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# Ultra-Processed Food Literacy Intervention: A School Randomised Pilot Trial in Portugal

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**ABSTRACT**

Worldwide, ultra-processed food (UPF) consumption is rising. Children and adolescent are age groups most affected by the increased consumption of such products. The aim of this pilot trial was to develop a health promotion intervention that increases literacy on UPF among Portuguese adolescents. A public school from the district of Porto was chosen by convenience. From the 10 total classes (242 students) registered in the seventh grade, the school management randomly selected 3 classes (74 students). This intervention was implemented in May/June 2021 in a face-to-face situation and involved an UPF booklet and its explanatory video, both developed to fulfil this trial objectives, and two literacy sessions about UPF identification and health implications of its consumption, also including ludic activities. To assess effectiveness, a questionnaire about UPF knowledge was applied at baseline and post-intervention. The sample consisted of 64 adolescents aged between 12 and 14 years (mean=12.75; sd=0.668). Most students were Portuguese (93.8%) and female (56.3%). Knowledge about UPF increased from 4.2% at baseline to 39.3% in the final stage of the intervention ($p<0.001$). This intervention showed to be effective by increasing students' knowledge on UPF. Additional intervention studies on this thematic should be performed in order to enhance literacy and facilitate conscious about healthy food choices.

**Keywords:** Ultra-Processed Food; Intervention; Literacy; Food and Nutrition Education

## Introduction

Worldwide, ultra-processed food (UPF) consumption is rising. Children and adolescents are the age group most affected by the increased consumption of such products [1-4]. In Portugal this increase is also observed. A recent study reported that UPF consumption among children and adolescents (around 22% of total quantity consumed) was higher compared to other age groups [5]. Half of the adolescents were included in the "Unhealthy» food pattern, being characterized by a higher consumption of UPF, such as sugar sweetened beverages, industrial breads, sausages and lowest consumption of non-processed food, like fresh fruits, vegetables and legumes [6]. Children and adolescents are more exposed to the marketing of UPF, in public spaces, including near schools and in television commercials, which can influence their food choices [7,8]. UPF are energy-dense, nutrient-poor foods and sugar-sweetened beverages, usually accessible in increasing portion size, at affordable prices, which have replaced minimally processed fresh foods and water in many settings of school and family meals [9]. This trend of increased availability and consumption of the processed and UPF has been associated to the rise in diet-related noncommunicable diseases [10,11]. The increase prevalence of overweight in the Portuguese population is mentioned in the most recent national reports and this fact is related with inadequate eating habits [12-14]. The COVID-19 pandemic seems to have contributed to further modify the eating habits of the Portuguese population. In a recent study carried out in Portugal, almost half of the general population (45.1%) reported having changed their eating habits during this period, with 41.8% having the perception that it has changed for the worst [12]. In this same study, an increase in the consumption of "snacks" during the confinement period was reported by almost a third of the Portuguese population [12]. Often, the composition of food occasions, commonly referred as snacks, frequently includes UPF, industrial formulations that include in their ingredients an excess of sugar, oils, fats and salt, antioxidant substances and additives, stabilizers and preservatives [15].

Despite being convenient because they are ready to eat or pre-prepared, regular and excessive consumption of these UPF has been associated with worse health indicators [11,16,17]. Some activities and campaigns are being carried out to reverse this situation. A Portuguese campaign called "Eating better, a recipe for life", from the National Program for the Promotion of Healthy Eating (PNPAS), was launched in 2019 - 2020, as well as the legislation that apply restrictions on food advertising aimed at children under 16 years of age [12]. The promotion of food and nutrition literacy can also contribute to raise awareness among young people and their families to make healthier choices. An intervention programme can be an effective method to create awareness [18]. The process of developing an intervention must bring together several components in order to constitute a more promising approach to behavioral change [19]. In 2018, a strategy for improving school nutrition in Portugal was proposed which foresees the inclusion of the School Nutritionist in the creation and promotion of a healthy food environment. While the presence of a nutritionist in schools in Portugal is not yet a reality, for this fact the intervention studies carried out by external entities are essential to diagnose the situation and to design and implement actions in food and nutrition education [20]. The World Health Organization (WHO) defines health literacy as the set of "cognitive and social skills and the ability of individuals to gain access to understand and use information in ways that promote and maintain good health" [21]. The food and nutrition literacy should be universal and provided in a manner that is useful, clear and accessible to all members of a community. The population needs to be empowered with knowledge about health and nutrition to make conscious healthier choices about what to eat and to provide their family, infants and children [15,22]. This nutritional intervention study is within the scope of the health goals established by the National Program for the Promotion of Healthy Eating 2022 [23], namely, the reduction in the consumption of salt, sugar, trans fats and the increase in the consumption of fruits and vegetables. Through increasing literacy on UPF, the health risks of its consumption and the possibilities for their replacement by other healthier foods, the presented intervention intends to raise awareness about this issue in young population. The aim of this pilot trial was to develop a health promotion intervention that increases literacy on UPF among Portuguese adolescents.

## Materials and Methods

### Study Sample and Design

A public school from the district of Porto was chosen by convenience. From the 10 total classes (242 students) registered in the seventh grade, the school management allowed the intervention to be applied in three classes, that were randomly selected by them and included 74 students. All of these seventh graders were considered as eligible for this study and a signed informed consent was obtained from their guardians. Exclusion criteria included classes with students who had previously attended food education sessions on this thematic (3 classes from the initial 10). The pilot trial was implemented in May and June 2021 in class time in a face-to-face situation in 64 students (Figure 1).

