

Readiness for behavioral change and variation in food consumption among adolescents from a school-based community trial in Duque de Caxias, RJ

Prontidão para mudança de comportamento e variação do consumo alimentar de adolescentes participantes de ensaio comunitário de base escolar em Duque de Caxias, RJ

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ABSTRACT: *Objective:* To investigate the influence of the stage of readiness for changes in food consumption variation among adolescents participating in school-based community trial in Duque de Caxias (RJ), Brazil. *Methods:* It is a secondary analysis of a one-year randomized community trial to prevent excessive weight gain in students attending the 5th grade in 20 public schools in the municipality of Duque de Caxias. The activities conducted discouraged the consumption of sweetened beverages and cookies and encouraged the consumption of fruits and beans. A food frequency questionnaire was applied at the beginning and at the end of the study. The stages of readiness for behavioral change vary in a scale from (1) “I don’t think of changing diet” to (5) “I’m already changing my diet successfully”. For the longitudinal analyses, we used generalized linear mixed models. *Results:* There was a greater change in the consumption of fruit and soft drinks among participants in the intervention group who were in the action stage, compared to participants who did not think about changing their diet. *Conclusion:* The proposed strategy may be used to identify population groups with motivation for changes in dietary behavior.

Keywords: Food consumption. Adolescent. Motivation. Randomized controlled trial. Feeding behavior. Fruit.

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RESUMO: *Objetivo:* Verificar a influência do estágio de prontidão para mudança de comportamento na variação do consumo alimentar de adolescentes participantes de ensaio comunitário de base escolar em Duque de Caxias (RJ). *Métodos:* Trata-se de análise secundária de um ensaio comunitário randomizado para prevenção do ganho excessivo de peso conduzido durante 1 ano letivo com alunos do 5º ano de 20 escolas públicas do município de Duque de Caxias. Foram desenvolvidas atividades que desencorajaram o consumo de refrigerantes e biscoitos e estimularam o consumo de frutas. Aplicou-se questionário de frequência alimentar ao início e ao final do estudo. Os estágios de prontidão para mudança do comportamento alimentar variam de (1) “não penso em mudar minha alimentação” a (5) “já estou mudando minha alimentação e com sucesso”. Para as análises longitudinais, foram empregados modelos generalizados lineares mistos. *Resultados:* Observou-se maior alteração no consumo de frutas e refrigerantes entre os participantes do grupo intervenção que se encontravam nos estágios de ação, comparados aos que não pensavam em mudar. *Conclusão:* A estratégia proposta no presente artigo pode ser utilizada para identificar grupos populacionais com alguma propensão à alteração do comportamento alimentar.

Palavras-chave: Consumo de alimentos. Adolescente. Motivação. Ensaio clínico controlado aleatório. Comportamento alimentar. Frutas.

INTRODUCTION

The dietary pattern of Brazilian adolescents is characterized by low intake of vegetables and fruits, as well as high intake of high-sodium foods, sweets and soft drinks^{1,2}. Besides, in this population group, high prevalence of overweight is observed, which has tripled in the last three decades, being 20.5% in 2009³. This scenario stands out the urgent need for nutritional interventions that can promote and encourage healthy dietary habits among adolescents. Since this period is characterized by the beginning of autonomy regarding food choices, adolescence received more extensive attention than childhood in terms of developing nutritional interventions^{4,5}.

Nutritional interventions that can lead to changes in the dietary behavior of adolescents have been a challenge for public health. Many proposals have been tested; however, there is no consensus in the literature about the most efficient ways to guide these actions⁶.

It is known that the chances of success and impact of actions addressed to promoting healthy dietary practices increase when the determinants of dietary behavior of individuals or populations become clearer⁷. According to Ma et al.⁸, the efficacy of a nutritional intervention depends on the internalization of the need for changes in dietary habits. This individual's perception is a major aspect to be investigated for designing nutritional interventions, especially among adolescents, who are highly

susceptible to environmental influences. The transtheoretical model (TTM) is a promising tool to help in understanding the susceptibility for health-related behavior change⁹.

The TTM assumes that not all individuals are inclined, at the same level, to adopt specific behaviors, such as changing dietary habits and start eating healthier foods. Besides, even though the person may realize the need for behavioral changes, usually such a change is carried out in stages, not abruptly. More specifically, the stages of the model provide a conceptual scenario for understanding the process of individual behavioral change, and allow characterizing changes in the intention, attitude and dietary behavior, as well as the stage of readiness to perform it¹⁰⁻¹².

