increased their BMI category (7.8% vs. 16.0%) and a higher proportion maintaining the normal weight category (67.7% vs. 57.1%) compared to non-higher education participants (Table 3).

The results of the multinomial regression carried out to evaluate the association between attending higher education and the evolution of food consumption are summarized in Table 4. After adjustment for potential confounders, participants who attended higher education, compared to those who did not attend higher education were 43% less likely (95% CI 0.34 - 0.96) to keep their seafood consumption low compared to keeping their consumption high. For the consumption of fast food and sugary drinks, participants who attended higher education, compared to those who did not attend, were 59% (OR=0.41 95% CI 0.23-0.75) and 61% (OR=0.39 95% CI 0.22-0.69) less likely to maintain a high consumption, compared to the maintain low consumption group. They were also less likely to both increase or decrease consumption of fast food and sugary drinks compared to keeping consumption low. For the consumption of alcoholic beverages, as previously mentioned, consumption changes were not assessed, but

rather the association between attending higher education and the tertile of consumption at 21 years. Higher education participants were more likely to belong to the 2nd tertile of consumption and the 3rd tertile of consumption than the 1st, when compared to non-higher education participants (OR=1.99 95% CI 1.30-3.03; and OR=2.70 95% CI 1.69-4.31). Regarding the association with changes in BMI, in the crude model, participants who attended higher education, compared to those who did not, were 52% less likely to increase their BMI category. However, the association was not statistically significant after adjustment for the confounders.

Discussion

In this study, there were significant differences in food consumption at 21 years of age, and in the food intake changes between 13 and 21 years, between young people who attend or have attended higher education and those who have not. Part of those differences seems to be explained by differences in food consumption already present at age 13 and by some confounding variables such as parental educational level. Nevertheless, between 13 and 21 years old there was a largest increase in sugary drinks among non-higher education participants, and a higher consumption of alcoholic drinks among higher education participants.

Regarding diet, we found that, at the age of 21, participants who attended or were attending higher education had a higher consumption of seafood, rice, pasta and potatoes, vegetables, fruits, soup, coffee and tea and a lower consumption of fast food, and sugary drinks when compared to non-higher education participants. Therefore, young adults who attend or have attended higher education seem to have a healthier diet then those who did not. The eating habits of young people who attend higher education are well studied and

documented. Studies carried out in Spain report low adherence to recommendations regarding the consumption of bread and grains, fruit, meat, vegetables and excessive consumption of cold meats and sweets. [9] The adherence of these young adults to the Mediterranean Dietary Pattern, considered a health-promoting dietary pattern typical of this area, is also considered low [11]. The same seems to happen for Portuguese university students [8]. There are also concordant data for Brazil, with Monteiro *et al*. reporting that only about half of their sample of university students met the recommendations for consumption of fruit, raw salad, and vegetables, and that 28.1% of women and 32.1% of men consumed sugar-sweetened beverages 5 or more times per week [29]. Considering that there is a significant amount of evidence that points to the existence of unhealthy eating habits among higher education students, our results can be seem contradictory, however, we showed the existence of even worse habits among young people who do not enroll at higher education. With our study, we did not aim to assess whether young people's food consumption was in line with health recommendations, but rather whether food consumption evolved differently according to higher education attendance. We wanted to understand whether entering higher education can be considered a protective factor against worsening food consumption or whether all young people go through the same evolution in terms of food consumption when they begin their adult lives. It is important to highlight that although at the age of 21 some differences were detected between the food consumption of higher education and non-higher education participants, some of these differences already existed previously. When we evaluated the differences in food consumption at the age of 13, we found that participants who later enrolled at higher education already had a greater consumption of seafood, rice,

pasta and potatoes, fruit and soup and a lower consumption of fast food. When we assessed the evolution in consumption on a continuous basis, we found that there were differences between the groups in terms of consumption of eggs, soup, sugary drinks, coffee and tea and alcoholic drinks. For the food group of eggs, soup, coffee and tea, this difference seems minimal, since both groups have the same median differences in consumption. For the sugary drinks group there seems to be an increase among non-higher education participants and a decrease among higher education participants (with a median difference of 0.67 vs -0.21), while for the alcoholic beverages group there appears to be a greater increase among higher education participants (with a median difference of 0.13 vs 0.07). When the evaluation was carried out through the evolution between tertiles of consumption, we found that there were differences once again when it comes to the consumption of soup, sugary drinks, coffee and tea, and also when it comes to the consumption of seafood, rice, pasta and potatoes, and fast food. To understand the association between attending higher education and these changes, we performed multinomial regression models. When we adjusted these models for sex, physical exercise, tobacco consumption, and parents' maximum level of education, the differences that existed for the consumption of rice, pasta and potatoes, soup and coffee and tea lost their statistical significance. In terms of seafood, we found that higher education participants were 43% less likely to keep their consumption low than to keep their consumption high, when compared to non-higher education participants. This result can easily be explained by the already existing difference in seafood consumption at 13 years of age. Considering that higher education participants already had a higher consumption of seafood at that time, it is not surprising that a smaller proportion of them kept their

consumption low (13.2% vs 22.0%). Regarding the proportion of participants who have increased and reduced their consumption, there do not appear to be any significant differences (30.8% vs 29.6% and 31.6% vs 26.8% respectively). Regarding the fast food and sugary drinks group, we found that higher education participants were 59% and 61% less likely to maintain high consumption than to maintain low consumption, respectively, when compared to non-higher education participants. They were also 62% and 71% less likely to increase consumption and 51% and 55% less likely to decrease consumption. As it was mentioned before, we know that at the age of 13, non-higher education participants already had a higher consumption of fast food, so it is not surprising that a greater proportion of them maintained their consumption high (30.7% vs 21.9%) and a lower proportion kept consumption low (7.0% vs 22.5%) when compared to the group of university participants. The proportion of participants who increased and decreased their consumption does not seem to differ that much, with 36.6% and 31.3% of non-higher education and higher education participants increasing their consumption, respectively, and 25.8% and 24.3% decreasing their consumption. On the other hand, when it comes to the consumption of sugary drinks, there were no previous differences. In this case, there is a higher proportion of higher education students keeping their consumption low (19.9% vs 8.7%) and a higher proportion of non-higher education participants increasing their consumption of these drinks (36.9% vs 24.0%). This leads us to believe that not attending higher education appears to be associated with a greater increase in the consumption of sugary drinks among young people. There is evidence that the consumption of sugar-sweetened beverages is greater in individuals with lower levels of education and in individuals who consume fast food more frequently, which may explain our results [30-32]. With

