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APLICAÇÃO DO MODELO TRANSTEÓRICO EM INTERVENÇÕES NUTRICIONAIS PARA ADOLESCENTES: REVISÃO SISTEMÁTICA

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Brasília-DF
2018

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Trabalho de conclusão de curso elaborado e apresentado à comissão avaliadora da faculdade de saúde como requisito parcial à obtenção do título de bacharel em nutrição.

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1. REFERENCIAL TEÓRICO

1.1 Adolescência e comportamento alimentar do adolescente

A adolescência compreende o período dos 10 aos 19 anos, fase esta caracterizada por intensas transformações biopsicossociais, e acontece concomitante à puberdade, processo no qual se desenvolvem as características sexuais primárias e secundárias (WHO, 1995). A puberdade ocorre de forma distinta entre os sexos, com maior deposição de gordura nas meninas, e de massa muscular nos meninos, e com pico de crescimento em diferentes estágios (MARSHALL & TANNER, 1970).

As transformações corpóreas desta fase da vida repercutem no aumento das necessidades energéticas (WHO, 1995). Cerca de 50% do peso total do indivíduo é adquirido na adolescência. Ademais, o acentuado processo de mineralização óssea, com formação de 40% da estrutura da fase adulta, requer necessidade aumentada de cálcio**.** As mudanças corporais exigem atenção ao consumo de nutrientes tais como proteínas, ferro e vitamina A (VITOLO, 2015).

A alimentação nutritiva é componente essencial para o adequado crescimento e desenvolvimento do adolescente e práticas alimentares saudáveis atuam como fator de proteção contra doenças, em especial as Doenças Crônicas Não Transmissíveis (DCNT) (BRASIL, 2016). Dados do Estudo dos Riscos Cardiovasculares em Adolescentes (ERICA), do ano de 2015, cuja amostra abrangeu 75 mil adolescentes na faixa dos 12 aos 17 anos, de 1248 escolas em todo o território nacional, indicaram uma prevalência total de 8,4% de adolescentes na faixa de obesidade do Índice de Massa Corporal (IMC). Ainda de acordo com essa pesquisa foi constatada uma prevalência de 9,6% de estudantes hipertensos. Isso mostra a importância de se efetuar ações educativas para este público em especial (BLOCH et al., 2016).

Neste estudo a nível nacional foram identificadas várias inadequações alimentares no dia a dia dos estudantes. A saber, as bebidas açucaradas representam o terceiro item mais consumido, ficando atrás apenas do arroz e feijão. Além disso, detectou-se baixa prevalência do consumo de frutas, que apareceram dentre os 20 alimentos mais consumidos apenas no grupo de meninos de 12 a 13 anos (18%). Já a prevalência de consumo de hortaliças variou de 31,8% a 37,6% entre meninos e meninas, na faixa dos 12 aos 17 anos (SOUZA et al., 2016).

Dados do PeNSE de 2015 mostraram que 53% dos estudantes que participaram da pesquisa relataram passar mais de 3 horas por dia sentados, assistindo televisão, usando o computador, ou fazendo outras tarefas. Estes comportamentos sedentários representam fator de risco para o excesso de peso. Além disto, eles têm sido associados a uma maior frequência de consumo de guloseimas, biscoitos de pacote e bebidas açucaradas (COSTA et al., 2018).

A refeição mais negligenciada pelos adolescentes é o café da manhã, o que tem sido relacionado a uma queda nas capacidades cognitivas (ESTIMA et al., 2009). Segundo dados do PeNSE de 2015, 35,6% dos estudantes do 9º ano não fizeram o desjejum (BRASIL, 2016). Isto proporciona baixa ingestão de leite e seus derivados. A substituição das refeições principais por lanches do tipo *fast food* também é um hábito comum, sendo a janta a refeição mais frequentemente substituída (ESTIMA et al., 2009).

A frequência de consumo de refeições do tipo *fast food* também é preocupante. De acordo com o PenSE, cerca de 13,6% dos adolescentes do 9º ano consumiram *fast food* 3 ou mais vezes por semana no ano de 2015 (BRASIL, 2016). Isso contrasta com o guia alimentar para a população brasileira, cuja recomendação é que a base da alimentação seja composta de alimentos *in natura* ou *minimamente processados* (BRASIL, 2014).

Ainda de acordo com esta pesquisa, comer sentado em frente à televisão revelou-se como um hábito comum dos escolares, representando um percentual de 60,5% (BRASIL, 2016). O guia alimentar considera que as características do modo de comer, e as dimensões sociais e culturais influenciam a saúde, e portanto orienta que as refeições sejam feitas em ambiente calmo, sem se envolver em outras atividades (BRASIL, 2014).

O adolescente está no ápice da construção de sua identidade, e nesta fase, a influência dos amigos e do seu grupo de convívio se sobressai à influência familiar. Desta maneira, há a rejeição do padrão familiar, na tentativa de se autoafirmar como indivíduo independente (TOMÉ et al., 2015). Este grupo também está mais propenso à influência midiática, e aos padrões de beleza propagados por ela. Dessarte, um número considerável de adolescentes se depara com a insatisfação corporal, o que os estabelece como grupo de risco para o desenvolvimento de transtornos alimentares e comer transtornado. Os adolescentes têm mais chances de se envolver em práticas alimentares inadequadas, com o objetivo de emagrecimento ou ganho de massa muscular (LEAL et al., 2013; LIRA et al., 2017).

Dados da PeNSE do ano de 2015, mostraram que a cada 5 meninas entre 13 e 15 anos uma se sente gorda. Esta pesquisa também evidenciou que 7% dos alunos do 9º ano, o que representa um total de 184,2 mil estudantes, induziram o vômito ou fizeram uso de laxantes para emagrecer (BRASIL, 2016). A respeito dos padrões de beleza, Alvarenga et al., 2011 destaca:

" Muitos profissionais condenam a magreza exagerada, mas poucos percebem todas as nuances da ditadura da beleza, e, portanto, muitos se colocam como aliados na busca pelo corpo perfeito"

Considerando-se todas as características concernentes a este ciclo da vida, torna-se necessário a elaboração de atividades educativas que promovam melhora efetiva no perfil alimentar deste grupo, com foco na mudança e manutenção de hábitos, e não apenas em parâmetros antropométricos, evitando desta forma que práticas não saudáveis, tais como as citadas anteriormente sejam realizadas apenas no intuito de emagrecimento (ALVARENGA et al., 2015).