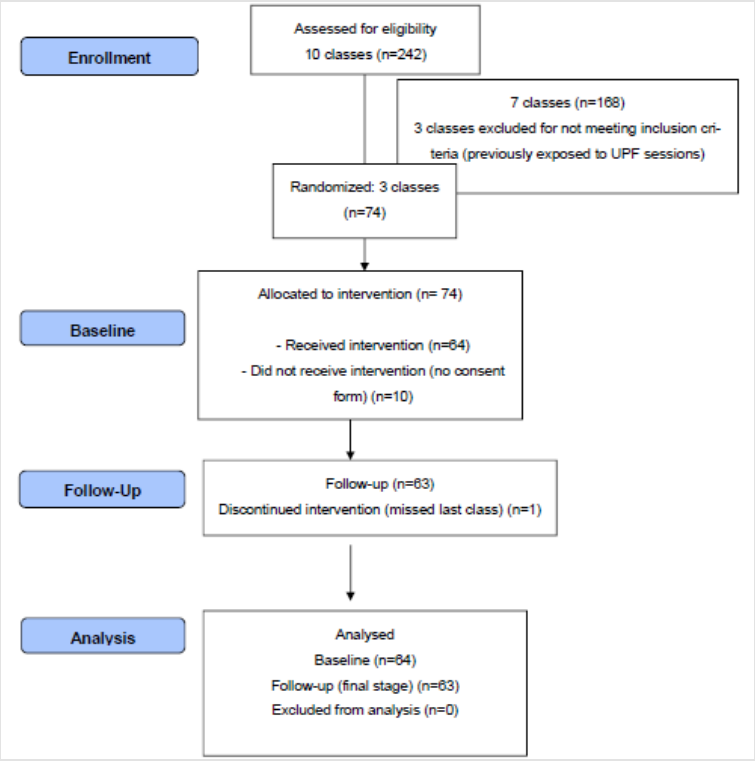


Figure 1: **Study flow diagram.**

## Intervention

The intervention was performed in the school environment, in the classrooms, using class schedules provided by the class directors. This study used the CONSORT 2010 checklist in accordance with the guidelines for pilot and non-randomized feasibility studies [24,25]. The Ethics Committee of the Faculty of Nutrition and Food Science of University of Porto approved this study (Opinion number 38/2021/CEFCNAUP).

## Instruments

For this pilot intervention, an unprecedent didactic manual named «Booklet on UPF» was designed and developed, based on the NOVA classification [15]. This classification has been the most used worldwide and defines industrial food processing as methods used by the industry "to make raw foods less perishable, easier to prepare, consume or digest, or more palatable and enjoyable, or else to transform them into food products" [15]. This booklet was settled in a digital format, which can be printed or viewed through electronic devices, and it contains 33 pages and is divided into seven main topics: What are UPF; Which are they; How to recognize them when purchasing; What are they for; What is the association with health; What foods should be chosen; and References for further reading. An explanatory didactic video lasting 3 minutes about the contents included in the UPF booklet was also developed to be sent to the students as a complement to the booklet understanding. To evaluate the intervention, a questionnaire was prepared. It included sociodemographic (sex, age, nationality, parent's education level) and lifestyle information (practice of physical activity, screen time, sleeping hours), eating habits and prior knowledge about UPF. Specifically, to assess eating habits, the questionnaire "Brief dietary assessment for initial approach" [26,27], complemented by "Questions to assess motivation and self-efficacy for eating habits changing", available in PNPAS 2020 Report [12], was used. This questionnaire was applied at baseline and in the final sessions.

## Plan

An intervention level one was implemented, which, in accordance to Boyle [18] (Boyle, 2017), aims to create awareness at the community level, in a specific population, in this situation, students at a basic school. A series of interconnected actions was carried out, through activities and meetings, aiming to specifically promote literacy about UPF and their health risks. The planned intervention was developed into four components:

a) Application of the evaluation questionnaire to the students at baseline. This activity was done in a face to-face situation and the researcher was present with each group while the questionnaires were answered. The time of this activity was around 15 minutes with each class.

b) Dissemination of the "Booklet on UPF" and the explanatory video about it; these tools (booklet and video) were sent to students by email through the Class Director Teachers in May 2021

c) Two sessions on food and nutrition education performed on each class in face-to-face situation. The sessions (lasting 50 minutes each) were organized and performed by the main researcher within an interval of 15 days.

The first session addressed the first sections of the booklet: Which foods are ultra-processed, and how to recognize them – theoretical-practical class on the definition and identification of UPF. In this session, students performed a practical activity in which they learned to recognize and distinguish UPF from other foods (processed or minimally processed) through food labels. This session was held with the three groups in May 2021. In this session students participated in an interactive activity, which they learned to read food labels and conclude whether or not it was UPF. The resources used were: Power point presentation; blackboard (to take note of foods that students classified as ultra-processed); food packaging (for checking and analysing labels and ingredients lists); test sheet to classify the foods observed in the classroom. The second session started with a briefing of the previous session, where the researcher asked the students questions such as: what are UPF? What examples of these foods do you know? And how to recognize an UPF? Subsequently, the session addressed the following topics of the booklet: What are UPF for? What is the relationship with health? What foods should be chosen? – theoretical class with the use of questions to interact with students (ex: «What is the healthiest food?» for which students had to choose among two options and explain why was that one they thought was the healthiest). This session took place on June 2021. The resources used in this session were: Power point presentation; test sheet to verify the learning in the sessions. The test consisted of 8 pairs of food options for the student to mark the option they considered healthiest in each pair. This activity occurred at the end of this session and was performed individually by each student. After the activity, the researcher provided the correct answers. The fourth and last component of the intervention was the completion of the final questionnaire, the same used at baseline, in June 2021.

## Outcome Variables

An impact assessment was developed at the end of the intervention comparing the results obtained at the baseline and final questionnaires of the intervention.

## Primary Outcomes

The primary outcome in this analysis is the increase of UPF literacy among students, measured at the baseline and at the final of intervention using a score questionnaire. To test the adolescent's knowledge about UPF, four simple dichotomous questions were asked: "Is fruit in syrup an UPF?", "Is canned tuna an UPF?", "Is cereal bar an UPF?" and "Is olive oil an UPF?"

## Secondary Outcomes

As secondary outcomes, a dietary frequency questionnaire was used, evaluating daily consumption of vegetables, fruit, sweetened beverages portions, and the weekly consumption of pulses, fish, vegetable soup, fried foods, and UPF such as chips, sweets, fast food and processed meat.

### Statistical Analysis

Initially, the frequency of the variables of interest was calculated. In order to address differences between baseline and final students' knowledge and UPF consumption, Pearson 'chi-square test and McNemar test were used. To assess students' knowledge on UPF, at baseline, students answered the question «Do you know what UPF are?» with dichotomous answer «yes» or «no». Those who answered «yes» were asked questions about four foods, whether or not they were ultra-processed: fruit in syrup, cereal bar, canned tuna, olive oil. Based on these four questions, those who correctly answered all of them were considered with the best knowledge on UPF. Statistical software IBM SPSS Statistics 27 was used to perform all statistical analyses.

## Results

### Sociodemographic and Lifestyle Characteristics

Sixty-four students from three 7th grade classes participated in the intervention. Most students were female, aged between 12 and 14 years (mean=12.75; sd=0.668). The majority of students had Portuguese nationality and around one third of both fathers and mothers had basic level of education (Tables 1).

### UPF Consumption Before and After the Intervention

Although not statistically significant, the consumption of chips and sweets was lower after the intervention (Table 2).