Considering the importance of associating the stage of readiness to the adoption of specific behaviors, the objective of this study was to verify the influence of the stage of readiness for behavioral change on the variation of food consumption among adolescents participating in a school-based community trial in Duque de Caxias (RJ).

METHODS

This is a secondary analysis of a randomized school-based community trial, called *Pais, Alunos e Professores Pela Alimentação Saudável* (PAPPAS), conducted in a sample of students attending the fifth grade in public schools from Duque de Caxias, Rio de Janeiro, Brazil. Out of the 35 eligible schools, 20 were selected to participate in the study (one classroom was randomly selected in each school), being randomly placed in the control ($n = 10$) and intervention ($n = 10$) groups. The process of randomization was based on the prevalence of overweight in the year previous to the study. The detailed description of methods, as well as the sample size calculation and the main results of the main study, were published by Cunha et al.¹³.

To sum up, interventions aimed at: discouraging the intake sugar-sweetened beverages, replacing snacks based on ultra-processed foods (especially cookies) by fresh foods, especially fruits, and encouraging the intake of beans. The intervention was based on nutritional education activities conducted monthly in the classroom. The study aimed at verifying the impact of these interventions on the Body Mass Index (BMI) of the adolescents.

The trial was conducted in the 2010 school year and followed the CONSORT guidelines¹⁴. It was observed that there wasn't statistically significant difference in the variation of BMI, across time, for the participants in the intervention group when compared to those in the control group ($b = 0.003$; $p = 0.75$); however, there was a reduction in the intake of soft drinks and cookies, as well as an increase in the consumption of fruits in the intervention group, when compared to control ($p < 0.05$). Considering the results observed in this trial, in the present study, food consumption data were used as outcomes.

The study was approved by the Ethics Committee of the Social Medicine Institute at Universidade do Estado do Rio de Janeiro. The procedures for data collection were in accordance with the Resolution 196/96, from the Ministry of Health, respecting the principles of autonomy, privacy and non-maleficence. The participation of students in the research was conditioned to the signing of the consent form by the father/mother or guardian.

Data were collected by interviews with the students using a standardized questionnaire containing socioeconomic questions and aspects of the dietary habits, including the frequency of consumption of sweetened beverages and lifestyle. There was one question about the stages of readiness for dietary behavioral changes. All interviewers (nutritionists) were trained by the coordination team in February, 2010. The data collection period included the school year (March to December, 2010) and had 3 moments of measurement (baseline, middle of the school year, and post-intervention — end of the school year). The present study used the baseline data regarding the stages of readiness for dietary behavioral changes. The food consumption of adolescents was assessed using a food frequency questionnaire (FFQ) referring to the past six months. The assessed items were similar to those from a previously validated FFQ addressed to adolescents from the metropolitan region of Rio de Janeiro¹⁵. The variation in the daily frequency of consumption of fruits, cookies and soft drinks was analyzed, since these items are considered to be markers of healthy and unhealthy diet among adolescents.

The adolescents' perception regarding the stage of readiness for dietary behavioral changes was assessed at baseline using the following question: "Concerning your diet": (1) I don't think of changing my diet; (2) I'm thinking of changing my diet, but I'm still not sure; (3) I've decided to change my diet, and I'm only thinking of how to do so; (4) I'm already changing my diet, but I'm finding difficulties; (5) I'm already changing my diet successfully. These response options are based on the five stages (pre-contemplation, contemplation, decision, action and maintenance) of the TTM.

For this analysis, the five stages were recategorized in: individuals who do not think of changing their diet (stage 1); those who are in motivational stages (stages 2 and 3); and people in the action stages (stages 4 and 5), as suggested by Prochaska et al.¹⁶. It is worth to mention that changes in the stages of readiness were not one of the objectives of the intervention, and the application of the TTM aimed at verifying the effects of the stages of readiness at baseline at food consumption changes, which consisted on the main objective of the intervention. To measure body weight, a portable electronic scale attached to a body composition device (Tanita BC-558) was used, with capacity of up to 150 kg and variation of 100 g. Height was measured in duplicate, using the portable anthropometer from AlturaExata (Belo Horizonte, Minas Gerais, Brazil), with a 200 cm amplitude and 0.1 cm variation. Both procedures followed the recommendations of Gordon et al.¹⁷.