1.2 Modelo Transteórico de Mudança de Comportamento

O modelo transteórico de mudança de comportamento (MTT) foi desenvolvido por James O. Prochaska e Carlo DiClemente na década de 80, e inicialmente aplicado em programas de cessação do tabagismo, nos anos 90. A elaboração desta teoria recebeu influência de inúmeros autores da área da psicoterapia e comportamento. Nele estão presentes os conceitos de autoeficácia, estágios de mudança de comportamento, o equilíbrio de decisões e os processos de mudança (BERTOLIN et al., 2011; PROCHASKA et al., 1997).

Os estágios de mudança são o constructo que representa a linha temporal da teoria. No estágio de pré- contemplação o indivíduo não está consciente de que precisa mudar, e também lhe faltam informações de como fazer a mudança acontecer. Há pouca motivação, ou esta é inexistente. Na contemplação já existe uma menor resistência, e até se pensa sobre mudar, mas não existe nada programado. O indivíduo torna-se consciente de que existe algo errado em seu comportamento, mas enxerga mais dificuldades do que vantagens relacionadas à mudança (PROCHASKA et al., 1997).

Na etapa da decisão, o indivíduo se sente mais preparado para agir, desenvolvendo planejamentos a curto prazo. Ele avalia os prós e contras de forma mais positiva. O estágio de ação é caracterizado pela atitude de mudança propriamente dita, com alterações significativas no comportamento, e superação de desafios. A manutenção representa a capacidade de manter os novos hábitos por pelo menos 6 meses (PROCHASKA et al., 1997).

É importante ressaltar que os estágios são dinâmicos, e não seguem necessariamente de forma linear. Portanto, é possível que alguém no estágio de manutenção tenha recaídas, voltando à contemplação, por exemplo. Mas à medida que mais desafios são superados, há uma melhora também na autoeficácia, tornando o indivíduo capaz de mudanças cada vez mais consistentes (PROCHASKA et al., 1997).

Atualmente existem dois algoritmos utilizados na nutrição, através dos quais é possível avaliar em qual estágio a pessoa se encontra. O primeiro deles se baseia no consumo alimentar, com caráter quantitativo, cujas perguntas visam uma resposta numérica, como por exemplo o número de porções de frutas se consome por dia. A vantagem deste algoritmo é o fácil entendimento, contudo, ao se alterar a referência, que consiste na recomendação de número de porções para cada grupo alimentar, perde-se a classificação em estágios. No segundo algoritmo, são feitas questões de cunho subjetivo visando saber se o indivíduo considera adequado seu consumo de determinado alimento, ou grupo alimentar. Este é vantajoso por permitir que o entrevistado reflita sobre a própria alimentação, em contrapartida é desvantajoso pois a percepção que o indivíduo tem de alimentação saudável nem sempre coincide com as recomendações nutricionais (BERTOLIN et al., 2011).

Os processos de mudança são os meios pelos quais acontece a mudança, através dos quais a pessoa torna se capaz de progredir para os próximos estágios. Foram elaborados 10 processos de mudança, dentre os quais subdivide-se em dois tipos: processos cognitivos e experimentais, e processos comportamentais. Um exemplo de processo cognitivo é o aumento da consciência, que nada mais é do que a aquisição de informações sobre um comportamento específico, e os impactos que este hábito pode acarretar na saúde do indivíduo. A busca por suporte ou ajuda de alguém durante a mudança de comportamento é o processo comportamental denominado relacionamentos de auxílio (PROCHASKA et al., 1997).

A crença que o indivíduo tem sobre a própria capacidade de manter um hábito adquirido se entende como autoeficácia. À medida em que se avança entre os estágios há um aumento da autoeficácia (BERTOLIN et al., 2011).

1.3. Aplicação do Modelo Transteórico em intervenções nutricionais

O comportamento alimentar está sujeito a influências sociais, culturais, psicológicas, portanto não está atrelado apenas à razão. Compreender melhor os fatores que o determinam, e como acontece o processo de mudança viabiliza um aumento no impacto das intervenções nutricionais (OLIVEIRA et al., 2008). O MTT preconiza que a capacidade de mudar está diretamente ligada aos estágios, assim, quanto mais avançado nos estágios a pessoa estiver, maior é a prontidão para mudança. Separando-se os indivíduos em estágios, é possível a aplicação de atividades de Educação Alimentar e Nutricional (EAN) de forma mais direcionada para as necessidades de cada estágio, aumentando as chances de resultados positivos (BANDURA et al., 2008).

A aquisição de informação é importante, no entanto, esta sozinha não é capaz de gerar mudanças no padrão alimentar. Quando a pessoa não acredita existir uma solução para alterar o próprio comportamento, ela entra em um processo de negação, e a mudança não se concretiza. A mudança precisa fazer sentido na ótica do indivíduo. Para tanto, faz-se necessário entender a forma na qual a pessoa enxerga seu padrão alimentar, ajustando assim as metas do indivíduo aos propósitos da ação educativa (ALVARENGA et al., 2015).

O uso de abordagens que consideram o estágio em que o indivíduo se encontra, tem se mostrado eficaz, aumentando a efetividade das ações de EAN. Estudo de Cunha et al., 2015, realizado com 424 alunos de escolas públicas do município de Duque de Caxias, Rio de Janeiro, classificou de acordo com os estágios de mudança os participantes de uma intervenção cujo intuito era a prevenção de ganho excessivo de peso. A diminuição da frequência de consumo de refrigerantes foi maior entre os indivíduos que estavam no estágio de ação, assim como o aumento do consumo de frutas.

Estudo de Toral et al., 2006, evidenciou que os adolescentes tinham percepções equivocadas quanto à qualidade da própria alimentação, 79,7% acreditavam comer frutas de forma adequada, e 83,7% acreditavam comer verduras adequadamente, no entanto o consumo adequado de frutas e verduras representava apenas 12,4 e 10,3%,

respectivamente. Esses resultados confirmam a necessidade de se efetivar ações visando mudanças de hábitos alimentares nesta fase da vida.

Revisão sistemática de Menezes et al., 2016 avaliou a efetividade de intervenções direcionadas a hábitos alimentares e atividade física que faziam uso do MTT. Dentre os 18 estudos analisados, no entanto, apenas 2 tinham amostra composta por adolescentes. Atualmente não existem estudos que analisem de forma concisa o resultado de atividades de EAN com o uso do MTT neste grupo. O propósito do presente trabalho é descrever como o MTT foi utilizado em intervenções nutricionais voltadas para adolescentes e determinar quão efetivas foram estas intervenções.