Comparing the results of food consumption between male and female adolescents before and after the intervention, chips consumption in males reduced after the intervention (p = 0.027), which was not observed among females. Table 3 shows the association between sex and consumption of healthy foods and UPF at baseline and after intervention. After intervention, more than half (58.8%) of the female adolescents consumed 1 to 2 servings of pulses per week, while 42.9% of the males consumed 3 or more servings per week (p=0.043). Also, in the final evaluation related to UPF consumption, males consumed more soft drinks per day than females (p=0.05). There was no significant difference in the consumption of processed meat and gender. However, 29.4% of female students consume 4 times or more a week, and more than 75% of male students consume these foods 1 to 3 times a week. Other sociodemographic factor associated with food consumption was parents' level of education, which is significantly associated with fish consumption (p=0.037) after the intervention. While more than half (53.8%) of participants whose parents had only basic education consumed fish once a week or less, none of those whose parents had that education level or high school consumed fish 5 times or more, and yet 25% of those whose parents had higher education consumed fish 5 times or more a week. Children whose parents had less education consumed less fish, but also less candy and sweets: 69.2% consumed sweets less than once a week (p=0.025) (Table 4).

Despite not presenting statistical significance (p=0.155), students with parents with lower-level education seemed to have increased their consumption of chips after the intervention, while students with parents with higher level education showed a decrease in the consumption of this food after the intervention (p=0.887).

Consumption of soft drinks seemed to have decreased after the intervention, both in students with lower school level parents' (basic school) and students with parents with higher education. However, this result was also not statistically significant. The highest consumption of sweets (4 times or more) decreased in all levels of education, comparing before and after the intervention (Table 4).

Table 1: Sociodemographic and lifestyle sample characterization (baseline).

| | n | % |
|---|---|---|
| Gender | | |
| Female | 36 | 56.3 |
| Male | 28 | 438 |
| Age (years) | | |
| 12 | 27 | 43.5 |
| 13 | 29 | 46.8 |
| 14 | 6 | 9.7 |
| Nationality | | |
| Portuguese | 60 | 93.8 |
| Other | 4 | 6.3 |
| Father's education level | | |
| Basic education | 18 | 34.0 |
| High school | 14 | 26.4 |
| University | 10 | 18.9 |
| Unknown | 11 | 20.8 |
| Mother's education level | | |
| Basic education | 18 | 29.5 |
| High school | 17 | 27.6 |
| University | 18 | 29.5 |
| Unknown | 8 | 13.1 |
| Practice physical activity | | |
| Yes | 37 | 57.8 |
| No | 27 | 42.2 |
| Screen time (hours) | | |
| Until 2h | 10 | 15.6 |
| More than 2h | 54 | 84.4 |
| Sleeping hours | | |
| Less than 8h | 22 | 35.5 |
| 8h or more | 40 | 64.5 |

Table 2: Comparison of students UPF and non UPF consumption before and after the intervention

| | | Time n (%) | p value |
|---|---|---|---|
| | Baseline | Final | |
| Chips | | | 0.083 |

| | | | |
|---|---|---|---|
| Less than once a week | 13 (20.3) | 24 (38.1) | |
| 1 to 3 times | 39 (60.9) | 31 (49.2) | |
| 4 times or more | 12 (18.8) | 8 (12.7) | |
| Fruit | | | 0.91 |
| 3 to 5 servings per day | 24 (38.1) | 23 (36.5) | |
| 1 to 2 servings | 34 (54.0) | 36 (57.1) | |
| None | 5 (7.9) | 4 (6.3) | |
| Vegetables | | | 0.633 |
| 3 to 5 servings per day | 21 (32.8) | 19 (30.2) | |
| 1 to 2 servings | 34 (53.1) | 38 (60.3) | |
| None | 9 (14.1) | 6 (9.5) | |
| Sugar-sweetened beverages | | | 0.969 |
| Less than once per day | 31 (49.2) | 30 (47.6) | |
| 1 to 2 times | 22 (34.9) | 22 (34.9) | |
| 3 times or more | 10 (15.9) | 11 (17.5) | |
| Pulses | | | 0.623 |
| 3 times or more a week | 19 (29.7) | 17 (27.4) | |
| 1 to 2 times | 34 (53.1) | 30 (48.4) | |
| Less than once a week | 11 (17.2) | 15 (24.2) | |
| Fish | | | 0.495 |
| 5 times or more a week | 8 (12.5) | 4 (6.3) | |
| 2 to 3 times | 34 (53.1) | 36 (57.1) | |
| Once a week or less | 22 (34.4) | 23 (36.5) | |
| Sweets | | | 0.053 |
| Less than once a week | 24 (37.5) | 22 (34.9) | |
| 1 to 3 times | 29 (45.3) | 38 (60.3) | |
| 4 times or more | 11 (17.2) | 3 (4.8) | |
| Fast food | | | 0.93 |
| Less than once a week | 41 (65.1) | 39 (61.9) | |
| 1 to 3 times | 20 (31.7) | 22 (34.9) | |
| 4 times or more | 2 (3.2) | 2 (3.2) | |
| Soup | | | 0.609 |
| Daily | 23 (36.5) | 18 (28.6) | |
| 3 to 4 times a week | 13 (20.6) | 16 (25.4) | |
| 2 times or less a week | 27 (42.9) | 29 (46.0) | |
| Fry foods | | | 0.281 |
| 2 times or less a week | 47 (73.4) | 48 (76.2) | |
| 3 to 4 times a week | 17 (26.6) | 13 (20.6) | |
| 5 times or more a week | 0 (0) | 2 (3.2) | |
| Processed meat | | | 0.72 |
| Less than once a week | 16 (25.0) | 12 (19.0) | |
| 1 to 3 times a week | 36 (56.3) | 38 (60.3) | |
| 4 times or more a week | 12 (18.8) | 13 (20.6) | |

Table 3: Frequency of UPF and non-UPF consumption by students, before and after the intervention and association between females and males.