The mean daily frequency of consumption of the selected foods and BMI (weight/height²) was compared among adolescents who did not think of changing their diet, those who were in motivational stages and individuals in the action stages at the baseline, using the Kruskal-Wallis test, by considering the asymmetry of distributions. The variation rate in the intake of fruits, cookies and soft drinks across time, according to the stage of readiness for dietary changes among the students at baseline, was assessed using generalized linear mixed models, by the PROC GLIMMIX procedure, in *Statistical Analysis System (SAS)* v. 9.3. This procedure considers both missing data and the cluster effect¹⁸, and is indicated for ordinal outcomes, such as the daily frequency of food consumption. The link function used was *cumlogit*, and distribution was multinomial. Once the process of randomization of schools was conducted in pairs, according to the similarity in the prevalence of overweight, the match was contemplated in the model¹⁹.

An effect modification model by sex was tested by including the interaction variable between sex*stage of readiness for changes at baseline; however, the results were not statistically significant ($p > 0.05$), and the final analysis was conducted without gender stratification.

RESULTS

The stage of readiness for dietary behavioral changes was assessed at baseline in 424 adolescents. The longitudinal data analysis comprised 458 students, who participated at least in one of the measurements of food consumption. Out of these, 50.6% were male participants, and mean age was 11 years old (standard deviation – SD = 1.22).

Regarding the stage of readiness for changes in the baseline, more than half of adolescents (52%, $n = 222$) reported being in the pre-contemplation stage, that is, they were not considering changing their diet; 16% ($n = 66$) reported being in the contemplation stage; 12% ($n = 52$), in the preparation stage; 10% ($n = 41$), in the action stage; and 10% ($n = 43$), in the maintenance stage (data not shown).

In the group that had the intervention, BMI of the adolescents in the baseline was lower among participants who do not think of changing. However, no statistically significant differences were found in the daily frequency of the consumption of fruits, cookies and soft drinks among adolescents who did not consider changing their diet (pre-contemplation stage) and those at the other stages, both in the intervention and in the control group (Table 1).

It was observed that changes in the daily frequency of consumption of soft drinks were higher among individuals who were in the action stage when compared to those in the other stages, both in control and intervention groups; however, the reduction in the consumption

of these drinks was more present among participants in the intervention group. Regarding the consumption of cookies, the daily frequency of consumption reduced more among those in the action stages from the intervention group. Regarding the fruits, the daily frequency of consumption increased more among participants in the intervention group that were in the action stage, when compared to those in other stages. There was not a clear pattern of change associated with stages of readiness for the dietary behavioral change in the control group (Figure 1).

The results obtained in the longitudinal statistical analysis are described in Table 2. The rates of variation of consumption across time, for each food group, are identified by the variables action stages*time and motivational stages*time, which compare the variation among individuals who are in the action and motivational stages, respectively, to those who do not think of changing their dietary behavior. There was a statistically significant variation in the consumption of fruits and soft drinks among participants in the intervention group that were in the action stages, compared to those who did not think of changing. For fruits, the general effect of TTM presented $p = 0.06$, and there was more variation of increase (0.66) for individuals in the action stage ($p = 0.02$). Regarding soft drinks, the general effect of TTM presented $p = 0.006$, there was more variation (-0.83) among adolescents in the intervention group who were in the action stage ($p = 0.003$). Results remained the same after adjustment for baseline BMI.

Table 1. Mean and standard deviation of Body Mass Index and daily frequencies of consumption of food items according to promptness stage for change in food consumption at baseline

	Intervention group			Control group		
	Does not think of changing (n = 114)	Motivational stages (n = 55)	Action stages (n = 38)	Does not think of changing (n = 108)	Motivational stages (n = 63)	Action stages (n = 46)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
BMI (kg/m ²)	16.75* (2.29)	18.70 (3.24)	17.35 (3.49)	17.98 (3.14)	19.59 (4.32)	18.84 (3.90)
Fruits (times/day)	0.85 (0.86)	0.86 (0.80)	0.90 (0.86)	0.73 (0.81)	0.55 (0.66)	0.90 (0.99)
Cookies (times/day)	0.64 (0.35)	0.55 (0.36)	0.70 (0.38)	0.64 (0.34)	0.58 (0.38)	0.62 (0.37)
Soft drinks (times/day)	0.58 (0.56)	0.69 (0.63)	0.70 (0.57)	0.66 (0.65)	0.63 (0.56)	0.75 (0.68)

* $p < 0.001$ in Kruskal-Wallis test.