2. APRESENTAÇÃO DO ESTUDO

As demais etapas do estudo realizado como Trabalho de Conclusão de Curso serão apresentadas na forma do artigo científico *"Transtheoretical Model-Based Interventions in Adolescents: A Sistematic Review"* a ser submetido à revista científica Journal of Adolescent Health (Qualis CAPES Nutrição A1/2017). Dessa forma, as seções a seguir correspondem ao artigo, já nas normas exigidas pela revista, e, portanto, em inglês.

ABSTRACT

Adolescence is considered a period of intense biopsychosocial changes, and requires specific nutritional needs. Literature has shown a tendency of inadequate eating habits among youth, consequently, nutritional interventions are required. The Transtheoretical Model (TTM) is a theory that classifies individuals based on their readiness to change and has been applied to several interventions. This work aimed to describe how the TTM was applied to nutritional interventions for adolescents, thus evaluate its effectiveness. The full protocol can be checked on the PROSPERO website (#CRD42018096819). The initial search in seven databases yielded 3779 results, from which 10 papers were included. Only randomized controlled trials and quasi-experimental designs written in English, Spanish and Portuguese were included, without restrictions to time of publication. Assessment of quality and risk of bias were made through the Effective Public Health Practice Project Quality Assessment Tool, and it revealed five weak articles. Adolescents were mostly recruited from schools, and the duration of the studies ranged from a month to three years. The model was used individually or combined with other behavioral change theories, and the majority of the

studies had a computer component, with usage of CD-ROMs, videos, websites and email. All studies assessed Stages Of Change, except for one. Seven studies included measures for decisional balance, five of them measured self-efficacy, and only one study measured processes of change. Eight interventions had positive results regarding improvements in dietary behaviors or TTM's measurements, with significant differences from control group. Some results suggests that the usage of the model associated with other behavioral change theories turns to be effective as well, although it is not possible determine if the TTM is more effective than the others theories, since no comparisons were explored in the studies. Future studies may consider comparing the TTM with other theories in order to get a better understanding of its effectiveness.

INTRODUCTION

Adolescence is considered a period of intense biopsychosocial changes, and requires specific nutritional needs. Healthy eating habits are essential to the appropriate growth and development of this age group, as well as a protective factor against non communicable diseases [1-3]. Literature has shown a tendency of inadequate eating habits among youth, such as high intake of sugary beverages [4], omission of breakfast and low consumption of fruits and vegetables [5]. Consequently, nutritional interventions are required, since they make changes in eating habits possible.

The Transtheoretical Model (TTM) describes changes, not as something punctual, instead, as a series of steps that take place according to someone's degree of motivation. Individuals are separated among five stages, which is determined by their motivation and the steps are classified as processes of change. Each stage has processes which are more suitable for it [6].

This model was first applied to smoking cessation [7,8], and it was also used for other health issues, such as physical activity [9], fruit and vegetable consumption [10] and weight control [11]. A systematic review concerning physical activity among adolescents found that considering someone's stage of change raises the effectiveness of the intervention, since it enables the usage of a strategy that suits better to the individual's needs [12]. Unfortunately, such a work that explores nutritional issues lacks in this age group.

Therefore, this work aimed to describe how the TTM was applied to nutritional interventions for adolescents, thus evaluate its effectiveness.

METHODS

The development of this work followed The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) directions, therefore it is registered on PROSPERO Website (#CRD42018096819).

Data sources and search strategy

The following databases were searched, so that we could find articles in English, Portuguese and Spanish: Adolec, Google Scholar, LILACS, PsycINFO, PubMed, Science Direct and Web of Science. A second search was conducted after a period of thirty days, in order to reach newer articles. A librarian assessed quality of the primary search by filling out Peer Review of Electronic Search Strategy (PRESS) form. Figure 1 shows the primary search strategy, for PubMed, that was then adapted for all remaining databases. Some Mesh Terms were applied such as *Adolescent*, *Feeding Behavior*, *Health Education*. Since there was not a Mesh Term for Transtheoretical Model, it was searched as *Transtheoretical Model*, *Stages of Change and stages of behavioral change*.

Figure 1. Search Strategy for PubMed

adolescent OR adolescents OR adolescence OR teen OR teens OR teenager OR teenagers OR youth OR youths

AND

"nutritional intervention" OR "nutritional interventions" OR "intervention study" OR "intervention studies" OR education OR "health education" OR "nutrition education"

AND

eating OR food OR "food intake" OR ingestion OR consumption OR "food consumption" OR "feeding behavior" OR "feeding behaviors" OR "eating behavior" OR "eating behaviors" OR "feeding pattern" OR "feeding patterns" OR "dietary habit" OR "dietary habits" OR "food habits" OR "food habit" OR "eating habit" OR "eating habits" OR "diet habit" OR "diet habits"

"transtheoretical model" OR "stages of change" OR "stages of behavioral change"

1912 articles found

Eligibility criteria

Randomized Controlled Trials and Quasi- Experimental Studies which included mostly or just teenagers, aged between eleven to nineteen, according to data from WHO, that have been exposed to a nutritional intervention following the Transtheoretical Model constructs of Prochaska and Diclemente were eligible. Exclusion criteria was a non-healthy population and studies that only classified the participants among the *stages of change*. Obese individuals were not classified as non- healthy. There was not restrictions concerning period of time.

Selection process

Titles and abstracts searched were submitted to the software Mendeley. Duplicates were removed and assessed manually by first reviewer. Two reviewers were responsible for studies analysis, by reading of title and abstract, and the ones that don't match criteria were discarded. The full paper was read by two reviewers separately if eligibility couldn't be determined. Discordances between the first and second reviewer were solved by an expert. Figure 2 shows the selection process from beginning.