| | **Baseline n (%)** | | | **Final n (%)** | | |
|---|---|---|---|---|---|---|
| | **Female** | **Male** | **p value** | **Female** | **Male** | **p value** |
| Chips | | | 0.557 | | | 0.355 |
| Less than once a week | 9 (25.0) | 4 (14.3) | | 11 (32.4) | 13 (44.8) | |
| 1 to 3 times | 21 (58.3) | 18 (64.3) | | 17 (50.0) | 14 (48.3) | |
| 4 times or more | 6 (16.7) | 6 (21.4) | | 6 (17.6) | 2 (6.9) | |
| Fruit | | | 0.448 | | | 0.404 |
| 3 to 5 servings a day | 12 (33.3) | 12 (44.4) | | 14 (41.2) | 9 (31.0) | |
| 1 to 2 servings | 20 (55.6) | 14 (51.9) | | 17 (50.0) | 19 (65.5) | |
| None | 4 (11.1) | 1 (3.7) | | 3 (8.8) | 1 (3.4) | |
| Vegetables | | | 0.219 | | | 0.912 |
| 3 to 5 servings a day | 11 (30.6) | 10 (35.7) | | 11 (32.4) | 8 (27.6) | |
| 1 to 2 servings | 22 (61.1) | 12 (42.9) | | 20 (58.8) | 18 (62.1) | |

| | | | | | | |
|---|---|---|---|---|---|---|
| None | 3 (8.3) | 6 (21.4) | | 3 (8.8) | 3 (10.3) | |
| Sugar-sweetened beverages | | | 0.484 | | | 0.05 |
| Less than once a day | 19 (52.8) | 12 (44.4) | | 21 (61.8) | 9 (31.0) | |
| 1 to 2 times | 13 (36.1) | 9 (33.3) | | 9 (26.5) | 13 (44.8) | |
| 3 times or more | 4 (11.1) | 6 (22.2) | | 4 (11.8) | 7 (24.1) | |
| Pulses | | | 0.103 | | | **0.043** |
| 3 times or more a week | 7 (19.4) | 12 (42.9) | | 5 (14.7) | 12 (42.9) | |
| 1 to 2 times | 21 (58.3) | 13 (46.4) | | 20 (58.8) | 10 (35.7) | |
| Less than once a week | 8 (22.2) | 3 (10.7) | | 9 (26.5) | 6 (21.4) | |
| Fish | | | 0.561 | | | 0.683 |
| 5 times or more a week | 5 (13.9) | 3 (10.7) | | 3 (8.8) | 1 (3.4) | |
| 2 to 3 times | 17 (47.2) | 17 (60.7) | | 19 (55.9) | 17 (58.3) | |
| Once or less a week | 14 (38.9) | 8 (28.6) | | 12 (35.3) | 11 (37.9) | |
| Sweets | | | 0.941 | | | 0.894 |
| Less than once a week | 13 (36.1) | 11 (39.3) | | 12 (35.3) | 10 (34.5) | |
| 1 to 3 times | 17 (47.2) | 12 (42.9) | | 20 (58.8) | 18 (62.1) | |
| 4 times or more | 6 (16.7) | 5 (17.9) | | 2 (5.9) | 1 (3.4) | |
| Fast food | | | 0.946 | | | 0.836 |
| Less than once a week | 24 (66.7) | 17 (63.0) | | 20 (58.8) | 19 (65.5) | |
| 1 to 3 times | 11 (30.6) | 9 (33.3) | | 13 (38.2) | 9 (31.0) | |
| 4 times or more | 1 (2.8) | 1 (3.7) | | 1 (2.9) | 1 (3.4) | |
| Soup | | | 0.054 | | | 0.589 |
| Daily | 11 (30.6) | 12 (44.4) | | 11 (32.4) | 7 (24.1) | |
| 3 to 4 times a week | 5 (13.9) | 8 (29.6) | | 7 (20.6) | 9 (31.0) | |
| 2 times or less a week | 20 (55.6) | 7 (25.9) | | 16 (47.1) | 13 (44.8) | |
| Fry foods | | | 0.748 | | | 0.993 |
| 2 times or less a week | 27 (75.0) | 20 (71.4) | | 26 (76.5) | 22 (75.9) | |
| 3 to 4 times a week | 9 (25.0) | 8 (28.6) | | 7 (20.6) | 6 (20.7) | |
| 5 times or more a week | 0 | 0 | | 1 (2.9) | 1 (3.4) | |
| Processed meat | | | 0.508 | | | 0.058 |
| Less than once a week | 10 (27.8) | 6 (21.4) | | 8 (23.5) | 4 (13.8) | |
| 1 to 3 times a week | 18 (50.0) | 18 (64.3) | | 16 (47.1) | 22 (75.9) | |
| 4 times or more a week | 8 (22.2) | 4 (14.3) | | 10 (29.4) | 3 (10.3) | |

Table 4: Frequency of UPF and non-UPF consumption by students, before and after the intervention and association between parent's level education.