the exception of sugary drinks, differences in consumption at age 21 seem to be justified by factors other than higher education attendance. A variable that seems important to highlight in this sense is the level of education of the participants' parents. We can infer that it is likely that the majority of participants who attended or attend university come from households where at least one parent has already attended university. In fact, when we analyzed our data we found that 44.9% of higher education participants had at least one parent with more than 12 years of completed schooling compared to only 10.2% of non-higher education participants. There is evidence that higher levels of education among parents are associated with healthier eating among their children. In one study in the United Kingdom, Cribb et. al concluded that the quality of children's diet at age 10 was associated with the mother's level of education. Lower education levels were associated with greater consumption of unhealthy food groups, such as burgers and sausages, while fruit and vegetable consumption showed a positive gradient with an increase in maternal education level. [33] In the same sense, a study published in 2023 showed that adherence to the Mediterranean dietary pattern was greater among children whose parents had completed higher education. [34]

When it comes to alcohol consumption, the results were as expected, with significant differences between higher education and non-higher education participants. More than one third of young people in higher education attendees reported drinking alcohol at least once a week, compared to 26.8% of non-higher education participants. For binge drinking behavior, while around half of the participants who did not attend higher education reported 0 episodes of binge drinking in the last 6 months, only 30.5% of higher education participants reported no binge drinking episodes. It is also important to highlight that 26.8% of young

adults who attended or attend higher education reported having 6 or more episodes. These results point to higher education being a risk factor for excessive alcohol consumption, which seems to be in accordance with the literature. Patrick *et al*. assessed the prevalence and frequency of high intensity drinking among young people in the United States, and showed that between the ages of 21 and 22 there was a peak in the frequency of binge drinking episodes (more than 5 drinks) and high intensity drinking (more than 10 drinks) among young people who attended university, when that did not happen for the remaining young adults [35]. In another study, the same author also concluded that, although episodes of binge drinking and high intensity drinking are relatively common among the young adult population in general, four-year college students and those who did not live with their parents were more likely to engage in in high intensity drinking behaviors [36]. This may result from the fact that drinking alcohol is considered a common social practice among young people who attend higher education. Alcohol consumption is often seen as a way to relax or strengthen friendships. Furthermore, taking into account that the consumption of alcoholic beverages tends to be done in groups and in the context of social events, there is also the aggravating social pressure to drink among this group [37].

Among the participants who attended or are attending higher education, 15.9% had overweight and 4.8% obesity. These values are in line with studies carried out among other young university students. Cross-sectional studies carried out in Poland, Germany and Morocco reported that 16%, 18% and 16.4% of their samples, respectively, had overweight or obesity. [7, 16, 38] Prevalence of overweight and obesity appears to be greater among non-higher education participants (24.0% and 10.1%, respectively). When we evaluated BMI category

change between the ages of 13 and 21, there were also significant differences according to higher education attendance: 10.1% of higher education participants maintained overweight or obesity categories and 7.8% changed to overweight or obesity, while for non-higher education participants proportions were higher (12.9% and 16%, respectively). In our adjusted model we did not find statistically significant differences that would relate higher education attendance to the evolution of BMI category, however there appears to be a lower probability of higher education participants increasing their BMI category than maintaining a normal BMI category, when compared to non-higher education participants. The literature reports that these is a tendency for young people to gain weight when entering higher education [4, 5, 17, 18, 39]. A systematic review and meta-analysis, published in 2020, and with the aim of evaluating changes in body weight across the education and employment transitions of early adulthood concluded that there is consistent evidence that there is an increase in weight in the transition between high school and university [40]. It also concluded that there is not enough information regarding the evolution of weight when young people transition from high school directly to the job market. Taking this into consideration, as well as our results, it is possible to assume that the problem of weight gain appears to be common across this age group and possibly greater among young people who do not attend higher education.

This study does not come without some limitations. Firstly, it is important to highlight that all those who completed at least 1 year of higher education were considered as university participants. One year may not be enough to lead to significant changes in participants' eating habits and weight, so the differences

we detected may be slightly underestimated. Furthermore, we did not have the opportunity to evaluate eating habits immediately before entering higher education, as well as throughout the subsequent years, which would have allowed us to assess the impact of entering higher education more rigorously on young people's diets. We also highlight that only participants who had valid data regarding the FFQ and the assessment of weight and height at 13 and 21 years old were included in the study. We found that at 13 years of age there were no differences in terms of sex and BMI between participants included and excluded from the study. However, there were differences between the proportion of young people attending private education and their parents' maximum education level. Taking into account that there was a greater proportion of young people attending private education in our sample, and their parents' maximum level of education was higher, it is possible that the differences in our results were undervalued, since the level of education tends to be associated with healthier eating habits. It is also relevant to mention that with the data we had available we were only able to assess the participants' households and not whether the young people who were at university lived alone or with their family during the academic year, which is considered relatively common and may also have a significant impact on food consumption. Secondly, it is important to note that while at age 21 the FFQ was applied through an interview, at age 13 it was self-applied with the help of parents or legal guardians, which can make it more prone to error. The questionnaire used at age 13 also had the disadvantage of not being validated for the population in question as well as not being a quantitative. However, there is evidence that an FFQ validated for an adult population is valid for adolescents in the same population, as well as the fact that the frequency of consumption is more relevant

to assess food consumption than the portion of consumption itself [41-43]. On the other hand, this study addresses a large gap in the literature, as it allows the comparison of the eating habits and weight of young adults who did not attend higher education with those who did [21]. There are many studies carried out on young university students, but ours, to our knowledge, is one of the first that compares higher education attendees to their peers who did not attend higher education. Our work also has the advantage of being based on longitudinal data and using a population-based sample, which supports its external validity. Taking into account the large amount of information collected, it was also possible to adjust our results for common confounding variables such as sex, smoking habits, physical exercise and parental education level.