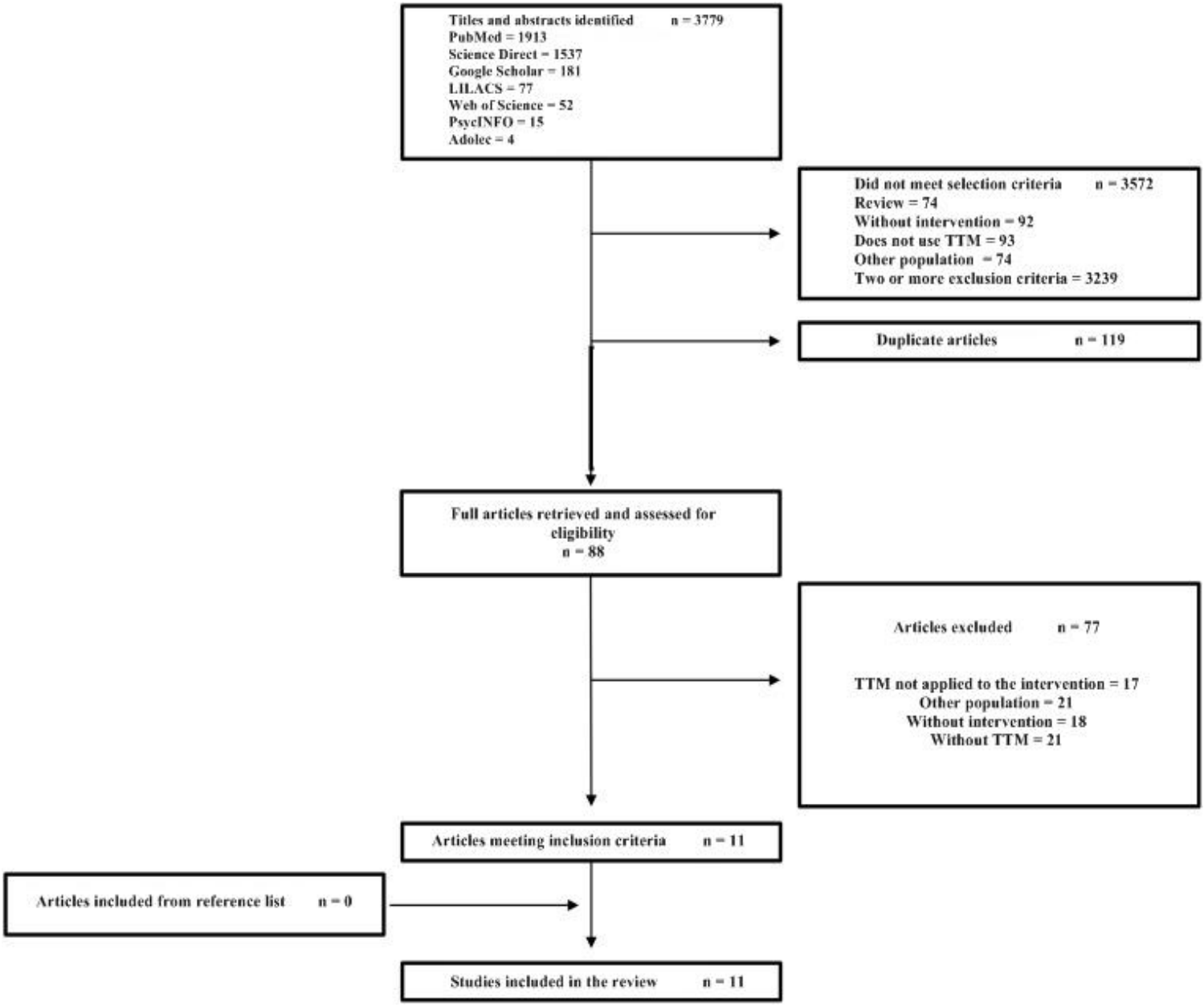

Figure 2: Selection process

Data extraction and Assessment of Study Quality

Data extraction occurred through the usage of an adaptation of the table model from Melo et al. 2017. That model follows instructions of Centre for Reviews and Dissemination for Undertaking Reviews in Healthcare. Type of publication, intervention characteristics and outcomes, population characteristics such as age, gender, ethnicity, measures, including TTM constructs measures were included on data extraction. Two reviewers did this process separately and assessed quality and risk of

bias through a questionnaire, developed by Effective Public Health Practice Project. The articles were classified as weak, moderate or strong. Weak studies were included though the risk of bias was discussed in the article. It was also conducted a hand search of bibliographies from included studies. A meta analysis could not be performed due to heterogeneity of included studies.

RESULTS

The initial search returned 3779 results, from which 119 duplicates were removed. Then 3572 abstracts that did not meet selection criteria were excluded. A total of 88 articles remained for reading of full text, and 77 papers that did not match eligibility criteria were also removed. The reasons for exclusion are available on fig 2. This resulted in 11 papers published between the years of 2003 and 2018 [13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23]. Two of them were assessed combined because it is about the same intervention [16, 17]. An article exploring the implementation of a intervention included in the review were added through reference list [24]. Another article was added the same way [25], and both were analyzed combined with their pairs.

Methodological quality of studies

Three articles were classified as weak [13, 15, 21], four as moderate ones [14, 18, 20, 23] and three studies were considered strong [16, 19, 22]. Most of the studies were rated as weak due to a non-representative sample and because blinding was not mentioned in the paper. All articles were classified as strong regarding confounders.

Population

All studies recruited adolescents from schools except for one, which recruited adolescents from youth service agencies [16]. Participants aged seven to nineteen, and just one study included preteens, whose age ranged seven to twelve [18], while the others included adolescents between twelve and nineteen years old. The majority of the studies targeted low income population, with three of them focusing in medium income adolescents [13, 22, 23], one targeting African Americans [16] and two of them including exclusively girls [14, 23]. Two studies focused in obese adolescents [18, 23].

Study design

The sample size varied between 50 to 4158 participants. A total of seven randomized controlled trial [13, 14, 18, 19, 21, 22] and four quasi-experimental studies [15, 16, 20, 23] were included.

Follow-up and study duration

Most studies had one follow-up measurements, with exception of one that had two [13]. Study duration (including pretest and posttest measurements) ranged from one month to three years, with plenty of them having six months of duration or more [13, 14, 18, 19, 21, 22, 23].

Theoretical basis

The TTM was used to the development of all interventions, though some of them based the study on other theories as well. Two studies used a combination of health promotion and TTM [15, 20], one measured psychosocial determinants from social cognitive theory and theory of planned behavior [14] and one article used the Attitude, Social influence and self-Efficacy (ASE) model associated with the TTM [21].

Intervention strategies and measured variables

The majority of the interventions had a computer component [13, 14, 15, 16, 19, 21, 22]. Strategies included use of websites [13, 21], videos [15], email [19] and CD-ROMs [14, 16], as ways to provide information and for assessment. One intervention made use of SMS [21]. One intervention sent printed magazines [19]. Concerning subjects, two studies focused in strategies for obese adolescents [18, 23], three studies aimed to promote a low-fat diet [14, 15, 20], one study focused in reduce risk cancer behaviors [21], and two of them intended to prevent obesity or improve consumption of fruits and vegetable [13, 16]. The remaining articles aimed to change dietary behaviors [19, 22]. Some of the interventions focused in physical activity as well [13, 15, 18, 20, 21, 22]. Most interventions occurred during class periods [13, 14, 15, 20, 22, 23]. Dietary assessment methods, such as food frequency questionnaires, 3-day food record, and self-reported consumption were applied for some articles [15, 16, 18, 19, 20]. One article assessed previous nutritional guidance [19], and six articles evaluated physical activity status [13, 15, 18, 20, 21, 22].