| | Baseline n (%) | | | | Final n (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Basic | High | University | p value | Basic | High | University | p value |
| Chips | | | | 0.646 | | | | 0.407 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Less than once a week | 3 (20.0) | 4 (20.0) | 3 (15.0) | | 1 (7.7) | 3 (15.0) | 3 (18.8) | |
| 1 to 3 times | 11 (73.3) | 11 (55.0) | 12 (60.0) | | 5 (38.5) | 10 (50.0) | 10 (52.5) | |
| 4 times or more | 1 (6.7) | 5 (25.0) | 5 (25.0) | | 7 (53.8) | 7 (35.0) | 3 (18.8) | |
| Fruit | | | | 0.318 | | | | 0.607 |
| 3 to 5 servings a day | 6 (42.9) | 8 (40.0) | 6 (30.0) | | 3 (23.1) | 7 (35.0) | 7 (43.7) | |
| 1 to 2 servings | 7 (50.0) | 9 (45.0) | 14 (70.0) | | 9 (69.2) | 11 (55.0) | 9 (56.3) | |
| None | 1 (7.1) | 3 (15.0) | 0 (0) | | 1 (7.7) | 2 (10.0) | 0 (0) | |
| Vegetables | | | | **0.028** | | | | 0.136 |
| 3 to 5 servings a day | 3 (20.0) | 15 (75.0) | 9 (45.0) | | 1 (7.7) | 2 (10.0) | 3 (18.7) | |
| 1 to 2 servings | 8 (53.3) | 4 (20.0) | 8 (40.0) | | 10 (76.9) | 13 (65.0) | 5 (31.3) | |
| None | 4 (26.7) | 1 (5.0) | 3 (15.0) | | 2 (15.4) | 5 (25.0) | 8 (50.0) | |
| Sugar-sweetened bever- ages | | | | 0.472 | | | | 0.323 |
| Less than once a day | 6 (42.9) | 8 (40.0) | 6 (30.0) | | 5 (38.5) | 8 (40) | 4 (25.0) | |
| 1 to 2 times | 4 (28.6) | 10 (50.0) | 11 (55.0) | | 6 (42.6) | 7 (35) | 11 (68.8) | |
| 3 times or more | 4 (28.6) | 2 (10.0) | 3 (15.0) | | 2 (15.4) | 5 (25) | 1 (6.3) | |
| Pulses | | | | 0.573 | | | | 0.25 |
| 3 times or more a week | 8 (53.3) | 8 (40.0) | 11 (55.0) | | 6 (50.0) | 10 (50.0) | 6 (37.5) | |
| 1 to 2 times | 3 (20.0) | 7 (35.0) | 7 (35.0) | | 1 (8.3) | 4 (20.0) | 7 (43.8) | |
| Less than once a week | 4 (26.7) | 5 (25.0) | 2 (10.0) | | 5 (41.7) | 6 (30.0) | 3 (18.7) | |
| Fish | | | | 0.669 | | | | **0.037** |
| 5 times or more a week | 7 (46.7) | 12 (60.0) | 9 (45.0) | | 6 (46.2) | 13 (65.0) | 7 (43.8) | |
| 2 to 3 times | 2 (13.3) | 1 (5.0) | 4 (20.0) | | 0 (0) | 0 (0) | 2 (25.0) | |
| Once or less a week | 6 (40.0) | 7 (35.0) | 7 (35.0) | | 7 (53.8) | 7 (35.0) | 5 (31.3) | |
| Sweets | | | | 0.823 | | | | **0.025** |
| Less than once a week | 6 (40.0) | 9 (45.0) | 10 (50.0) | | 4 (30.8) | 15 (75.0) | 9 (56.3) | |
| 1 to 3 times | 6 (40.0) | 8 (40.0) | 5 (25.0) | | 9 (69.2) | 5 (25.0) | 5 (31.3) | |
| 4 times or more | 3 (20.0) | 3 (15.0) | 5 (25.0) | | 0 (0) | 0 (0) | 2 (12.5) | |
| Fast food | | | | 0.086 | | | | 0.125 |
| Less than once a week | 8 (53.3) | 8 (15.0) | 4 (40.0) | | 3 (21.3) | 4 (20.0) | 9 (56.3) | |
| 1 to 3 times | 6 (40.0) | 17 (85.0) | 11 (55.0) | | 10 (76.9) | 15 (75.0) | 7 (43.8) | |
| 4 times or more | 1 (6.7) | 0 (0) | 1 (5.0) | | 0 (0) | 1 (5.0) | 0 (0) | |
| Soup | | | | **<0.001** | | | | 0.088 |
| Every day/all day | 5 (33.3) | 4 (21.1) | 3 (15.0) | | 3 (21.1) | 6 (30.0) | 4 (25.0) | |
| 3 to 4 times a week | 3 (20.0) | 1 (5.3) | 13 (65.0) | | 3 (23.1) | 2 (10.0) | 8 (50.0) | |
| 2 times or less a week | 7 (46.7) | 14 (73.6) | 4 (20.0) | | 7 (53.8) | 14 (60.0) | 4 (25.0) | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Fry foods | | | | 0.633 | | | | 0.302 |
| 2 times or less a week | 6 (40.0) | 5 (25.0) | 6 (30.0) | | 4 (30.8) | 5 (25.0) | 1 (6.3) | |
| 3 to 4 times a week | 9 (60.0) | 13 (75.0) | 14 (70.0) | | 9 (69.2) | 15 (75.0) | 14 (87.5) | |
| 5 times or more a week | 0 (0) | 0 (0) | 0 (0) | | 0 (0) | 0 (0) | 1 (6.3) | |
| Processed meat | | | | 0.076 | | | | 0.284 |
| Less than once a week | 11 (73.3) | 14 (70.0) | 7 (35.0) | | 7 (53.3) | 12 (60.0) | 9 (56.3) | |
| 1 to 3 times a week | 1 (6.7) | 3 (15.0) | 8 (40.0) | | 5 (38.5) | 2 (10.0) | 3 (18.8) | |
| 4 times or more a week | 3 (20.0) | 3 (15.0) | 5 (25.0) | | 1 (7.7) | 6 (30.0) | 4 (25.0) | |

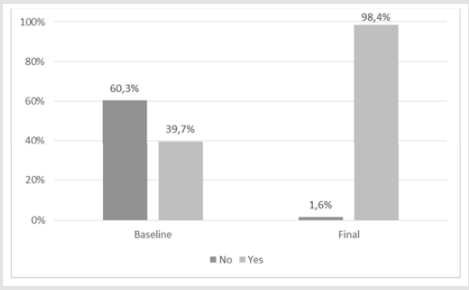


**Figure 2:** Comparison of students' knowledge self-reported about UPF before and after the inter-venation.

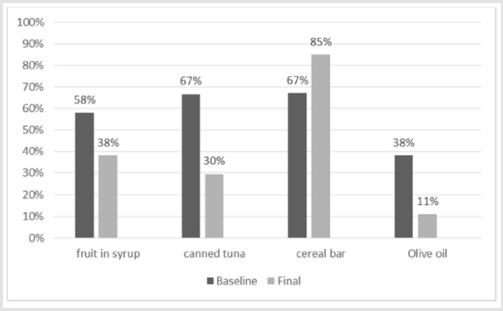


Figure 3: Comparison of students' knowledge about UPF before and after the intervention.

### Knowledge about UPF

Figure 2 shows the comparison between UPF' knowledge self-reported before and after the intervention. Before the intervention, 60.3% of students did not know what an UPF is. After the intervention, 98.4% of the students reported to know what an UPF is ($p < 0.001$). At baseline, before the presentation of the booklet and the literacy sessions, 58% of the students answered that fruit in syrup was an UPF. After intervention, only 38% still classified fruit in syrup as UPF. In relation to canned tuna, at baseline 67% of students answered it was an UPF. After intervention, only 30% responded that canned tuna was an UPF. The third food questioned was the only UPF in the questionnaire. Before the intervention 67% of students responded that cereal bar was an UPF, and after intervention this result increased to 85% (Figure 3). Before intervention, 38% of students classified olive oil as UPF, but after intervention, only 11% of students still believed that it was an UPF. In the initial stage of the intervention, from the students who answered "yes" to question "Do you know what UPF are?", only 4.2% answered all four questions correctly. In the final stage of the intervention, 39.3% correctly identified the four given options($p<0.001$) (Table 5).

