



## Interdisciplinary intervention reduces the consumption of ultra-processed foods in adolescents with overweight or obesity

*Intervenção interdisciplinar reduz o consumo de alimentos ultraprocessados em adolescentes com sobrepeso ou obesidade*

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### ABSTRACT

The aim of this study was to evaluate the effect of interdisciplinary intervention with motivational approach on the consumption of ultra-processed foods in overweight or obese adolescents. The method used was a randomized clinical trial in which participants were allocated to control group (CG) and intervention group (IG). The data collection of food consumption occurred through the 24-hour food record, obtained at the beginning and end of interventions. The foods consumed were classified into the four NOVA groups according to the degree of processing which they are submitted. Forty-two adolescents with a mean age of 16.5±1.3 years, mostly female (69%), participated in the study. In IG, the average kcal of ultra-processed foods decreased by 37.5% after intervention. In contrast, there was an increase in the consumption of processed foods in both groups. It was concluded that the interdisciplinary intervention with a motivational approach was effective in reducing the consumption of ultra-processed foods in the studied population.

**Keywords:** Adolescent. Industrialized foods. Life style. Pediatrics.

### RESUMO

Este estudo objetivou avaliar o efeito da intervenção interdisciplinar com abordagem motivacional sobre o consumo de alimentos ultraprocessados em adolescentes com sobrepeso ou obesidade. O método utilizado foi um ensaio clínico randomizado no qual os participantes distribuíram-se em grupo controle (GC) e grupo intervenção (GI). A coleta de dados do consumo alimentar ocorreu mediante o recordatório de 24 horas, obtido no início e ao final das intervenções. Os alimentos consumidos foram categorizados nos quatro grupos da classificação alimentar NOVA conforme o grau de processamento a qual são submetidos. Participaram 42 adolescentes com média de idade de 16,5±1,3 anos, a maioria do gênero feminino (69%). No GI, a média de quilocalorias de alimentos ultraprocessados diminuiu 37,5% após a intervenção; em contrapartida, aumentou o consumo de alimentos processados em ambos os grupos. Concluiu-se que a intervenção interdisciplinar com abordagem motivacional foi eficaz na redução do consumo de alimentos ultraprocessados na população estudada.

**Palavras-chave:** Adolescente. Alimentos industrializados. Estilo de vida. Pediatria.

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## INTRODUCTION

The assessment of food quality has been gaining ground in population studies on food, nutrition and health. In this context, the NOVA food classification was created by Monteiro *et al.*<sup>1</sup>, which groups foods according to the nature, extent and purpose of the processing to which they are subjected to. They are classified into four groups: fresh or minimally processed, processed culinary ingredients, processed and ultra-processed<sup>2</sup>.

Ultra-processed foods are characterized by having a high caloric value and being attractive to the palate<sup>3,4</sup>. In recent decades, their marketing and intake have increased significantly<sup>5,6</sup>. Surveys conducted with Americans, Canadians and British show that they represent approximately 50-60% total energy value (TEV) in the diet of consumers<sup>7-9</sup>.

In Brazil, studies in which data were collected on the food consumption of adolescents found that ultra-processed foods considerably contribute to the increase in the TEV of the diet, promoting weight gain and, consequently, some comorbidities<sup>10</sup>. In addition, there is an association between the consumption of these foods and the deficient supply of micronutrients and cardiometabolic risk. These factors harm health, influencing in the short and long term the quality of life of this population<sup>11,12</sup>.

The high intake of ultra-processed products becomes a concern, as it is related to the incidence of chronic non-

communicable diseases (NCDs). Meta-analysis studies found that consumption of these foods increases the risk of overweight, obesity and high waist circumference by up to 34%, metabolic syndrome by 79%, dyslipidemia by 102%, cardiovascular disease by up to 34% and 25% the chance of mortality from all causes<sup>13,14</sup>.