Application of the TTM

All studies assessed Stages Of Change (SOC), except for one [14]. Seven studies included measures for decisional balance [13, 14, 16, 19, 20, 22, 23], five of them measured self-efficacy [14, 16, 19, 20, 23] and only one study measured processes of change [23]. Participants of a intervention from Mauriello et al. received stage-matched and tailored feedback messages based on their TTM-based assessments, which included all TTM constructs [13]. Haerens et al. used the TTM to define the content and approach of the feedback for fat and fruit consumption. Concepts of self-efficacy, benefits and barriers related to their fat intake were also applied [14]. An intervention from Frenn et al. was designed for the whole class focusing in processes appropriate for those in precontemplation and contemplation stages, and computer generated tailored feedback based on stage of change for physical activity and dietary fat was provided individually. The processes used for the whole class were self reevaluation and consciousness raising. Decisional balance was explored in half of sessions of the intervention, whose topics were reducing barriers to healthy foods and physical activity and emphasize its benefits [15]. The TTM-based intervention program from Di Noia et al. included an introductory session, and a stage assessment, which was followed of three stage-tailored sessions that used processes of change strategies most suitable for every stage. For those in precontemplation the processes consciousness raising, dramatic relief and environmental reevaluation processes were used. For contemplation/preparation sessions the self-reevaluation and self-liberation were incorporated. For those in action/maintenance stages the processes reinforcement management, helping relationships, counterconditioning, and stimulus control were used [16]. Yusop et al. included in the intervention nutritional counseling and the educational topic was tailored to the participant's current stage. The processes that fit better to every stage were applied to the sessions [18]. Intervention from Toral et al. developed printed educational materials that promoted healthy dietary habits and sent them to participants according to their stage of change [19]. Frenn et al. delivered four class sessions based in the processes of consciousness raising and self-reevaluation, because the majority of students were in the precontemplation or contemplation SOC. Separate smaller group sessions took place for those in preparation, action and maintenance SOC. Intervention from Lana et al. developed a website based on ASE theory and TTM, they also sent SMS as a way to increase self-efficacy [21].

Intervention from Brick et al. delivered computerized TTM-tailored intervention sessions for three groups, according to their school year [22]. Participants of a intervention from Jalambadani et al. had lessons that focused on indentifying barriers and how to overcome them, and methods to stay motivated. The curriculum also included some processes of change and self-efficacy [23].

Intervention duration and frequency of exposure

In one study participants were exposed to the intervention only once [14], while three interventions had weekly sessions [16, 18, 23], and another send printed magazines once a month [19]. One study enabled access to a website during a period of nine months [21].

Main outcomes

Eight interventions had positive results regarding improvements in dietary behaviors or TTM's measurements [13, 14, 15, 16, 18, 21, 22, 23], with significant differences from control group. Jalambadani et al. found a more significant weight loss in the experimental group than the control group at the final follow-up [23], whereas Md. Yusop et al. found a increase in weight of both groups, although it was more expressive in control group [18]. Md. Yusop also found statistically significant increase in physical activity of the intervention group, when compared to control group, and no significant differences between two groups in dietary intake [18]. Haerens et al and M. Freen et al. had positive results with intervention group reducing fat intake [14, 15], while intervention group from Freen et al. increased percentage of fat, though it was to a lesser extent than the control group [20]. Freen et al. also found a improvement in intervention group regarding physical activity [20]. Toral et al. did not find differences in participant's fruit and vegetable intake, neither in perceived self-efficacy, benefits and barriers when compared to the baseline measurements [19]. Intervention groups from three studies improved consumption of fruits and vegetables [13, 16, 21] and two of them also progressed through stages [13, 21]. Participants from one intervention had higher probabilities of transitioning toward maintenance [22].

CONCLUSION

The results from assessed studies showed that TTM based interventions for adolescents are way more effective than those that does not use the model, when it comes to changing dietary habits. Some positive aspects of the application of the TTM includes its low-cost, its flexibility, and the fact that it personalizes the intervention for every participant according to its level of readiness to change. Besides, when used combined with technologies such as computers, it turns the intervention more attractive to this age period. Differences in time of exposure and follow up assessments make it difficult to evaluate if the results are sustainable. Some results suggest that the usage of the model associated with other behavioral change theories turns to be effective as well, although it is not possible determine if the TTM is more effective than the others theories, since no comparisons were explored in the studies. Future studies may consider comparing the TTM with other theories in order to get a better understanding of its effectiveness.

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4. ANEXOS

Tabela 1. Data Extraction Table

Study	Author	Type of publication	Country	Funding
Acceptability of a school-based intervention for the prevention of adolescent obesity/ Results of a multi-media multiple behavior obesity prevention program for adolescents	Mauriello et al.	Journal article	England	National Heart, Lung, and Blood Institute of the National Institutes of Health
Explaining the effects of a 1-year intervention promoting a low fat diet in adolescent girls- a mediation analysis	Haerens et al.	Journal article	Belgium	Policy Research Centre Sport, Physical Activity and Health
Changing the tide- an Internet or video exercise and low-fat diet intervention with middle-school students	M. Freen et al.	Journal article	United States	Milwaukee Area Health Education Center and the state of Wisconsin
Computer-Mediated Intervention Tailored on Transtheoretical Model Stages and Processes of Change Increases Fruit and Vegetable Consumption Among Urban African-American Adolescents / Mediating Variables in a Transtheoretical Model Dietary Intervention Program	Di Noia et al.	Journal article	United States	National Cancer Institute
The effectiveness of a stage-based lifestyle modification intervention for obese children	Md. Yusop et al.	Journal article	Malaysia	Research University Grant Scheme
Intervention Based Exclusively on Stage-Matched Printed Educational Materials Regarding Healthy Eating Does Not Result in Changes to Adolescents Dietary Behavior	Toral et al.	Journal article	Brazil	International Life Sciences Institute, a nongovernmental and nonprofit organization
Stage-based interventions for low-fat diet with middle school students	Freen et al.	Journal article	United States	Institutional Postdoctoral Felloship in Health Promotion and Disease Prevention, University of Michigan, and the Graduate School, Marquette University
Impact of a web-based intervention supplemented with text messages to improve cancer prevention behaviors among adolescents - results from a randomized controlled trial	Lana et al.	Journal article	Spain and Mexico	Spanish Ministry of Health
Intervention Effects on Stage of Change Membership and Transitions among Adolescent Energy Balance Behaviors/ Multiple behavior interventions to prevent substance abuse and increase energy balance behaviors in middle school students	Brick et al.	Journal article	United States	Grants DA020112 from NIDA, T32MH019927 from NIMH, and Grant G20RR030883 from NIH
The effect of education on reducing fast food consumption in obese iranian female adolescents - An application of the transtheoretical model and the theory of planned behavior	Jalambadani et al.	Journal article	Iran	Tehran University of Medical Sciences