Table 5: Percentage of correct answers about UPF knowledge

| Number of correct answers | Time | |
|---|---|---|
| | Baseline (%) | Final (%) |
| 1 | 33.3 | 9.8 |
| 2 | 33.3 | 13.1 |
| 3 | 29.2 | 37.7 |
| 4 | 4.2 | 39.3 |

Note: *$p<0.001$

## Discussion

To our best knowledge, this is the first intervention trial to explore UPF literacy in Portugal, and the first using a booklet and sessions of food education from this theme. On research platforms (October 2022) using the terms «intervention and ultra-processed food and literacy» there was found one only study [28] and it is related with front-of-packages labelling to enable consumers to make informed and healthier choices. Miranda, et al. highlighted the require increasing promotion of health education and food literacy in the Portuguese population [29]. Our study showed that before the intervention the students did not have enough knowledge to distinguish processed or unprocessed foods from UPF. The simple and short intervention performed, with the booklet presented in this study, based on the NOVA classification, combined with the literacy sessions, showed to slightly improve knowledge about UPF. On this subject, it is relevant to highlight that an USA Randomised controlled study to assess the impact of a proof-of-concept education intervention on nutrition knowledge verified that NOVA principles may be more easily understood and applied than those of MyPlate [30].

Of note is that this intervention was developed in four components, described in the methodology. A recent study in Sri Lanka with scholar

children using a multicomponent intervention revealed greater effects on children's food knowledge and healthy food preferences when compared with the single component intervention outcomes. This study suggests that a single component intervention oriented on nutrition education for children could be a more cost-effective and feasible intervention [31]. Performed a Randomised controlled trial with 1108 Dutch children aged 12–14 years to evaluate the effectiveness of a school-based multicomponent health pro-motion intervention [32]. The nutrition-related educational component of the intervention was included in 11 lessons. As in our study, they assessed specific food behaviour such as consumption of sugar-containing beverages and consumption of snacks, using an adapted self-report questionnaire. They found small but significant between-group differences. Prior to this intervention, only 4.2% students had adequate knowledge about UPF. After intervention, 39.3% students had adequate knowledge about UPF ($p < 0.01$). Our findings are supported by Wang et al. In a Randomised controlled trial involving 1633 Chinese schoolchildren aged 9–10 years. They showed that the combination of school based, and family-based interventions could lead to a reduction in sugar-sweetened beverages consumption among primary-school students [33]. Our results suggest that the UPF booklet combined with UPF literacy sessions should be a tool to increase the knowledge of this kind of food among students and improve their food choices. In addition, interventions that combine nutrition education and changes in the schoolchildren environment have been shown effectiveness [34]. Our findings showed that the consumption of chips between male adolescents decreased after the intervention ($p = 0.027$). The results of our study followed the same trend observed in (Inacio, et al. [35]). An intervention program using an intuitive method with 245 Brazilian children and adolescents between the ages of 5 and 14 years showed decreased mean intake of UPF (3.56 to 1.50 portions; $P< 0.001$) and the method was effective regarding teaching about food and nutrition. They found that the use of food and nutrition education interventions presented positive outcomes on the food practices of the partici pants [35].

Although our findings did not show statistical significance in most of the results that compared the consumption of UPF before and after the intervention, there was a statistically significant increase in UPF knowledge, namely it's the correct identification. Findings from a systematic review and meta-analysis evaluating effectiveness of behavioral interventions to reduce the intake of sugar-sweetened beverages in children and adolescents [36] indicated that Behavioural interventions conducted in schools are possibly superior to no intervention in reducing sugar-sweetened beverages intake. At the same time, in a recent study with Portuguese children and adolescents it was observed that about half of them were classified in the "Unhealthy" dietary pattern, which was characterized by a higher consumption of sugar-sweetened beverages. Furthermore, over one third of the calories consumed by Portuguese children and adolescents came from UPF [6]. Comparing baseline with the final stage of this intervention, the results of the adapted food frequency questionnaire showed a decrease in weekly consumption of UPF such as chips and sweets. Sugar-sweetened beverages, a kind of UPF, did not present a decrease in consumption after intervention. In contrast, it was observed that a greater magnitude intervention carried out in Brazil with 1,140 students aged 9 to 12 years showed a statistically significant reduction in soda intake of 66 ml in the intervention group [37]. A cohort study with 1137 Australian adolescents assessed sugar-sweetened beverages consumption using food frequency questionnaires and verified that consistently higher consumption of these foods in adolescence and early adulthood is associated with increased fat mass [38]. In our study, the sugar-sweetened beverage consumption of male adolescents was higher than on female adolescents ($p = 0.05$). These results are in line with a study that analysed the beverage consumption of Chinese children and adolescents aged 6–17 years and showed that carbonated beverages consumption was relatively high, especially in male adolescents aged 12–17 years [39]. In the same way a study with a national representative Portuguese sample verified that male adolescents and younger adults consumed more UPF than females of the same age group [5]. A similar intervention that took place in Switzerland, assessed the consumption of UPF in a convenience sample of obese adolescents aged from 12 to 14 years and the data showed that they consumed an insufficient quantity of vegetables, fruits, dairy products, and starchy foods and an excessive amount of meat portions and sugary and fatty products compared to the current Swiss recommendations [40]. Although our study did not assess the relationship between UPF and diseases, it is known that UPF are associated with several undesirable health outcomes [10,41-44].

Sugar-sweetened beverages are widely available and accessible in school environments, and their presence and characteristics can influence their consumption. A study examining the school food environments association with sugar-sweetened beverages consumption among adolescents in Brazil verified that public and private schools that sold soft drinks were associated with higher average sugar-sweetened beverages consumption and highlighted the importance of creating healthy school food environments [45]. Our intervention aimed to improve literacy about UPF between students to facilitate healthier choices in school or other food environments. The level of education, an important proxy of socioeconomic status, is often related to specific dietary characteristics. A Brazilian study [46] observed that the chance of adhering to a dietary pattern composed of fresh foods that are considered healthy was higher among participants with a medium level of education, whereas those who declared at least a complete higher education had a greater chance of adhering to a food pattern composed of traditional Brazilian cuisine, revealing schooling as a major constraint on food consumption compared to income. The Present study supports these results, as it was observed that adolescents of parents with a lower level of education consumed fish less often during the week. Lower scores related to the variety of nutritious foods, fruit, vegetables, total cereals, eat and poultry, fish, eggs, nuts and seeds, legumes/beans, water were inversely associated with a higher percentage of energy from UPF among younger Australian adults (aged 19 - 30 years) and

lower levels of education [47].

### Limitations and Strengths

The small sample size, the short duration of the intervention and the fact that the questionnaire used to assess changes in eating behaviors was not validated for the Portuguese population are some limitations of this study. Another limitation of this study is the fact that the sample was chosen for convenience. Despite being just a pilot study, the absence of a control group can be also pointed as a limitation. To our best knowledge, this is the first intervention trial that works UPF literacy in Portugal, and studies on this topic are still scarce [28]. Another strength of this study is the positive implications in community nutrition and public health, using food and nutrition education to promote health. To improve robustness, this study used CONSORT 2010 guidelines. Empower children and youth to be autonomous, thoughtful and responsible for their food choices is most powerful than only disseminating theorical contents [19]. Unfortunately, empowerment is still far from being able to change choices. In fact, changes in eating behavior are complex and subject to many factors [48,49]. Strategies like changing food environment can be added to improve effectiveness.