Worldwide, excess weight affects all age groups. In the case of children and adolescents between 5 and 19 years old, more than 340 million were overweight or obese in 2016. This is worrying data, as one in every six adolescents between 10 and 19 years old is overweight<sup>15</sup>.

The main non-pharmacological management to improve this condition is through a change in lifestyle, including healthy eating habits and physical activity<sup>16</sup>. However, adherence to this strategy is still very low, especially among adolescents<sup>17,18</sup>. Thus, new approaches are needed, and interventions based on motivation and that consider psychological aspects as mediators of change can bring positive results<sup>19</sup>.

Considering the harmful effects of the intake of ultra-processed products to health in general, it is essential to identify mechanisms that contribute to their reduction. Therefore, this study aimed to evaluate the effect of an interdisciplinary intervention with a motivational approach on the intake of ultra-processed foods, according to the NOVA food classification, in overweight or obese adolescents.

## METHOD

### DESIGN

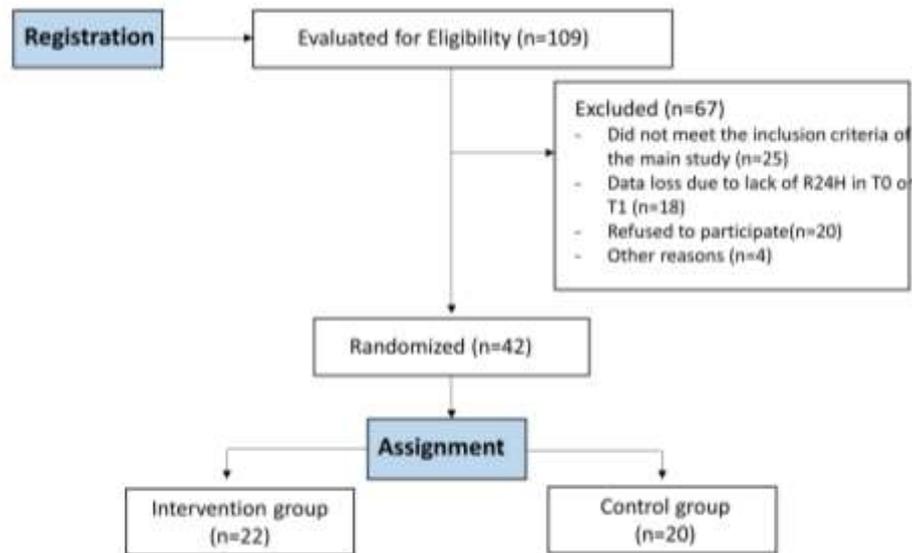
This was a controlled, randomized clinical trial with single blinding of individuals, registered in the Brazilian Registry of Clinical Trials (ReBEC) (RBR-234nb5) and Clinical Trials (NCT02455973), which followed the recommendations of the Consolidated Standards of Reporting Trial (CONSORT). The studied sample originated from a secondary database of a main study entitled “Randomized clinical trial of a motivational interdisciplinary intervention based on the transtheoretical model of change for lifestyle modification in overweight/obese adolescents”.

### POPULATION

Participants were forty-two male and female adolescents. Recruitment was carried out for convenience, through dissemination on social networks, radio, print media and television. Interested

parties underwent a screening in which a multidisciplinary team presented the study objectives and evaluated the following inclusion criteria: age between 15 and 18 years; and overweight or obesity (Body Mass Index (BMI)  $\geq$ ScoreZ+1)<sup>20</sup>. In the case of exclusion criteria, the following were included: absolute contraindication for physical activity; presence of diagnosis of severe psychiatric disorders and/or significant cognitive impairment; diagnosis of type 1 diabetes mellitus; being pregnant; and unavailability of program follow-up. The contraindication for physical activity was assessed by the physical therapy team, and the presence of psychiatric disorders was assessed by the psychology team through the Youth Self Report (YSR)<sup>21</sup> and the Depression, Anxiety and Stress Scale (DASS)<sup>22</sup>.