Objectives of the study	Study Design	Inclusion/Exclusion criteria
To report on effectiveness trial outcomes of Health in Motion, a computer-tailored multiple behavior intervention for adolescents.	Randomized controlled trial	Inclusion criteria: Students in the 9th, 10th or 11th grade, that are able to speak English.
To examine mediation effects of changes in psychosocial determinants of dietary fat intake (attitude, social support, self-efficacy, perceived benefits and barriers) on changes in fat intake in adolescent girls.	Randomized controlled trial	Students in 7th and 8th grade from 15 out of 65 Flemish schools with technical and vocational education in West-Flanders (Belgium) that returned signed parental consent forms; Being 11-15 years old.
To examine the effectiveness of an eight-session health promotion/transtheoretical model Internet/video-delivered intervention to increase physical activity and reduce dietary fat among low-income, culturally diverse, seventh-grade students.	Quasi-experimental design	Only students in 7th year, from public schools in Midwestern region.
To examine the efficacy of an intervention based on the transtheoretical model (TTM) for increasing fruit and vegetable consumption among economically disadvantaged Arican-American adolescents.	Quasi-experimental design	Being Arican-American and aged 11 to 14 years
To assess the effectiveness of a stage-based lifestyle modification intervention for obese children.	Randomized controlled trial	Only obese children, whose BMI-for-age score were greater than +2SD, aged 7-11 years old were included. Those diagnosed with serious medical conditions or those who were taking medications that interfere with weight status; and those who were already participating in any weight management programme were excluded.
To assess the impact of a six-month stage-based intervention on fruit and vegetable intake, regarding perceived benefits and barriers, and self-efficacy among adolescents.	Randomized controlled trial	Only students in 7th or 8th year, from public schools in Brasília.
To test a theoretically based short- term intervention.	Quasi-experimental design	Students from sixth, seventh, and eighth grade students from two mutually exclusive academic "families" within the school were invited to participate
To assess the impact of a web-based intervention supplemented with text messages to reduce cancer risk linked with smoking, unhealthy diet, alchohol consumption, obesity, sedentary lifestyle and sun exposure.	Randomized Controlled Trial	Spanish and Mexican adolescents attending secondary school between 2009 and 2012.
This study evaluated Stage of change progression in a large computer-delivered, Transtheoretical Model- tailored intervention focusing on physical activity and fruit and vegetable consumption (FV).	Randomized Controlled Trial	Being aged 10 to 15 years old.
This study aimed at investigating the effect of education on reduction of fast food consumption among female adolescents suffering from obesity and overweight conditions in Sabzevar (Iran), in accordance with the TTM model, perceived behavioural control and subjective norms.	Quasi-experimental design	Inclusion criteria: female aged 15 to 18 years; having a BMI values > or equal 85th (CDC); having an Iranian nationality; and consuming fast food once a week. Exclusion criteria: having a disease; not completing the questionnaire; and having physical activity.

Recruitment Methods	Age	Gender	Ethnicity
Students were recruited from eight high schools in Rhode Island, Massachusetts, New York and Tennessee.	15.9 y	Male: 49.2 % Female: 50.8 %	75 % White, 10.5 % Black, 7.1 % Asian, 5.5 % Hispanic 3.4 % Combination, 1.4 % Other, 0.5 % American indian or alaskan native
A random sample of 15 out of the 65 Flemish schools with technical and vocational education in West-Flanders (Belgium) was selected to participate in the intervention study. Theses 15 schools were then randomly assigned to the intervention or control conditions (5 schools per condition) : (a) Intervention with parental support, (b) intervention alone and (c) control condition. The parents of all 2991 pupils in 7th and 8th grade received an informed consent form seeking their authorizations for their child to take part in the study.	11 - 15 / 12.9 y	100 % Female	Not informed
The study was conducted in a Midwestern urban public middle school. A total of 178 seventh-grade students in six classes were invited to participate.	12 - 14 / NA	40.6 % Male	44.8% Hispanic, 25% Black, 8.8% White, 4.7% Native American, 2.6% Asian, 14.1% Other
This study was conducted in 27 youth services agencies located in urban areas of New York, New Jersey, and Pennsylvania. Nine pairs of agencies matched on the size of their youth population were randomized to one of two conditions: computer intervention (CIN) and control. Of the remaining agencies, one served a disproportionately large youth population compared with the others and was assigned to the control arm to guard against the potential loss of participants in this arm.	11 - 14 / 12.4 y	61% female	15% Hispanic
Out of 284 obese children aged 7-11 years old from five primary schools in three districts of Selangor, 50 children were recruited.	7 - 11 / 9.8 y	52.5 % Boys 47.5% Girls	95% Malay, 5% Non-Malay
The sampling process aimed toward obtaining a representative sample of adolescents in the 7th and 8th school years in Brasília. Four schools were randomly selected for the intervention group and six schools for the control group.	11 - 19 / NA	59.5 % Female	Not informed
A central city middle school serving low-income, culturally diverse students was the setting for the study.	12 - 17 / 13.82 y	52 % female 47 % male	50 % African American, 20 % Caucasian, 14 % Hispanic, 15 % Other races
Program information was sent by email to all teachers. Links and banners were placed on the main educational portals. Participation was voluntary, but most interested teachers encouraged their students to participate.	12- 16 / NA	54.8 % female	78 % Mexican
Students from 20 middle schools across Rhode Island participated in the study.	10 - 15 / 11.4 y	47.8 % female	65.0 % White, 15.6 % Hispanic, 3.8 % Black, 2.4 % Asian, 2.2 % American Indian/ Alaskan Native, 0.5 % Pacific Islander
The students in the study were selected among the obese and overweight students in 12 schools located in Sabzevar, Iran.	15 - 18 / 16.36 y	100 % Female	Iranian