## Conclusion

This simple and short intervention, using a booklet and two literacy sessions, showed to be effective by increasing students' knowledge on UPF but limited to change food choices. Additional and longer intervention studies on this thematic should be performed in order to enhance literacy and facilitate conscious about healthy food choices in this age group.

## Author Contributions

Conceptualization, T.P.A., C.A. and S.R.; methodology, T.P.A., C.A. and S.R.; validation, T.P.A., M.M., C.A. and S.R.; formal analysis, T.P.A., M.M. and S.R..; investigation, T.P.A.; data curation, T.P.A and S.R.; writing—original draft preparation, T.P.A.; writing—review and editing, M.M., C.A. and S.R.; visualization, T.P.A., M.M., C.A. and S.R.; supervision, C.A. and S.R.; project administration, S.R. All authors have read and agreed to the published version of the manuscript.

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## Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki, and all procedures involving human subjects were approved by the Ethics Committee of the Faculty of Nutrition and Food Science of University of Porto (Opinion number 38/2021/CEFCNAUP).

## Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

## Data Availability Statement

All data generated or analyzed during this study are available from the corresponding author on reasonable request.

## Conflicts of Interest

The authors declare no conflict of interest.

## References

1. Rauber F, Louzada MLDC, Martinez Steele E, Leandro F M de Rezende, Christopher Millett, et al. (2019) Ultra-processed foods and excessive free sugar intake in the UK: a nationally representative cross-sectional study. BMJ Open 9(10): e027546.
2. Machado PP, Martinez Steele E, Louzada MLDC, Renata Bertazzi Levy, Anna Rangan, et al. (2019) Ultra-processed food consumption drives excessive free sugarintake among all age groups in Australia. Eur J Nutr 59(6): 2783-2792.
3. Baraldi LG, Martinez Steele E, Canella DS, Monteiro CA (2018) Consumption of ultra-processed foods and associated sociodem-ographic factors in the USA between 2007 and 2012: evidence from a nationally representative cross-sectional study. BMJ Open 8(3): e020574.
4. Moubarac JC, Batal M, Martins AP, Rafael Claro, Renata Bertazzi, et al. (2014) Processed and ultra-processed food products: consumption trends in Canada from1938 to 2011. Can J Diet Pract Res 75(1): 15-21.
5. Magalhães V, Severo M, Correia D, Torres D, Costa de Miranda R, et al. (2021) Associated factors to the consumption of ultra-processed foods and its relationship with dietary sources in Portugal. J Nutr Sci 7: 10-e89.
6. De Moraes MM, Oliveira B, Afonso C, Santos C, Torres D, et al. (2021) Dietary Patterns in Portuguese Children and Adolescent Population: The UPPER Project. Nutrients 13(11): 3851.
7. (2019) UNICEF. The State of the World's Children 2019. Children, Food and Nutrition: Growing well in a changing world. UNICEF, New York, USA.
8. (2021) FAO, IFAD, UNICEF, WFP and WHO. The State of Food Security and Nutrition in the World 2021. Transforming food systems for food security, improved nutrition and affordable healthy diets for all. FAO, Rome, Italy.
9. (2016) World Health Organization (WHO) Report of the commission on ending childhood obesity. WHO, Geneva, Switzerland, p. 50.
10. De Araújo TP, de Moraes MM, Magalhães V, Afonso C, Santos C, et al. (2021) Ultra-Processed Food Availability and Noncommunicable Diseases: A Systematic Review. Int J Environ Res Public Health 18(14): 7382.
11. Lane M, Davis JA, Beattie S, Clara Gómez-Donoso, Amy Loughman, et al. (2021) Ultra processed food and chronic noncommunicable diseases: A systematic review and meta-analysis of 43 observational studies. Obes Reviews 22(3): e13146.
12. PNPAS. Gregório MJ, Teixeira D, Monteiro R, Sousa SM, Irving S, Graça P, et al. (2020) National Program for the Promotion of Healthy Eating. Brief advice for healthy eating in primary health care: intervention models and tools 2020. Directorate-General for Health, Lisbon.
13. (2020) National Institute of Statistics (INE). National Health Survey 2019. Department of Statistics, Portugal.
14. Lopes C, Torres D, Oliveira A, Severo M, Alarcão V, et al. (2017) Inquérito

Alimentar Nacional e de Atividade Física, IAN-AF 2015-2016: Relatório de resultados. Universidade do Porto.