We conclude that although in general food consumption between 13 and 21 years old evolves in a similar way between young people who attended or are attending higher education and young people who did not, there are marked differences when it comes to the consumption of sugary drinks and alcoholic beverages. It is also worthy to mention that young adults who followed to higher education seem to generally have a healthier diet. Regarding the evolution of weight, even though there was not statistical significance, we found that there was a noticeable tendency for young people who do not enroll at higher education to increase their BMI category during the same time period. We know that the literature points to the implementation of unhealthy eating habits and weight gain with the beginning of higher education, and as such, beginning higher education was perceived as a risk period to the development of unhealthy lifestyles. However, according to our results it seems safe to assume that these changes

might be present among all young adults independently of their higher education attendance, and that these changes may even be more significant among young people who do not go on to higher education. Young adulthood seems to be a period of interest for the implementation of public health measures aimed at promoting healthy lifestyles. It is important to note the existing differences among young adults who attend or not higher education when planning these measures.

References

1. Hu T, Jacobs DR, Jr., Larson NI, Cutler GJ, Laska MN, Neumark-Sztainer D. Higher Diet Quality in Adolescence and Dietary Improvements Are Related to Less Weight Gain During the Transition From Adolescence to Adulthood. J Pediatr. 2016; 178:188-93.e3.
2. Demory-Luce D, Morales M, Nicklas T, Baranowski T, Zakeri I, Berenson G. Changes in food group consumption patterns from childhood to young adulthood: the Bogalusa Heart Study. Journal of the American Dietetic Association. 2004; 104(11):1684-91.
3. Patrick ME, Azar B. High-Intensity Drinking. Alcohol Res. 2018; 39(1):49-55.
4. Pope L, Hansen D, Harvey J. Examining the weight trajectory of college students. Journal of nutrition education and behavior. 2017; 49(2):137-41. e1.
5. Deliens T, Deforche B, Chapelle L, Clarys P. Changes in weight and body composition across five years at university: A prospective observational study. PLoS One. 2019; 14(11):e0225187.
6. Antonopoulou M, Mantzorou M, Serdari A, Bonotis K, Vasios G, Pavlidou E, et al. Evaluating Mediterranean diet adherence in university student populations: Does this dietary pattern affect students' academic performance and mental health? Int J Health Plann Manage. 2020; 35(1):5-21.
7. Stroebele-Benschop N, Dieze A, Hilzendegen C. Students' adherence to dietary recommendations and their food consumption habits. Nutr Health. 2018; 24(2):75-81.
8. Bárbara R, Ferreira-Pêgo C. Changes in Eating Habits among Displaced and Non-Displaced University Students. Int J Environ Res Public Health. 2020; 17(15)
9. Ramón-Arbués E, Granada-López JM, Martínez-Abadía B, Echániz-Serrano E, Antón-Solanas I, Jerue BA. Factors Related to Diet Quality: A Cross-Sectional Study of 1055 University Students. Nutrients. 2021; 13(10)
10. Messina MP, D'Angelo A, Ciccarelli R, Pisciotta F, Tramonte L, Fiore M, et al. Knowledge and Practice towards Alcohol Consumption in a Sample of University Students. Int J Environ Res Public Health. 2021; 18(18)
11. López-Moreno M, Garcés-Rimón M, Miguel M, Iglesias López MT. Adherence to Mediterranean Diet, Alcohol Consumption and Emotional Eating in Spanish University Students. Nutrients. 2021; 13(9)
12. Moutinho LSM, de Oliveira Cruz Mendes AM, Lopes M. Alcohol Consumption and Binge Drinking Among Young Adults Aged 20-30 Years in Lisbon, Portugal. J Addict Nurs. 2018; 29(4):E9-e15.
13. Munt AE, Partridge SR, Allman-Farinelli M. The barriers and enablers of healthy eating among young adults: a missing piece of the obesity puzzle: A scoping review. Obes Rev. 2017; 18(1):1-17.
14. Hilger J, Loerbroks A, Diehl K. Eating behaviour of university students in Germany: Dietary intake, barriers to healthy eating and changes in eating behaviour since the time of matriculation. Appetite. 2017; 109:100-07.
15. Papadaki A, Hondros G, J AS, Kapsokefalou M. Eating habits of university students living at, or away from home in Greece. Appetite. 2007; 49(1):169-76.
16. Benaich S, Mehdad S, Andaloussi Z, Boutayeb S, Alamy M, Aguenaou H, et al. Weight status, dietary habits, physical activity, screen time and sleep duration among university students. Nutr Health. 2021; 27(1):69-78.

17. Fedewa MV, Das BM, Evans EM, Dishman RK. Change in weight and adiposity in college students: a systematic review and meta-analysis. American journal of preventive medicine. 2014; 47(5):641-52.
18. Gropper SS, Simmons KP, Connell LJ, Ulrich PV. Weight and body composition changes during the first three years of college. Journal of obesity. 2012; 2012
19. Chen C, Ye Y, Zhang Y, Pan XF, Pan A. Weight change across adulthood in relation to all cause and cause specific mortality: prospective cohort study. Bmj. 2019; 367:l5584.
20. Nelson M, Story M, Larson N, Neumark-Sztainer D, Lytle L. Emerging adulthood and college-aged youth: An overlooked age for weight-related behavior change. Obesity, 16 (10), 2205–2211. 2008.
21. Stok FM, Renner B, Clarys P, Lien N, Lakerveld J, Deliens T. Understanding eating behavior during the transition from adolescence to young adulthood: a literature review and perspective on future research directions. Nutrients. 2018; 10(6):667.
22. Georgiou CC, Betts NM, Hoerr SL, Keim K, Peters PK, Stewart B, et al. Among young adults, college students and graduates practiced more healthful habits and made more healthful food choices than did nonstudents. Journal of the American Dietetic Association. 1997; 97(7):754-59.
23. Lopes C, Aro A, Azevedo A, Ramos E, Barros H. Intake and adipose tissue composition of fatty acids and risk of myocardial infarction in a male Portuguese community sample. Journal of the American Dietetic Association. 2007; 107(2):276-86.
24. Araújo J, Severo M, Lopes C, Ramos E. Food sources of nutrients among 13-year-old Portuguese adolescents. Public health nutrition. 2011; 14(11):1970-78.
25. Cabral M, Araújo J, Lopes C, Ramos E. Food intake and high-sensitivity C-reactive protein levels in adolescents. Nutrition, Metabolism and Cardiovascular Diseases. 2018; 28(10):1067-74.
26. Onis Md, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bulletin of the World health Organization. 2007; 85(9):660-67.
27. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, et al. Harmonizing the metabolic syndrome: a joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity. Circulation. 2009; 120(16):1640-45.
28. Grundy SM, Cleeman JI, Daniels SR, Donato KA, Eckel RH, Franklin BA, et al. Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute scientific statement. Circulation. 2005; 112(17):2735-52.
29. Monteiro LZ, Varela AR, Lira BA, Contiero LC, Carneiro MLA, Souza P, et al. Weight status, physical activity and eating habits of young adults in Midwest Brazil. Public Health Nutr. 2019; 22(14):2609-16.
30. Miller C, Wakefield M, Braunack-Mayer A, Roder D, O'Dea K, Ettridge K, et al. Who drinks sugar sweetened beverages and juice? An Australian population study of behaviour, awareness and attitudes. BMC obesity. 2019; 6(1):1-12.
31. Kunzova M, Neto GAM, Infante-Garcia MM, Nieto-Martinez R, González-Rivas JP. Risk Factors Associated with the Consumption of Sugar-Sweetened