The complete sample flowchart is illustrated in Figure 1. Participants were randomized using the Randomizer software (version 4.0). Carried out in four cycles of three months each, data collection began in 2017 and extended until 2018.



**Figure 1.** Flowchart of study participants

Source: Research data, 2021

## SAMPLE

The sample size of 42 patients was calculated using the WinPepi<sup>23</sup> software, with 80% power and 5% significance level, based on data from a previous study<sup>24</sup>.

## INTERVENTION

An interdisciplinary intervention was carried out, with a motivational approach, based on the Transtheoretical Model of Change (TTM), which consists of a framework to understand, measure and intervene in behavior change<sup>25</sup>. It is based on the premise that behavioral change takes place through a process in which people go through different levels of motivation to change represented by stages of motivation to change. The stages of change comprise: precontemplation, contemplation, preparation, action and maintenance.

To assess readiness to change habits, the readiness-to-change ruler was used, which consists of an analog scale in which the participant indicates the point that best represents how ready they are to change their behavior at that moment. Thus, the participant answers the point on an analog scale that best represents how ready they are to change their behavior at that moment. Adolescents answered two questions regarding the frequency and intensity of physical activity and nine involving eating habits, such as: increased intake of fruits, vegetables, cereals and fish; and reduced intake of sausages, salt, trans fats and sugar<sup>26</sup>.

Twelve weekly meetings were held, lasting 1h30min over three months, at the Pontifical Catholic University of Rio Grande do Sul (PUCRS). They were led by a multidisciplinary team, through a partnership between the areas of Nutrition, Nursing, Physical therapy and Psychology

of the School of Health and Life Sciences at that institution. The first and last meetings were attended by the guardians to strengthen family support and clarify any doubts. All meetings were audio-recorded and transcribed later.

Participants were randomly assigned to a control group (CG) and an intervention group (IG). The complete description of the protocol and specification of the control and intervention group sessions are published by Ribeiro *et al.*<sup>27</sup>.

Control group: the focus of the sessions was the development of skills, through educational actions in health, using the pedagogy of transmission, which starts from the premise that knowledge is the most important point of education. Thus, these sessions followed a schedule of lectures in which adolescents received only guidance on what they should do to change eating habits and physical activity. The group was guided by a team consisting of a professional from Nursing, Physical therapy, Nutrition and Psychology and followed a schedule of lectures that addressed cardiovascular risk factors and their prevention. Meetings were weekly, lasting an hour, for three months.

Intervention group: weekly meetings were held with an interdisciplinary team, lasting 1h45min. The focus was on the development of skills, through educational actions in health that would provide the development of autonomy and empowerment to change eating habits and physical activity behaviors, based on interdisciplinary

motivational strategies<sup>27</sup>. The intervention had a motivational approach, based on the TTM<sup>25</sup>, and at each meeting a change process was used. The first six sessions were based on the early stages of readiness-to-change (precontemplation and contemplation), and the last six covered the more advanced stages of preparation, action, and maintenance. The themes were: Initiating change – Motivational Treatment Model; My Roles and Impact on Lifestyle; Knowing the ingredients and exercises and the consequences on the heart to make the decision to change – decisional balance; Temptation, trust and problem solving in the face of healthy exchanges; Talking about self-care and setting a goal to take care of food and exercise: preparing for change; Identifying triggers, managing desires and impulses and rewarding successes; between others.

In the first 75 minutes of the IG meeting, theoretical content was presented highlighting the cardiovascular risk related to lifestyle to motivate the improvement of these habits, including self-care, healthy eating and physical activity. In the last 30 minutes, the participants, together with the research team, had a guided physical activity practice experience using the Xbox<sup>®</sup> interactive video game (United States, Microsoft). The inclusion of this exercise moment aimed to motivate adolescents to include other sessions during the week. The intervention in this group allowed greater interaction between health professionals and the analyzed group, in

addition to encouraging the effective involvement of the adolescents.