SD: standard deviation; BMI: Body Mass Index.

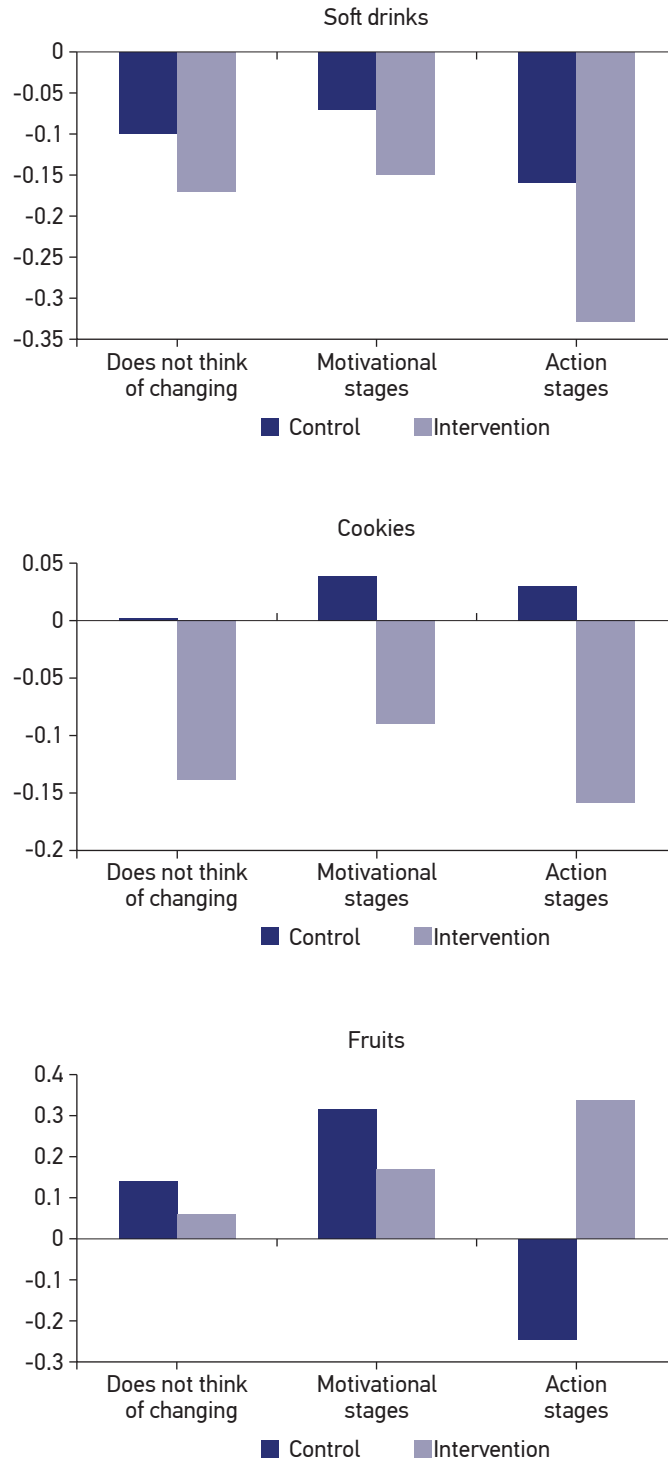


Figure 1. Variation of daily mean frequency (times/day) of consumption of soft drinks, cookies and fruit of adolescents, according to their promptness stage for change at baseline.

Table 2. Variation rate in food consumption according to promptness stage for change in dietary behavior of adolescents at baseline.