Beverages among Czech Adults: The Kardiovize Study. Nutrients. 2022; 14(24):5297.
32. Al-Hanawi MK, Ahmed MU, Alshareef N, Qattan AMN, Pulok MH. Determinants of sugar-sweetened beverage consumption among the Saudi Adults: findings from a nationally representative survey. Frontiers in Nutrition. 2022; 9:744116.
33. Cribb VL, Jones LR, Rogers IS, Ness AR, Emmett PM. Is maternal education level associated with diet in 10-year-old children? Public health nutrition. 2011; 14(11):2037-48.
34. Depboylu GY, Kaner G. Younger age, higher father education level, and healthy lifestyle behaviors are associated with higher adherence to the Mediterranean diet in school-aged children. Nutrition. 2023; 114:112166.
35. Patrick ME, Terry-McElrath YM, Kloska DD, Schulenberg JE. High-intensity drinking among young adults in the United States: Prevalence, frequency, and developmental change. Alcoholism: clinical and experimental research. 2016; 40(9):1905-12.
36. Patrick ME, Terry-McElrath YM. High-intensity drinking by underage young adults in the United States. Addiction. 2017; 112(1):82-93.
37. Supski S, Lindsay J, Tanner C. University students' drinking as a social practice and the challenge for public health. Critical Public Health. 2017; 27(2):228-37.
38. Suwalska J, Kolasińska K, Łojko D, Bogdański P. Eating Behaviors, Depressive Symptoms and Lifestyle in University Students in Poland. Nutrients. 2022; 14(5)
39. Deforche B, Van Dyck D, Deliens T, De Bourdeaudhuij I. Changes in weight, physical activity, sedentary behaviour and dietary intake during the transition to higher education: a prospective study. International Journal of Behavioral Nutrition and Physical Activity. 2015; 12(1):1-10.
40. Winpenny EM, Smith M, Penney T, Foubister C, Guagliano JM, Love R, et al. Changes in physical activity, diet, and body weight across the education and employment transitions of early adulthood: A systematic review and meta-analysis. Obes Rev. 2020; 21(4):e12962.
41. Shatenstein B, Amre D, Jabbour M, Feguery H. Examining the relative validity of an adult food frequency questionnaire in children and adolescents. Journal of pediatric gastroenterology and nutrition. 2010; 51(5):645-52.
42. Mendes VMM. Assessing dietary intake in adolescents: the role of food portion size evaluation in food frequency questionnaires. Universidade do Porto (Portugal); 2015.
43. Molag ML, de Vries JH, Ocké MC, Dagnelie PC, van den Brandt PA, Jansen MC, et al. Design characteristics of food frequency questionnaires in relation to their validity. American journal of epidemiology. 2007; 166(12):1468-78.

TABLE 1: Participants characteristics at 21 years of age, in higher education and non-higher education participants

		Higher education participants	Non-higher education participants
Demographic Characteristics		n (%)	
Sex	Woman	340 (56.3)	131 (45.6)
	Man	264 (43.7)	156 (54.4)
Marital Status	Single	600 (99.3)	247 (86.1)
	Married	3 (0.5)	38 (13.2)
	Divorced / Separated	1 (0.2)	2 (0.7)
Household	Lives alone	3 (0.5)	2 (0.7)
	Lives with at least one parent	586 (97.4)	248 (87.0)
	Lives with a spouse	2 (0.3)	24 (8.4)
Anthropometric data		Median (25^{th}; 75^{th} percentiles)	
Weight (kg)		62.1 (55.2; 72.0)	65.1 (57.2; 75.3)
Lean mass (kg)		48.0 (42.7; 59.7)	51.5 (45.2; 61.1)
Fat mass (%)		19.2 (13.9; 25.5)	19.1 (11.6; 26.4)
Height (cm)		167.9 (161.5; 175.2)	168.2 (160.8; 175.7)
BMI (kg/m^2)		22.0 (20.1; 24.4)	22.8 (20.7; 25.9)
		n (%)	
BMI Categories	Underweight	41 (6.8)	18 (6.3)
	Normal weight	438 (72.5)	171 (59.6)
	Overweight	96 (15.9)	69 (24.0)
	Obesity	29 (4.8)	29 (10.1)
Lifestyle characteristics		n (%)	
How do you spend their free time	Mainly sitting	191 (31.7)	93 (32.4)
	Mainly standing	302 (50.1)	127 (44.3)
	Active/very active	110 (18.2)	67 (23.3)
Practice of sports	Yes	334 (55.3)	134 (46.7)
	No	270 (44.7)	153 (53.3)
Smoking Habits	Never smoked	196 (32.5)	73 (25.4)
	Tried smoking	204 (33.8)	75 (26.2)
	Ex-smoker	15 (2.5)	11 (3.8)
	Smoker	189 (31.2)	128 (44.6)
Drinking habits	Non drinker	9 (1.5)	6 (2.1)
	Ex-drinker	9 (1.5)	11 (3.8)
	<1 x per week	352 (58.3)	184 (64.2)
	1-6 x per week	225 (37.2)	77 (26.8)
	Daily	9 (1.5)	9 (3.1)
Binge drinking	0	180 (30.5)	137 (49.5)
	1 to 2 times	131 (22.2)	67 (24.2)

episodes	3 to 5 times	121 (20.5)	39 (14.1)
in the last	6 to 9 times	72 (12.2)	12 (4.3)
6 months	10 times or more	86 (14.6)	22 (7.9)
Eating Habits		Median (25^{th}; 75^{th})	
Number of not homemade lunch during the week		3.0 (1.0; 5.0)	1.0 (0.0; 4.0)
Number of not homemade dinner during the week		1.0 (0.0; 2.0)	1.0 (0.0; 2.0)
Total of not homemade meals during the week		4.0 (2.0; 6.0)	2.0 (0.0; 6.0)