Participants had tolerance for missing up to three sessions. In both groups, only two meetings were held with the parents or legal guardians, which took place at the beginning and at the end of the intervention, with the aim of involving the family in the process and strengthening family support.

## DATA COLLECTION

Anthropometric data was collected by measuring weight and height in triplicate. Weight was measured with individuals in an orthostatic position, with minimal clothing, barefoot and using a digital scale (G Tech, Glass 1 FW, Rio de Janeiro, Brazil) accurate to 100g. Height was obtained with the participants barefoot, with feet in a parallel position, ankles together and head in a Frankfort plane; a portable stadiometer (Altura Exata, TBW, São Paulo, Brazil) accurate to 1mm was used.

From these data, the BMI was known by the weight/height<sup>2</sup> ratio. The BMI classification was evaluated using the BMI-for-age indicator according to the reference curve of the World Health Organization (WHO) (2007) for this age group and considering the cutoff point  $BMI \geq Z$  Score+1.

Data on food consumption were collected through a 24-hour dietary recall survey, on a random day of the week, applied when the adolescents entered the

study (T0) and after three months of intervention (T1). They were asked about all foods and beverages consumed within 24 hours of the previous day, with details such as brands, preparation techniques and quantities<sup>28</sup>.

For the 24-hour recall, we used the Multiple Pass Method (MPM), developed in 1999 by the United States Department of Agriculture (USDA), with the objective of reducing possible errors in the quantification of food consumption<sup>28</sup>. This method comprises five steps: quick listing, listing of commonly forgotten foods, setting the time and meal, detailing cycle and final review.

The servings consumed were transformed into grams with the help of the Table for Assessment of Food Consumption in Household Measures<sup>29</sup>. Data collection did not include the added salt used in the preparation and/or at the table, as well as the intake of sodium from pure water. The amount, in grams, consumed by the participants was transformed into calories using the Brazilian Table of Food Composition (TACO)<sup>30</sup>, and if the food was not included in the TACO, the information was extracted from the product label. Then, the items present in the 24-hour recall were classified into one of the four groups of the NOVA food classification, which can be consulted in more detail in the original publication by Monteiro et al.<sup>1</sup> The amount in grams and the percentage of energy from each food group were evaluated in relation to the total energy of the diet.

## STATISTICAL TREATMENT

Data were double-entered, stored in an Excel® spreadsheet (United States, Microsoft) and analyzed using the Statistical Package for Social Sciences – SPSS® 21.0 software (United States, IBM). The normality of the distribution of quantitative data was checked by the Kolmogorov Smirnov test. These data were described as mean and standard deviation, and categorical data as absolute and relative frequency. Means were compared by the Student's t-test and the association between categorical measures, by the chi-square test of Pearson.

For the comparison between the amount of kcal according to NOVA processing levels, before and after the intervention, of the control and intervention groups, the generalized estimating equation model was used, in which results with  $P < 0.05$  were considered significant. To better examine the statistical differences obtained and measure the effect size<sup>31</sup>, the Cohen D test was performed, followed by a comparison power analysis, considered reliable when at least 80%. These last analyses were performed using GPower<sup>32</sup>

3.1.9.7 software for Windows (Universidade de Düsseldorf, Düsseldorf, Alemanha).

## ETHICAL ASPECTS

Parents or legal guardians signed the Informed Consent (IC) specific for each intervention, and the adolescents signed the Assent Term (TA). The study was registered in the Clinical Trial Registry (NCT02455973) and in the Brazilian Registry of Clinical Trials (RBR-234nb5), in addition to having been approved by the Research Ethics Committee of the Pontifical Catholic University of Rio Grande do Sul (PUCRS) (10/834.1).

## RESULTS

Forty-two adolescents with a mean age of  $16.5 \pm 1.3$  years, mostly female (69.0%), were evaluated. Their characteristics did not show a statistically significant difference between the control and intervention groups at the time of inclusion in the study (Table 1).