Socioeconomic status	Intervention
Medium Income	Students self-directed through the 30-minute program in which they completed a series of TTM-based assessments and received stage-matched and tailored feedback messages based on their responses.
Low income	The healthy eating intervention had an environmental and an individual-based component. At the personal level, students completed a youth-based version of the computer-tailored fat intake intervention during one class hour. In the intervention group with parental support, a CD with the adult computer-tailored intervention for fat intake was given to all parents for them to use and complete at home.
Low income	The intervention was conducted in a computer laboratory where each student had a computer. The focus of the intervention was on strategies appropriate for all stages of change, particularly for those in precontemplation and contemplation stages.
87% of participants came from communities in which 20% or more of families had incomes below the federal poverty level.	A staging measure built into the session classified users into precontemplation, contemplation/preparation, or action/maintenance. Then they completed three additional intervention sessions according to their classification.
RM 2001 to RM 5000 - 22.5 % > RM 5000 - 77.5 % Low to medium income Malaysian current estimated household income = 5,228 RM	Participants in Intervention Group (IG) received a stage-based lifestyle modification that included activities such as nutrition counselling, a hands-on activity (healthy food preparation) and 'Sharing is Caring", a session to encourage parents/caregivers to share their experiences during the intervention period.
33% Low income	Every month, during a period of six months, the intervention group received colorful printed magazines that promoted healthy eating and information newsletters directed toward the participants' stages of change. The magazines were handed out at the schools and the newsletters were mailed.
Low income	A four-session stage-based classroom intervention during the FACE class regarding fat consumption with middle school students.
Weekly expenditure 2.9 € or less 42.2 % 3–5.9 € 26.0 % 6 € or more 31.8 %	The experimental group members had free access to a tailor-made and interactive website. During the academic year, this website was periodically updated with different school and leisure activities related to the avoidance of risk behaviors. To encourage participation, the program included a competition that gave rewards to the winners. SMS were also sent to students to stimulate the adoption of healthy behaviors and as a reminder of participation.
Medium Income	Each participant interacted with five 30-min computerized TTM-tailored intervention sessions that were group specific: one in sixth grade, three times in seventh grade, and one in eighth grade. The energy balance group included fruit and vegetable consumption.
Medium Income	The first lesson focused on basic nutrition concepts to include the food guide pyramid and the importance of reduction in the consumption of fast food for overall health and wellbeing. The later lessons focused on identifying barriers and overcoming barriers, goal-setting, and identifying methods to stay motivated. Each training session was followed by a 30-minute discussion with students on difficulty and ease in consumption reduction of fast food.

Co- Intervention	Time/frequence of exposure	Measures/ Instruments to collect data
The intervention included classification in stages for physical activity and increasing awareness of its importance, and limited TV viewing.	3 intervention sessions within 2 months	Stages of change for physical activity, fruit and vegetable consumption and limited TV viewing Decisional balance- for fruit and vegetable consumption Body mass index classification
NA	One class hour	Food frequency questionnaire Self-efficacy, perceived benefits and perceived barriers
A intervention regarding physical activity ocurred along the low-fat diet intervention.	Eight sessions of 40min (a class period) and four 2- to 3-min videos (included on the first 4 sessions)	Dietary fat staging instrument Exercise staging question Food Habits Questionnaire
NA	Four onsite 30-minute weekly sessions	Perceived Pros and Cons of Fruit and Vegetable Consumption Self- Efficacy for Fruit and Vegetable Consumption Stages of Change and Fruit and Vegetable Consumption Self-reported fruit and vegetable consumption
Participants also had aerobic exercise sessions, on weekends, once every two months.	3 sessions of 2 hours of aerobic exercise on weekends (once every two months) 1 hour of Nutritional counselling (sessions during a period of 24 weeks) A "Sharing is Caring" session (1h30min) A hands-On activity	Stages of change Physical activity Questionnaire for Older Children 3-day Food record Measures of body composition
NA	6 newsletters and magazines, once a month.	Stages of change, Decisional balance, Self-Efficacy Self-reported fruit and vegetables consumption Previous Nutritional Guidance
This intervention also had a physical activity component	4 sessions of 45-min	Temptation scale for low-fat foods Decisional Balance Questionnaire Food Habits Questionnaire The Child and Adolescent Activity Log (CAAL)
The experimental and control group received information for reducing cancer risk linked with smoking, alcohol consumption, sedentary lifestyle and sun exposure.	They had access to a website during a period of 9 months	Stages of change Total cancer behavioral risk
This study had a smoking and alcohol prevention program, physical activity and limited TV viewing were explored as well.	Five sessions	Stages of change for smoking acquisition and cessation Stages of change for alcohol acquisition and cessation Stages of change for energy balance behaviors (for physical activity and fruit and vegetable consumption)
NA	60 min, twice a week for 12 weeks	Stages of change, Decisional Balance , Self-Efficacy Processes of change, Perceived behavioral control

Stages of Change Pre-Intervention	Stages of Change Pos- Intervention	Follow-up (number and time)
25.2 % Precontemplation 22.7 % Contemplation 34.3 % Preparation 1.7 % Action 16.0 % Maintenance	Not measured	5 times (baseline, one month and two months intervention, 6 months and 12 months follow-up assessments)
Not measured	Not measured	2 times (baseline and follow up)
Not informed	Not informed	3 times (intervention, pre-test and posttest ocurred one week before and after intervention)
Intervention 31,62% Precontemplation 58,11% Contemplation/Preparation 10,25% Action/Maintenance	Intervention 16,33% Precontemplation 60,41 % Contemplation/Preparation 22,94% Action/Maintenance	3 times (intervention, pre-test and posttest ocurred two weeks before and after intervention)
Not informed	Not informed	3 times (baseline, follow up at every month and 6-month after intervention)
Precontemplation: 44.6 % Intervention Contemplation: 14.6 % Intervention Preparation: 30.4 % Intervention Action: 1.6% Intervention Maintenance: 8.8% Intervention	Precontemplation: 43.5 % Intervention Contemplation: 19.9 % Intervention Preparation: 27.2 % Intervention Action: 2.0 % Intervention Maintenance: 7.4 % Intervention	3 times (baseline, a six-month intervention and assessment measures after the intervention)
Precontemplation: 25 Contemplation: 27 Preparation: 11 Action: 5 Maintenance: 6	Not informed	3 times (prettest, intervention and posttest)
Not informed	Not informed	2 times (intervention and post-test)
Precontemplation: 12.2 % Contemplation: 22.5 % Preparation: 34.4 % Action: 3.4 % Maintenance: 27.4 %	Not informed, though it is available in the article the movement patters of stages.	5 times (Baseline, intervention, follow up assessment every year for three years)
Not informed	Not informed	3 times (prettest, intervention and pos-test