TABLE 2: Consumption frequency of each food group at 21 years in higher education participants and non-higher education participants

	Higher education participants	**Non-higher education participants**	
Food group (daily frequency)	Median (25^{th}; 75^{th})		p-value
Dairy	2.43 (1.57; 3.36)	2.14 (1.43; 3.50)	0.745
Seafood	0.70 (0.41; 0.99)	0.57 (0.34; 0.95)	**0.024**
Red meat	0.86 (0.57; 1.01)	0.86 (0.57; 1.21)	0.157
White meat	0.57 (0.43; 0.86)	0.57 (0.43; 0.79)	0.225
Eggs	0.14 (0.14; 0.43)	0.43 (0.14; 0.43)	0.787
Cereals	1.49 (1.07; 2.21)	1.49 (1.00; 2.43)	0.636
Rice, pasta and potatoes	1.57 (1.29; 1.86)	1.36 (1.00; 1.64)	**0.002**
Soup	0.61 (0.43; 1.00)	0.43 (0.14; 1.00)	**<0.001**
Vegetables	2.16 (1.29; 3.43)	1.99 (1.06; 3.00)	**0.005**
Fruit	1.57 (1.06; 2.17)	1.29 (0.79; 1.95)	**<0.001**
Added fat	1.00 (0.50; 1.43)	0.92 (0.50; 1.43)	0.371
Fast food	0.36 (0.21; 0.64)	0.57 (0.33; 0.92)	**<0.001**
Sweets and pastry products	1.31 (0.75; 1.89)	1.19 (0.73; 1.96)	0.651
Sugary drinks	0.57 (0.21; 1.00)	0.93 (0.43; 1.57)	**<0.001**
Coffe and tea	0.07 (0.00; 0.14)	0.00 (0.00; 0.07)	**<0.001**
Alcoholic Beverages	0.14 (0.07; 0.35)	0.07 (0.00; 0.21)	**<0.001**

p-value estimated by the Mann-Whitney test.

TABLE 3: Transitions in the tertiles of food groups consumption and in BMI categories from 13 to 21 years of age for higher education participants and non-higher education participants

		Higher education participants	Non-higher education participants	
Food group	Transition from 13 to 21 years	n (%)		p-value
Dairy	Maintain low	99 (16.4)	58 (20.2)	0.169
	Maintain high	152 (25.2)	63 (22.0)	
	Increase	152 (25.2)	84 (29.3)	
	Decrease	201 (33.2)	82 (28.6)	
Seafood	Maintain low	80 (13.2)	63 (22.0)	**0.010**
	Maintain high	147 (24.3)	62 (21.6)	
	Increase	186 (30.8)	85 (29.6)	
	Decrease	191 (31.6)	77 (26.8)	
Red meat	Maintain low	100 (16.6)	48 (16.7)	0.387
	Maintain high	140 (23.2)	63 (22.0)	
	Increase	187 (31.0)	104 (36.2)	
	Decrease	177 (29.3)	72 (25.1)	
White meat	Maintain low	191 (31.6)	97 (33.8)	0.776
	Maintain high	65 (10.8)	25 (8.7)	
	Increase	164 (27.2)	77 (26.8)	
	Decrease	184 (30.5)	88 (30.7)	
Eggs	Maintain low	334 (55.3)	161 (56.1)	0.339
	Maintain high	2 (0.3)	2 (0.7)	
	Increase	147 (24.3)	79 (27.5)	
	Decrease	121 (20.0)	45 (15.7)	
Cereals	Maintain low	76 (12.6)	44 (15.3)	0.716
	Maintain high	151 (25.0)	67 (23.3)	
	Increase	186 (30.8)	86 (30.0)	
	Decrease	191 (31.6)	90 (31.4)	
Rice, pasta and potatoes	Maintain low	78 (12.9)	53 (18.5)	**0.021**
	Maintain high	148 (24.5)	48 (16.7)	
	Increase	160 (26.5)	76 (26.5)	
	Decrease	218 (36.1)	110 (38.3)	
Soup	Maintain low	164 (27.2)	119 (41.5)	**<0.001**
	Maintain high	139 (23.0)	43 (15.0)	
	Increase	113 (18.7)	62 (21.6)	
	Decrease	188 (31.1)	63 (22.0)	
Vegetables	Maintain low	100 (16.6)	63 (22.0)	0.254
	Maintain high	164 (27.2)	70 (24.4)	
	increase	179 (29.6)	78 (27.2)	
	decrease	161 (26.7)	76 (26.5)	
Fruit	Maintain low	176 (29.1)	99 (34.5)	0.100
	Maintain high	79 (13.1)	33 (11.5)	
	Increase	174 (28.8)	63 (22.0)	
	Decrease	175 (29.0)	92 (32.1)	
Added fat	Maintain low	100 (16.6)	43 (15.0)	0.189