**Table 1.** Characteristics of the sample of overweight and obese adolescents (n = 42)

Variables	Total sample mean±SD	Groups		P
		Control (n = 20) mean±SD	Intervention (n = 22) mean±SD	
Age in years	16.5±1.3	16.7±1.3	16.4±1.2	0.541
Gender N (%)				
Male	13 (31.0)	7 (35.0)	6 (27.3)	0.588
Female	29 (69.0)	13 (65.0)	16 (72.7)	
BMI in kg/m <sup>2</sup>	34.4±5.1	35.64±5.4	33.25±4.7	0.134
Weight in kg	95.31±22.0	98.01±22.6	92.86±21.8	0.456
Height in m	1.65±0.1	1.64±0.1	1.66±0.09	0.679

Note: P: Student's t-test for numeric variables and Chi-square test for categorical variable.

BMI: Body Mass Index

Source: research data, 2021

In the intervention group, the mean kcal of processed foods increased (P = 0.005) (P < 0.05; effect size 3.128, large effect, 100% power), and that of ultra-processed foods decreased (P = 0.025) (P <

0.05; effect size 2.373, large effect, 100% power) after intervention. There was no difference in the other groups or intervention times, and the groups behaved similarly over time (Table 2).

**Table 2.** Comparison between the means of total energy and kilocalories before and after intervention in the control and intervention groups and the behavior of the groups over time in overweight and obese adolescents (n = 42)

NOVA groups kilocalories	Groups		Group	P Time	Group vs Time
	Control (mean±SD)	Intervention (mean±SD)			
Total energy value of the diet			0.122	0.384	0.975
T0	1631.95 <sup>aA</sup> ±139.3	1944.17 <sup>aA</sup> ±227.4			
T1	1511.12 <sup>aA</sup> ±174.2	1809.97 <sup>aA</sup> ±148.5			
Fresh or minimally processed			0.287	0.816	0.676
T0	523.6 <sup>aA</sup> ±72.0	573.5 <sup>aA</sup> ±60.0			
T1	483.0 <sup>aA</sup> ±71.2	586.8 <sup>aA</sup> ±72.4			
Processed culinary ingredients			§	§	§
T0	70.4 <sup>aA</sup> ±158.7	25.6 <sup>aA</sup> ±46.7			
T1	65.9 <sup>aA</sup> ±106.3	39.7 <sup>aA</sup> ±65.8			
Processed foods			0.272	0.005	0.411
T0	263.7 <sup>aA</sup> ±44.6	275.7 <sup>aA</sup> ±45.7			
T1	372.3 <sup>aA</sup> ±57.2	516.1 <sup>bA</sup> ±98.6			
Ultra-processed foods			0.314	0.025	0.514
T0	764.1 <sup>aA</sup> ±160.1	1069.5 <sup>aA</sup> ±220.0			
T1	590 <sup>aA</sup> ±133.2	667.4 <sup>bA</sup> ±94.8			

Note: Generalized Estimating Equation Model with Least Significant Difference Post Hoc. Different lowercase letters indicate significant difference, within each group, between T0 and T1; equal lowercase letters indicate no significant difference, within each group, between T0 and T1; and equal uppercase letters indicate no significant difference in the evolution of the means between the groups, at each moment (T0 or T1) §: data series does not allow the execution of the model.

Source: research data, 2021

## DISCUSSION

The results of this study reveal that, after an interdisciplinary intervention with a motivational approach, the consumption of ultra-processed foods in overweight or obese adolescents significantly decreased.

A systematic review that aimed to assess the evidence on the use of TTM in nutritional interventions for adolescents and its effectiveness in relation to food intake found four studies in which participants showed an improvement in the consumption of fruits and vegetables; in another four, they evolved in stages of readiness-to-change<sup>33</sup>. Participants in two interventions reduced their fat intake, and at the end of one intervention all were in the action and maintenance stages. These findings are in line with the present study, showing that TTM appears to be a successful strategy when used in nutritional interventions for adolescents. However, there are still no data in the literature that show the effectiveness of TTM in reducing the consumption of ultra-processed foods, which expresses a differential of the present study.