15. Monteiro CA, Cannon G, Levy RB, Moubarac JC, Jaime P, et al. (2016) A estrela brilha. Classificação dos alimentos. Saúde Pública. World Nutr 7(1-3): 28-40.
16. Martí A, Calvo C, Martínez A (2020) Consumo de alimentos ultraprocesados y obesidad: uma revisión sistemática. Nutr Hospitalaria 38(1).
17. Pagliai G, Dinu M, Madarena MP, Bonaccio M, Iacoviello L, et al. (2021) Consumption of ultra-processed foods and health status: A systematic review and meta-analysis. Br J Nutr 125(3): 308-318.
18. Boyle MA (2017) Community Nutrition in Action: An Entrepreneurial Approach. (7th Edn.)., Cengage Learning, pp. 797.
19. Faria R, Sousa B (2020) Educação alimentar em meio escolar e a figura do Nutricionista Escolar. Acta Portuguesa de Nutrição (20): 20-25.
20. Bento A, Cordeiro T, Frias A, Salvador C, Dias D, et al. (2018) Estratégia para a alimentaçãoescolar em Portugal – uma proposta. Acta Portuguesa de Nutrição 13: 08-13.
21. (2022) World Health Organization (WHO). Health Promotion. Health literacy. The mandate for health literacy.
22. Silk KJ, Sherry J, Winn B, Keesecker N, Horodynski MA, et al. (2008) Increasing Nutrition Literacy: Testing the Effectiveness of Print, Web site, and Game Modalities. J Nutr Educ Behav 40(1): 3-10.
23. Portugal. Ministério da Saúde. Direção-Geral da Saúde. Programa Nacional para a Promoção da Alimentação Saudável 2022-2030. Direção-Geral da Saúde, Lisboa, 2022.
24. Lancaster GA, Thabane L (2019) Guidelines for reporting non-Randomised pilot and feasibility studies. Pilot Feasibility Stud 5: 114.
25. Schulz KF, Altman DG, Moher D (2010) CONSORT 2010 statement: updated guidelines for reporting parallel group randomized trials. Ann Intern Med 152(11): 726-732.
26. Paxton AE, Strycker LA, Toobert DJ, Ammerman AS, Glasgow RE, et al. (2011) Starting the Consersation. Performance of a Brief Dietary Assessment and Intervention Tool for Health Professionals. Am J Prev Med 40(1): 67-71.
27. Jilcott SB, Keyserling TC, Samuel-Hodge CD, Johnston LF, Gross MD, et al. (2007) Validation of a brief dietary assessment to guide counseling for cardiovascular disease risk reduction in an underserved population. J Am Diet Assoc 107(2): 246-255.
28. Champagne B, Arara M, ElSayed A, Løgstrup S, Naidoo P, et al. (2020) World Heart Federation Policy Brief: Front-Of-Pack Labelling: Unhealthy Changes in theGlobal Food System. Global heart 15(1): 70.
29. Miranda RC, Rauber F, de Moraes MM, Afonso C, Santos C, et al. (2021) UPPER Group. Consumption of ultra-processed foods and non-communicable disease-related nutrient profile in Portuguese adults and elderly (2015-2016): the UPPER project. Br J Nutr 125(10): 1177-1187.
30. Nazmi A, Tseng M, Robinson D, Neill D, Walker J, et al. (2019) A Nutrition Education Intervention Using NOVA Is More Effective Than MyPlate Alone: A Proof-of-Concept Randomized Controlled Trial. Nutrients 11(12): 2965.
31. Sirasa F, Mitchell L, Azhar A, Chandrasekara A, Harris N, et al. (2021) A 6-week healthy eating intervention with family engagement improves food knowledge and preferences but not dietary diversity among urban preschool children in Sri Lanka. Public Health Nutr 24(13): 4328-4338.
32. Singh AS, Paw MJMCA, Brug J, Van Mechelen W (2009) Dutch Obesity Intervention in Teenagers: Effectiveness of a School- Based Program on Body Composition and Behavior. Arch Pediatr Adolesc Med 163(4): 309-317.
33. Wang C, Hong X, Wang W, Zhou H, Wu J, et al. (2022) The Combination of School-Based and Family-Based Interventions Appears Effective in Reducing the Consumption of Sugar-Sweetened Beverages, a Randomized Controlled Trial among Chinese Schoolchildren. Nutrients 14(4): 833.
34. Teo CH, Chin YS, Lim PY, Masrom SAH, Shariff ZM, et al. (2021) Impacts of a School-Based Intervention That Incorporates Nutri-tion Education and a Supportive Healthy School Canteen Environment among Primary School Children in Malaysia. Nutrients 13(5): 1712.
35. Inácio MLC, Pereira FC, Fernandes LB, Oliveira IRC, Pereira RC, et al. (2022) Food and Nutrition Education Using Intuitive Method and NOVA Food Classification: Implications for Food Practices of Children and Adolescents Intuitive Method in Food and Nutrition Education. Am J Health Prom 36(7): 1170-1182.
36. Rahman AA, Jomaa L, Kahale LA, Adair P, Pine C, et al. (2017) Effectiveness of behavioral interventions to reduce the intake of sugar-sweetened beverages in children and adolescents: a systematic review and meta-analysis. Nutr Rev 76(2): 88-107.
37. Sichieri R, Trotte AP, Souza RA, Veiga GV (2008) School randomised trial on prevention of excessive weight gain by discourag-ing students from drinking sodas. Public Health Nutr 12(2): 197-202.
38. Bennett AM, Murray K, Ambrosini GL, Oddy WH, Walsh JP, et al. (2022) Prospective Associations of Sugar-Sweetened Beverage Consumption During Adolescence with Body Composition and Bone Mass at Early Adulthood. J Nutr 152(2): 399-407.
39. Xu X, Piao W, Fang H, Guo Q, Ju L, et al. (2017) Beverage Consumption of Children and Adolescents Aged 6–17 Years China, 2016–2017. Chinese Center for Disease Control and Prevention CCDC Weekly 3(13): 279-284.
40. Borloz S, Della Torre S B, Collet TH, Chaparro CJ (2021) Consumption of Ultra processed Foods in a Sample of Adolescents with Obesity and Its Association with the Food Educational Style of Their Parent: Observational Study. JMIR Pediatr Parent 4(4): e28608.
41. Elizabeth L, Machado P, Zinöcker M, Baker P, Lawrence M, et al. (2020) Ultra-Processed Foods and Health Outcomes: A NarrativeReview. Nutrients 12(7): 1955.
42. Fiolet T, Srour B, Sellem L, Kesse-Guyot E, Allès B, et al. (2018) Consumption of ultra-processed foods and cancer risk: results from NutriNet-Sante prospective co-hort. Bmj 360 k322.
43. Juul F, Vaidean G, Parekh N (2021) Ultra-processed Foods and Cardiovascular Diseases: Potential Mechanisms of Action. Adv nutr 12(5): 1673-1680.
44. Narula N, Wong E, Dehghan M, Mente A, Rangarajan S, et al. (2021) Association of ultra-processed food intake with risk of inflammatory bowel disease: prospective cohort study. BMJ 374, n1554.
45. Rocha LL, Pessoa MC, Gratão LHA, Carmo AS, Cordeiro NG, et al. (2021) Characteristics of the School Food Environment Affect the Consumption of Sugar-Sweetened Beverages Among Adolescents. Front Nut 8: 742744.
46. Romeiro ACT, Curioni CC, Bezerra FF, Faerstein E (2020) Sociodemographic determinants of food consumption pattern: Pró Saúde Study. Rev Bras Epidemiol 23: e200090.
47. Marchese L, Livingstone KM, Wood JL, Wingrove K, Machado P, et al. (2021) Ultra-processed food consumption, socio-de-mographics and diet quality in Australian adults. Public Health Nutr 25(1): 94-104.
48. Chung A, Vieira D, Donley T, Tan N, Jean-Louis G, et al. (2021) Adolescent Peer Influence on Eating Behaviors via Social Media: Scoping Review. J Med Internet Research 23(6): e19697.
49. Poelman MP, Gillebaart M, Schlinkert C, Dijkstra SC, Derksen E, et al. (2021) Eating behavior and food purchases during the COVID-19 lockdown: A cross-sectional study among adults in the Netherlands. Appetite 157: 105002.

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