Fast food	Maintain high	155 (25.7)	58 (20.2)	**<0.001**
	Increase	185 (30.6)	93 (32.4)	
	Decrease	164 (27.2)	93 (32.4)	
	Maintain low	136 (22.5)	20 (7.0)	
	Maintain high	132 (21.9)	88 (30.7)	
	Increase	189 (31.3)	105 (36.6)	
	Decrease	147 (24.3)	74 (25.8)	
Sweets and pastry products	Maintain low	88 (14.6)	40 (13.9)	0.957
	Maintain high	162 (26.8)	75 (26.1)	
	Increase	194 (32.1)	91 (31.7)	
	Decrease	160 (26.5)	81 (28.2)	
Sugary drinks	Maintain low	120 (19.9)	25 (8.7)	**<0.001**
	Maintain high	149 (24.7)	80 (27.9)	
	Increase	145 (24.0)	106 (36.9)	
	Decrease	190 (31.5)	76 (26.5)	
Coffe and tea	Maintain low	235 (38.9)	126 (43.9)	**<0.001**
	Maintain high	36 (6.0)	12 (4.2)	
	Increase	197 (32.6)	59 (20.6)	
	Decrease	136 (22.5)	90 (31.4)	
	Consumption at 21 years	n (%)		
Alcoholic Beverages	1° tertile	138 (22.8)	116 (40.4)	**<0.001**
	2° tertile	220 (36.4)	88 (30.7)	
	3° tertile	246 (40.7)	83 (28.9)	
	Transition from 13 to 21 years	n (%)		
BMI categories	Maintain normal weight	409 (67.7)	164 (57.1)	**<0.001**
	Maintain overweight or obesity	61 (10.1)	37 (12.9)	
	Increased BMI category	47 (7.8)	46 (16.0)	
	Decreased BMI category	87 (14.4)	40 (13.9)	

TABLE 4: Multinomial regression models for the associations of being a higher education participant (vs. non-higher education participant) with changes in food group tertiles, and changes of BMI categories between 13 and 21 years of age

	Transition of food group tertiles from 13 to 21 years				Transition of food group tertiles from 13 to 21 years			
	Maintain low	Maintain high	Increase	Decrease	Maintain low	Maintain high	Increase	Decrease
	Crude OR (95% CI) for university students				Adjusted OR (95% CI)* for university students			
Seafood	0.54 (0.34 – 0.84)	Ref.	0.92 (0.62 – 1.37)	1.05 (0.70-1.56)	0.57 (0.34 – 0.96)	Ref.	1.10 (0.70 – 1.73)	1.11 (0.70 – 1.75)
Rice, pasta and potatoes	0.48 (0.30 – 0.77)	Ref.	0.68 (0.45 – 1.04)	0.64 (0.43 – 0.96)	0.88 (0.51 – 1.53)	Ref.	1.14 (0.70 – 1.86)	0.76 (0.48 – 1.20)
Soup	0.43 (0.28 – 0.65)	Ref.	0.56 (0.36 – 0.89)	0.92 (0.59 – 1.44)	0.78 (0.49 – 1.26)	Ref.	0.93 (0.55 – 1.58)	1.28 (0.77 – 2.12)
Fast food	Ref.	0.22 (0.13 -0.38)	0.27 (0.16 – 0.45)	0.2930 (0.17 – 0.50)	Ref.	0.41 (0.23 – 0.75)	0.38 (0.21 – 0.68)	0.49 (0.27 – 0.89)
Sugary drinks	Ref.	0.39 (0.23 – 0.65)	0.29 (0.17 – 0.47)	0.52 (0.31 – 0.86)	Ref.	0.39 (0.22 – 0.69)	0.29 (0.17 – 0.51)	0.45 (0.26 – 0.79)
Coffe and tea	Ref.	1.61 (0.81 – 3.20)	1.79 (1.25 – 2.57)	0.81 (0.58 – 1.14)	Ref.	1.50 (0.69 – 3.27)	1.32 (0.87 – 2.00)	0.90 (0.61– 1.35)
	Tertile of consumption at 21 years				Tertile of consumption at 21 years			
	1° tertile	2° tertile	3° tertile		1° tertile	2° tertile	3° tertile	
Alcoholic bevarages	Ref.	2.10 (1.48 – 2.98)	2.49 (1.76 – 3.54)		Ref.	1.99 (1.30 – 3.03)	2.70 (1.69 – 4.31)	
	Transition of BMI categories from 13 to 21 years				Transition of BMI categories from 13 to 21 years			
	Maintain normal weight	Maintain excess weight	Increase BMI category	Decrease BMI category	Maintain normal weight	Maintain excess weight	Increase BMI category	Decrease BMI category

	Crude OR (95% CI) for university students				Adjusted OR (95% CI)* for university students			
BMI	Ref.	0.66 (0.42 – 1.03)	0.41 (0.26 – 0.64)	0.87 (0.58 – 1.32)	Ref.	0.68 (0.34 – 1.35)	0.55 (0.29 – 1.02)	0.88 (0.49 – 1.58)

* Model adjusted for sex, physical exercise, smoking habits and parents' maximum level of education.

Supplementary Table 1: Median weight, fat mass, lean mass and BMI, and prevalence of BMI categories at 13, 17 and 21 years of age in higher education and non-higher education participants

		Higher education participants	Non-higher education participants
		Median (25^{th}; 75^{th})	
13 years	Weight (kg)	52.2 (47.1 – 59.3)	53.1 (45.8 – 59.3)
	Fat mass (%)	20.6 (13.3 – 27.5)	19.6 (11.9 – 28.1)
	BMI Z-score	0.35 (-0.26 – 1.07)	0.48 (-0.20 – 1.23)
	Lean mass (Kg)	40.6 (37.2 – 46.1)	40.7 (37.1 – 46.9)
17 years	Weight (kg)	59.8 (53.8 – 67.4)	61.3 (54.0 – 67.9)
	Fat mass (%)	20.0 (13.1 – 25.9)	17.2 (10.9 – 25.7)
	BMI Z-score	0.13 (-0.42 – 0.77)	0.18 (-0.38 – 0.84)
	Lean mass (kg)	46.5 (41.7 – 56.4)	49.6 (43.2 – 57.4)
21 years	Weight (kg)	62.1 (55.2 – 72.0)	65.1 (57.2 – 75.3)
	Fat mass (%)	19.2 (13.9 – 25.5)	19.1 (11.6 – 26.4)
	BMI	22.0 (20.1 – 24.4)	22.8 (20.7 – 25.9)
	Lean mass (kg)	48.0 (42.7 – 59.7)	51.5 (45.2 – 61.1)
		n (%)	
BMI categories 13 years	Underweight	6 (1.0)	3 (1.0)
	Normal weight	441 (73.0)	200 (69.7)
	Overweight	120 (19.9)	50 (17.4)
	Obese	37 (6.1)	34 (11.8)
BMI categories 17 years	Underweight	3 (0.5)	5 (2.0)
	Normal weight	467 (81.4)	191 (75.8)
	Overweight	82 (14.3)	41 (16.3)
	Obese	22(3.8)	15 (6.0)
BMI categories 21 years	Underweight	41 (6.8)	18 (6.3)
	Normal weight	438 (72.5)	171 (59.6)
	Overweight	96 (15.9)	69 (24.0)
	Obese	29 (4.8)	29 (10.1)