The use of TTM in nutritional interventions has been shown to be efficient, as well as its application in different contexts and populations<sup>33</sup>. The intervention of Di Noia *et al.* was positive in increasing the intake of daily servings of fruits and vegetables in the studied adolescents<sup>34</sup>. Another randomized clinical trial resulted in positive changes in the

quality of the diet, anthropometric and biochemical markers of the participants, with a significant difference between groups<sup>35</sup>.

Taking into account the prevalence of obesity in adolescents, as well as the low adherence to the methods currently used by this population, the interdisciplinary intervention with a motivational approach proposed in this study is innovative. After all, it represents a new strategy for the treatment and/or prevention of NCDs such as obesity, and it could improve adherence to treatment, as well as achieving sustainable long-term results<sup>36,37</sup>.

Another important point to be highlighted is that this intervention encompasses the treatment with the patient without imposing a restrictive prescription, but focusing on the process of behavior change, especially on the psychological aspects as mediators of it. Furthermore, it is suggested that this intervention program can be easily applied in primary care in health services, as long as professionals are trained.

In Brazil, research carried out with adolescents who used the same classification for ultra-processed foods found a relationship with obesity and food quality<sup>10,38</sup>. A study carried out with the participants of the 1982 Pelotas Birth Cohort found that the intake of ultra-processed foods contributed with 51.2% total calories ingested, being more related to females<sup>38</sup>. Furthermore, the intake of ultra-processed foods was positively associated

with the consumption of fat, sodium and calories.

Another study, which used data from the Household Budget Survey (POF 2008-2009), indicated that the availability of ultra-processed products at home was positively associated with both the medium BMI and the prevalence of overweight or obesity in the analyzed population<sup>10</sup>. In view of this scenario, in this research, ultra-processed foods represented 55% (1069.5kcal) of the TEV of food (1944,2kcal) before the intervention; however, after three months of intervention, there was a reduction of 37.5% (402.1 kcal) in their consumption.

A study carried out in the United Kingdom has shown that a 50% reduction in the intake of ultra-processed foods can reduce mortality from cardiovascular diseases by approximately 13%<sup>39</sup>. Although this is not the objective of the present study, adolescents had an average BMI equal to 34.4 kg/m<sup>2</sup>, contributing as a risk factor for mortality from cardiovascular causes. It is expected that the drop in consumption of these foods will bring positive health outcomes for adolescents in the short and long term.

Although the intake of ultra-processed foods decreased by 37.5% after the intervention, fresh food intake did not change, that is, no significant increase was observed in this food group. This outcome opens space for thinking about new interventions that promote and encourage the intake of fresh foods.

As there were no significant changes in the intake of groups 1 and 2 of the NOVA classification, it is clear that adolescents migrated their consumption to processed foods, due to their increased intake in both groups. However, this growth can be seen as a first step towards improving the quality of the adolescents' diet, considering that they have less additives in their composition and bring less damage to health when compared to ultra-processed ones.

The proposal to insert the NOVA food classification as a food intake assessment tool stands out. It can also be used as a strategy for nutritional education on food quality and its impact on health, in addition to promoting healthy eating habits<sup>40</sup>.

As a limitation of the study, the accuracy of the quantification of consumption and classification of foods through dietary recalls can be cited, as observed in other studies on food intake assessment. Furthermore, the use of just one 24-hour recall in the pre-intervention and another one after 12 weeks does not define the adolescents' usual diet. Nevertheless, the researchers aimed to reduce these possible measurement biases using the MPM<sup>28</sup>.

## CONCLUSION

Based on the results found here, it is possible to see that the interdisciplinary intervention with a motivational approach was able to reduce the intake of ultra-

processed foods, culminating in positive changes in the quality of food. In addition, the importance of monitoring food intake in relation to ultra-processed foods and its impact on the quality of life of individuals is highlighted.

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