Number of participants	Number of participants in analysis	Dropout rate (%)	Main results	Additional outcomes
1800	1800	34.3 %	The treatment group reported eating significantly more servings of fruit and vegetable than the control group at 2 months, 6 months, and 12 months.	The treatment group reported greater numbers of days doing at least 60 minutes of physical activity at 2 months than the control group. The difference between groups on reported average hours of TV was not significant at any timepoint.
843	788	6,50%	On average, the intervention group reduced their fat intake by 9.0 g/day more than did the control group.	No additional outcomes
134	103	77%	For the dietary fat data, those participating more than half the sessions decreased percentage of dietary fat from 30.7 to 29.9. Those participating in less than half the diet sessions were not significantly different than students in the control group classes.	Intervention students who completed more than half of sessions increased moderate/vigorous exercise by an average of 22 min, compared with a decrease of 46 min for the control group. Those who completed all three sessions (n = 39) increased activity by 33 min.
549	507	8%	Youths who interacted with the program increased their intake about 38% more than control-arm youths, which represents an average increase of 0.9 daily servings of fruits and vegetables. Moreover, CIN-arm youths evidenced greater increases in the perceived pros of eating five or more daily servings of fruits and vegetables than control-arm youths. In addition, greater percentages of youths in the CI arm than in the control arm progressed to later stages of change and mantained the target behavior of eating five or more daily servings of fruits and vegetables.	No additional outcomes
50	40	20%	Implementation of SOC in nutrition counselling among obese children was effective in modifying the behaviors of fruit, vegetable and fat consumption. It was found that children at higher SOC (maintenance or action) consumed less fat than those at lower SCO, specificaly precontemplation. This difference showed that enrolment in nutrition conseling increased knowledge or raised consciousness about nutrition.	The study showed that the stage-based lifestyle modification improved the body composition and physical activity of obese children.
860	771	29%	No significant changes to the participants' fruit and vegetable intake, benefits, and barriers or perceived self-efficacy were identified.	No additional outcomes
182	74	59.3%	The average percentage of fat in food ranged from 30.7 % to 32.8 %, with the intervention group increasing percentage of fat to a lesser extent than the control group.	Duration of exercise was significantly higher for the intervention group than the control group after the intervention.
2001	737	63.2 %	After taking part in the program, the percentage of experimental group 2 students who don't consume sufficient fruit decreased by	The intervention achieved a modest impact on cancer behavioral risk control. In all groups, alcohol intake was

			more than 70%. However, the same happened in the other groups. Prevalence of being overweight also decreased significantly (about 20%) in this group; while in the other ones it rose during the same period.	higher.
4158	2983	28.3 %	Regarding fruit and vegetable consumption, the energy balance (EB) group had greater percentages than the substance use prevention (SP) group progressing to Action/Maintenance (A/M) at 12 months, 24 months, and 36 months.	The EB group had less smoking acquisition than the SP group at 12 months. The EB group had greater percentages than the SP group progressing to A/M at 12 months. There were too few students (1–2 %) who were smoking or using alcohol at baseline to perform a meaningful analysis. For physical activity, the EB group had greater percentages than the SP group progressing to A/M at 24 months. For limited TV viewing the EB group had greater percentages than the SP group progressing to A/M at 12 months, 24 months, and 36 months.
420	420	0	The education group lost significantly more weight at the final follow-up than the control group.	No additional outcomes

Tabela 2: Quality Assessment Questionnaire

	AQ1	AQ2	Result	B1	B2	B3	B4	Result	CQ1.1	CQ1.2	Result	DQ1	DQ2	Result	EQ1	EQ2	Result	FQ1	FQ2	Result	Final Result
A1	3	1	3	1	No	0	0	1	3	4	2	3	3	3	1	1	1	2	1	2	Weak
A2	2	1	2	1	Yes	Yes	Yes	1	2	0	1	3	3	3	1	1	1	1	1	1	Moderate
A3	3	2	3	2	No	0	0	1	2	0	1	2	3	2	1	1	1	1	3	3	Weak
A4	2	5	2	2	No	0	0	1	2	0	1	2	3	2	1	1	1	1	1	1	Strong
A5	2	3	3	1	Yes	Yes	Yes	1	2	0	1	3	2	2	1	1	1	1	1	1	Moderate
A6	1	5	2	1	Yes	Yes	Yes	1	1	1	1	1	3	2	1	3	2	1	2	2	Strong
A7	2	1	2	2	Yes	Yes	No	1	2	0	1	2	3	2	1	1	1	2	3	3	Moderate
A8	3	4	3	1	Yes	No	No	1	2	0	1	3	3	3	1	3	2	1	3	3	Weak
A9	1	5	2	1	Yes	Yes	Yes	1	2	0	1	1	2	2	1	3	2	1	1	1	Strong
A10	2	4	2	2	No	0	0	1	2	0	1	3	3	3	1	3	2	1	1	1	Moderate

A1 - Acceptability of a school-based intervention for the prevention of adolescent obesity/ Results of a Multi-Media Multiple Behavior Obesity Prevention Program for Adolescents

A2- Explaining the effects of a 1-year intervention promoting a low fat diet in adolescent girls- a mediation analysis

A3- Changing the tide- an Internet or video exercise and low-fat diet intervention with middle-school students

A4- Computer-Mediated Intervention Tailored on Transtheoretical Model Stages and Processes of Change Increases Fruit and Vegetable Consumption Among Urban African-American Adolescents/ Mediating Variables in a Transtheoretical Model Dietary Intervention Program

A5- The effectiveness of a stage-based lifestyle modification intervention for obese children

A6- Intervention Based Exclusively on Stage-Matched Printed Educational Materials Regarding Healthy Eating Does Not Result in Changes to Adolescents Dietary Behavior

A7- Stage-based interventions for low-fat diet with middle school students

A8 - Impact of a web-based intervention supplemented with text messages to improve cancer prevention behaviors among adolescents - results from a randomized controlled trial

A9- Intervention Effects on Stage of Change Membership and Transitions among Adolescent Energy Balance Behaviors/ Multiple behavior interventions to prevent substance abuse and increase energy balance behaviors in middle school students

A10- The effect of education on reducing fast food consumption in obese iranian female adolescents - An application of the transtheoretical model and the theory of planned behavior