Supplementary Table 2: Differences in the median daily frequency consumption of food groups between 21 and 13 years old, by higher education attendance

	Higher education participants	Non-higher education participants	
Difference in consumption frequency (21 – 13 years)	Median (25^{th}; 75^{th})		p-value
Dairy	-0.50 (-1.50; 0.51)	-0.42 (-1.29; 0.86)	0.105
Seafood	0.07 (-0.28; 0.36)	0.07 (-0.21; 0.36)	0.505
Red meat	0.00 (-0.36; 0.36)	0.09 (-0.29; 0.50)	0.114
White meat	0.22 (0.00; 0.36)	0.21 (0.00; 0.36)	0.486
Eggs	0.00 (-0.08; 0.08)	0.00 (-0.07; 0.29)	0.040
Cereals	-0.68 (-1.77; 0.24)	-0.57 (-1.71; 0.43)	0.329
Rice, pasta and potatoes	0.07 (-0.36; 0.57)	0.07 (-0.36; 0.57)	0.501
Soup	0.00 (-0.57; 0.29)	0.00 (-0.36; 0.36)	0.016
Vegetables	0.29 (-0.69; 1.45)	0.37 (-0.50; 1.35)	0.852
Fruit	-0.50 (-1.37; 0.28)	-0.52 (-1.78; 0.30)	0.476
Added fat	-0.15 (-0.86; 0. 41)	-0.29 (-1.07; 0.43)	0.584
Fast food	-0.08 (-0.30; 0.15)	-0.08 (-0.49; 0.29)	0.938
Sweets and pastry products	-0.46 (-1.33; 0.24)	-0.42 (-1.30; 0.28)	0.906
Sugary drinks	-0.21 (-0.77; 0.15)	0.67 (-0.70; 0.72)	<0.001
Coffe and tea	0.00 (-0.07; 0.14)	0.00 (-0.07; 0.00)	<0.001
Alcoholic Beverages	0.13 (0.07; 0.35)	0.07 (0.00; 0.21)	<0.001

p-value estimated by the Mann-Whitney test.

Conclusion

We found that young people who attend higher education seem to generally have a healthier food intake. We also found that higher education attendance was associated with the consumption of alcoholic beverages and sugary drinks: while young people who were enrolled at higher education had larger increases in the consumption of alcoholic beverages, those who did not attend higher education increased their consumption of sugary drinks. These changes most likely result from the fact that higher education participants already had a more balanced diet during adolescence, since the evolution of food intake was similar between the groups. This can possibly be explained by the fact that there was a higher percentage of higher education participants with parents with a higher level of education, which is likely to be reflected in their children's diet. Regarding the evolution of weight, we found that there were no significant differences between the groups. However, it is important to highlight that there was a tendency among young people who do not attend higher education to increase their BMI category between the ages of 13 and 21.

Taking these results into account, it seems of great relevance to define public health strategies that target the consumption of alcoholic beverages and sugary drinks differentially among higher education students and young people who do not pursue higher education, since the consumption of both types of drinks can be considered harmful to health. In the future, it is also important to evaluate in more depth other determinants of food consumption in this age group, according to higher education attendance. Only in this way is it possible to design appropriate public health interventions for each group.

References

1. Arnett JJ. Emerging adulthood: What is it, and what is it good for? Child development perspectives. 2007; 1(2):68-73.
2. Tanner JL, Arnett JJ. Presenting "emerging adulthood": What makes it developmentally distinctive. Debating emerging adulthood: Stage or process. 2011:13-30.
3. Schwartz SJ, Petrova M. Prevention Science in Emerging Adulthood: a Field Coming of Age. Prevention Science. 2019; 20(3):305-09.
4. Arnett JJ. Emerging adulthood: A theory of development from the late teens through the twenties. American psychologist. 2000; 55(5):469.
5. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. Obesity. 2008; 16(10):2205.
6. Pegington M, French DP, Harvie MN. Why young women gain weight: A narrative review of influencing factors and possible solutions. Obesity Reviews. 2020; 21(5):e13002.
7. Mokdad AH, Serdula MK, Dietz WH, Bowman BA, Marks JS, Koplan JP. The spread of the obesity epidemic in the United States, 1991-1998. Jama. 1999; 282(16):1519-22.
8. Brebal KMM, Silveira J, Menezes RCE, Epifânio SBO, Marinho PM, Longo-Silva G. Weight gain and changes in nutritional status of Brazilian adults after 20 years of age: a time-trend analysis (2006-2012). Rev Bras Epidemiol. 2020; 23:e200045.
9. Zhao M, Bovet P, Xi B. Weight Status Change From Adolescence to Young Adulthood and the Risk of Hypertension and Diabetes Mellitus. Hypertension. 2020; 76(2):583-88.
10. Ryder JR, Jacobs DR, Jr., Sinaiko AR, Kornblum AP, Steinberger J. Longitudinal Changes in Weight Status from Childhood and Adolescence to Adulthood. J Pediatr. 2019; 214:187-92.e2.
11. Souza NAB, Rimes-Dias KA, Costa JC, Canella DS. Weight Gain and Change in Body Mass Index after Age 20 in the Brazilian Population and Associated Sociodemographic Factors: Data from the National Health Survey. Int J Environ Res Public Health. 2022; 19(5)
12. Fedewa MV, Das BM, Evans EM, Dishman RK. Change in weight and adiposity in college students: a systematic review and meta-analysis. American journal of preventive medicine. 2014; 47(5):641-52.
13. Pope L, Hansen D, Harvey J. Examining the weight trajectory of college students. Journal of nutrition education and behavior. 2017; 49(2):137-41. e1.
14. Deliens T, Deforche B, Chapelle L, Clarys P. Changes in weight and body composition across five years at university: A prospective observational study. PLoS One. 2019; 14(11):e0225187.
15. Deforche B, Van Dyck D, Deliens T, De Bourdeaudhuij I. Changes in weight, physical activity, sedentary behaviour and dietary intake during the transition to higher education: a prospective study. International Journal of Behavioral Nutrition and Physical Activity. 2015; 12(1):1-10.
16. Gropper SS, Simmons KP, Connell LJ, Ulrich PV. Weight and body composition changes during the first three years of college. Journal of obesity. 2012; 2012