	Intervention Group (n = 222)		Control Group (n = 236)	
	Coefficiente of regression	p-value	Coefficient of regression	p-value
Fruits		0.06		0.27
Time	0.05	0.72	0.36	0.01
Action stage	-0.80	0.09	0.62	0.14
Motivational stages	-0.16	0.69	0.52	0.17
Action stages*time	0.66	0.02	-0.33	0.20
Motivational stages*time	0.03	0.89	0.12	0.61
Cookies		0.09		0.40
Time	-0.70	< 0.0001	-0.08	0.58
Action stage	0.06	0.89	-0.22	0.58
Motivational stages	0.43	0.26	0.06	0.86
Action stages*time	-0.36	0.21	0.26	0.35
Motivational stages*time	0.34	0.17	0.31	0.22
Soft drinks		0.006		0.73
Time	-0.66	< 0.0001	-0.27	0.06
Action stage	-0.08	0.84	0.16	0.68
Motivational stages	-0.36	0.29	0.05	0.89
Action stages*time	-0.83	0.003	-0.15	0.58
Motivational stages*time	0.12	0.64	-0.18	0.47

Action stages*time represents the variation rate of consumption across time, for each food group, among the individuals who are in the action stages compared to individuals who do not think of changing their dietary behavior; Motivational stages*time represents the variation rate of consumption across time, for each food group, among the individuals who are in the motivational stages, compared to individuals who do not think of changing their feeding behavior.

DISCUSSION

In this study, the perception of the stage of readiness for dietary behavioral changes among adolescents participating in a randomized community trial was associated with the variation in the consumption of fruits, cookies and soft drinks.

The changes in the mean daily frequency of food consumption was observed among adolescents in the intervention group that were in the action stages at baseline, even though the association with cookies and fruits has been borderline. These findings corroborate the

theory that individuals who are more prone to change tend to perform them, and suggest that this factor should be considered in the conduction of interventional studies.

Another important finding in this study was the reduction in the consumption of soft drinks and the increasing intake of fruits among participants in the control group who were in action stages (even though the change has been higher in the intervention group), which points out that individuals who are more prone to changes can perform them even without any intervention; however, if encouraged, the intensity of change can be higher.

Most analyzed adolescents were in the pre-contemplation stage in the baseline of the study, that is, they were not considering changing their dietary habits. There are two possible explanations for this finding: the person has not tried at all to change the dietary behavior, or that there have been some frustrated attempts to change it, which may lead to setbacks to previous stages. According to Prochaska et al.¹⁶, behavioral changes throughout the different stages are not uniform or linear; instead, they are cyclic, involving adoption, maintenance, relapse and readoption of behaviors over time. In this spiral pattern, people can make progress, from contemplation to decision, from that stage to action and then maintenance; however, most individuals will find relapse. In that moment, people usually go back to a previous stage. Generally, these individuals are discouraged and resist to the desire of changing their behavior, so it is possible that they go back to the pre-contemplation stage, and staying there for long periods of time.

Individuals who did not think of changing their habits, at baseline, were the ones that presented the lowest variation of food consumption. This finding can be explained by the fact that these people have already presented a high consumption of fruits, and reduced consumption of cookies and soft drinks, since the baseline. However, there was no statistically significant difference in the consumption of these items among adolescents who did not consider changing their habits (stage 1) in comparison to those who were already at some level of change.

A possible limitation to this study is the use of a single question to capture the stage of readiness to change dietary behavior, and to verify an association with change in three food items. Some authors use an algorithm based on a questionnaire with questions, whose possibilities of response are mutually exclusive^{20,21}. However, the question used in this study was adapted by Chaves and Oyama²² in an intervention model for the sensitization of changes in dietary patterns, and presented validity to predict dietary behaviors. The classification of the stage of change is also related to the adequate perception of the person on the diet^{23,24}; however, according to Kristal et al.²⁴, the objective of the algorithm is not to show the adequacy of the dietary habits of the person, but instead, to detect the own perception regarding the diet.

Criticism regarding the TTM is a result of the possibility that the model does not reflect real and qualitatively different stages, but possibly represents a categorization of a continuous variable²⁵⁻²⁷, and the use of this model as a base for interventions to change dietary

habits is still controversial in the literature²⁸. However, the model allows identifying groups that do not respond to interventions.

The results of this study indicate that the assessment of the stage of readiness for dietary behavioral changes can be a useful tool in interventional studies that aim to change dietary behavior, since it allows identifying the readiness to change in population groups. In case of schools, the evaluation that at least a reasonable parcel of the population is prone to changes can have an enabling effect on the change of the group.

To sum up, the use of TTM to define and be the base for interventions has not been efficient; however, its use in the evaluation of readiness to change in clusters has proven to be important in changes of dietary habits of adolescents, and that possibility has been little explored in literature.

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