17. Vinke PC, Navis G, Kromhout D, Corpeleijn E. Age- and Sex-Specific Analyses of Diet Quality and 4-Year Weight Change in Nonobese Adults Show Stronger Associations in Young Adulthood. J Nutr. 2020; 150(3):560-67.
18. Schneider BC, Dumith SC, Orlandi SP, Assunção MCF. Diet and body fat in adolescence and early adulthood: a systematic review of longitudinal studies. Cien Saude Colet. 2017; 22(5):1539-52.
19. Demory-Luce D, Morales M, Nicklas T, Baranowski T, Zakeri I, Berenson G. Changes in food group consumption patterns from childhood to young adulthood: the Bogalusa Heart Study. Journal of the American Dietetic Association. 2004; 104(11):1684-91.
20. Gil M, Rudy M, Stanisławczyk R, Duma-Kocan P, Żurek J. Gender Differences in Eating Habits of Polish Young Adults Aged 20-26. Int J Environ Res Public Health. 2022; 19(22)
21. Cruz F, Ramos E, Lopes C, Araújo J. Tracking of food and nutrient intake from adolescence into early adulthood. Nutrition. 2018; 55-56:84-90.
22. Ramón-Arbués E, Granada-López JM, Martínez-Abadía B, Echániz-Serrano E, Antón-Solanas I, Jerue BA. Factors Related to Diet Quality: A Cross-Sectional Study of 1055 University Students. Nutrients. 2021; 13(10)
23. Monteiro LZ, Varela AR, Lira BA, Contiero LC, Carneiro MLA, Souza P, et al. Weight status, physical activity and eating habits of young adults in Midwest Brazil. Public Health Nutr. 2019; 22(14):2609-16.
24. Llanaj E, Ádány R, Lachat C, D'Haese M. Examining food intake and eating out of home patterns among university students. PLoS One. 2018; 13(10):e0197874.
25. Antonopoulou M, Mantzorou M, Serdari A, Bonotis K, Vasios G, Pavlidou E, et al. Evaluating Mediterranean diet adherence in university student populations: Does this dietary pattern affect students' academic performance and mental health? Int J Health Plann Manage. 2020; 35(1):5-21.
26. Bárbara R, Ferreira-Pêgo C. Changes in Eating Habits among Displaced and Non-Displaced University Students. Int J Environ Res Public Health. 2020; 17(15)
27. Patrick ME, Terry-McElrath YM, Kloska DD, Schulenberg JE. High-intensity drinking among young adults in the United States: Prevalence, frequency, and developmental change. Alcoholism: clinical and experimental research. 2016; 40(9):1905-12.
28. Messina MP, D'Angelo A, Ciccarelli R, Pisciotta F, Tramonte L, Fiore M, et al. Knowledge and Practice towards Alcohol Consumption in a Sample of University Students. Int J Environ Res Public Health. 2021; 18(18)
29. Moutinho LSM, de Oliveira Cruz Mendes AM, Lopes M. Alcohol Consumption and Binge Drinking Among Young Adults Aged 20-30 Years in Lisbon, Portugal. J Addict Nurs. 2018; 29(4):E9-e15.
30. Linden-Carmichael AN, Lanza ST. Drinking patterns of college-and non-college-attending young adults: is high-intensity drinking only a college phenomenon? Substance Use & Misuse. 2018; 53(13):2157-64.
31. Fazzino TL, Fleming K, Sher KJ, Sullivan DK, Befort C. Heavy drinking in young adulthood increases risk of transitioning to obesity. American journal of preventive medicine. 2017; 53(2):169-75.
32. Winpenny EM, Smith M, Penney T, Foubister C, Guagliano JM, Love R, et al. Changes in physical activity, diet, and body weight across the education and employment transitions of early adulthood: A systematic review and meta-analysis. Obes Rev. 2020; 21(4):e12962.

33. Gordon-Larsen P, Nelson MC, Popkin BM. Longitudinal physical activity and sedentary behavior trends: adolescence to adulthood. American journal of preventive medicine. 2004; 27(4):277-83.
34. Mazurek-Kusiak AK, Kobyłka A, Korcz N, Sosnowska M. Analysis of Eating Habits and Body Composition of Young Adult Poles. Nutrients. 2021; 13(11)
35. Munt AE, Partridge SR, Allman-Farinelli M. The barriers and enablers of healthy eating among young adults: a missing piece of the obesity puzzle: A scoping review. Obes Rev. 2017; 18(1):1-17.
36. Sexton-Dhamu MJ, Livingstone KM, Pendergast FJ, Worsley A, McNaughton SA. Individual, social-environmental and physical-environmental correlates of diet quality in young adults aged 18-30 years. Appetite. 2021; 162:105175.
37. Hilger J, Loerbroks A, Diehl K. Eating behaviour of university students in Germany: Dietary intake, barriers to healthy eating and changes in eating behaviour since the time of matriculation. Appetite. 2017; 109:100-07.
38. Papadaki A, Hondros G, J AS, Kapsokefalou M. Eating habits of university students living at, or away from home in Greece. Appetite. 2007; 49(1):169-76.
39. Kärkkäinen U, Mustelin L, Raevuori A, Kaprio J, Keski-Rahkonen A. Successful weight maintainers among young adults—A ten-year prospective population study. Eating Behaviors. 2018; 29:91-98.
40. Winpenny EM, Penney TL, Corder K, White M, van Sluijs EMF. Change in diet in the period from adolescence to early adulthood: a systematic scoping review of longitudinal studies. Int J Behav Nutr Phys Act. 2017; 14(1):60.
41. Stok FM, Renner B, Clarys P, Lien N, Lakerveld J, Deliens T. Understanding eating behavior during the transition from adolescence to young adulthood: a literature review and perspective on future research directions. Nutrients. 2018; 10(6):667.

Association of higher education attendance with food consumption and weight changes of young adults: a prospective cohort study

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