UNIVERSIDADE FEDERAL DE UBERLÂNDIA
FACULDADE DE MEDICINA
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS DA SAÚDE

ASSOCIAÇÃO ENTRE CONSUMO ALIMENTAR E PERPETRAÇÃO DE *BULLYING* ENTRE ADOLESCENTES BRASILEIROS

LETÍCIA MARTINS OKADA

UBERLÂNDIA, MG
2023

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Tese apresentada ao Programa de Pós-Graduação em Ciências da Saúde da Faculdade de Medicina da Universidade Federal de Uberlândia, como requisito parcial para a obtenção do título de Doutora em Ciências da Saúde.

Área de concentração: Ciências da Saúde.

Orientadora: Profa. Dra. Catarina Machado Azeredo.

UBERLÂNDIA, MG

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ATA DE DEFESA - PÓS-GRADUAÇÃO

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Data:	19.04.2023	Hora de início:	08:00h	Hora de encerramento:	10:30h
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Nome do Discente:	Letícia Martins Okada				
Título do Trabalho:	Associação entre consumo alimentar e perpetração de *bullying* entre adolescentes brasileiros				
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Iniciando os trabalhos, a presidente da mesa, Profa. Dra. Catarina Machado Azeredo, apresentou a Comissão Examinadora e a candidata, agradeceu a presença do público, e concedeu a Discente a palavra para a exposição do seu trabalho. A duração da apresentação da Discente e o tempo de arguição e resposta foram conforme as normas do Programa.

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FOLHA DE APROVAÇÃO

Letícia Martins Okada.

Associação entre consumo alimentar e perpetração de *bullying* entre adolescentes brasileiros.

Presidente da banca (orientador): Profa. Dra. Catarina Machado Azeredo.

Tese apresentada ao Programa de Pós-Graduação em Ciências da Saúde da Faculdade de Medicina da Universidade Federal de Uberlândia, como requisito parcial para a obtenção do título de Doutora em Ciências da Saúde.

Área de concentração: Ciências da Saúde.

Banca examinadora

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DEDICATÓRIA

À minha avó Sebastiana (in memorian), meu maior exemplo de força e resiliência, que sempre acreditou no meu potencial e me incentivou a seguir em frente.

Te amo, além desta vida!

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“ Ama a liberdade na disciplina de si mesmo.”

André Luiz, por Chico Xavier.

RESUMO

Introdução: Estudos anteriores avaliaram a associação entre o consumo alimentar e a perpetração de *bullying*, mas a maioria deles não avaliou padrões alimentares, nem especificou diferentes formas de *bullying*. Além disso, o papel dos comportamentos desviantes como um possível mediador dessa associação ainda não está claro. **Objetivos**: Avaliar a associação entre padrões alimentares com papeis no *bullying* e seus diferentes tipos de perpetração (Artigo 1), bem como avaliar o efeito mediador de comportamentos desviantes na associação entre o padrão alimentar ultraprocessado e perpetração de *bullying*, em adolescentes brasileiros (Artigo 2). **Métodos:** Foram utilizados dados originários do Projeto São Paulo para o desenvolvimento social de crianças e adolescentes (SP-PROSO), referentes a uma amostra representativa de estudantes do 9º ano do ensino fundamental, de escolas públicas e privadas do município de São Paulo (n=2.680). Por meio de análise fatorial exploratória e considerando a frequência de consumo de vários alimentos na semana anterior à pesquisa, foram obtidos os padrões alimentares saudável e não saudável (Artigo 1) e o padrão alimentar ultraprocessado (Artigo 2), considerados como exposições. Os desfechos foram os papeis no *bullying* (apenas vítima, apenas agressor, agressor-vítima) e perpetração de *bullying* (qualquer tipo, exclusão social, agressão psicológica/verbal, agressão física, destruição de propriedade, assédio sexual). Os comportamentos desviantes (mediador) foram avaliados por meio de um escore. Modelos de regressão multinomial e logística foram realizados para a amostra total e estratificados por sexo (somente para associação com assédio sexual), ajustado por covariáveis (Artigo 1). As análises de mediação foram realizadas por meio de regressão logística utilizando o método KHB (Artigo 2). **Resultados:** Adolescentes que tinham um padrão alimentar saudável eram menos propensos a serem agressores (RR: 0,67 IC95%=0,49-0,92), enquanto adolescentes com um padrão alimentar não saudável eram mais propensos a serem agressores-vítimas (RR: 1,29 IC95%=1,12-1,48). O padrão alimentar não saudável foi associado a qualquer tipo de perpetração de *bullying* (OR: 1,24 IC95%=1,12-1,38), principalmente com assédio sexual (OR: 1,71 IC95%=1,13-2,60) e agressão física (OR: 1,52 IC95%=1,18-1,95). Meninos com um padrão alimentar não saudável eram mais propensos a assediar sexualmente outro adolescente (OR: 2,10 IC95%=1,20-3,66). O efeito mediador dos comportamentos desviantes foi encontrado na associação do padrão alimentar ultraprocessado com todos os tipos de perpetração, com maior percentual de mediação para agressão psicológica/verbal (40,1%). Observou-se um pequeno efeito mediador positivo dos comportamentos desviantes na associação do padrão alimentar ultraprocessado com agressão física (18,3%) e destruição de propriedade (18,2%), o que significa que essas associações possuem outros mediadores, além dos comportamentos desviantes (efeito direto significativo). **Conclusões:** Adolescentes que tinham um padrão alimentar saudável eram menos propensos a perpetrar o *bullying*. O padrão alimentar não saudável foi associado à perpetração de *bullying*, especialmente o assédio sexual pelos meninos. A associação entre o padrão alimentar ultraprocessado e a perpetração de *bullying* pode ocorrer por meio de comportamentos desviantes. Para agressão física e destruição de propriedade, os comportamentos desviantes tiveram um efeito positivo no *bullying*, mas esse efeito explicou apenas uma pequena parcela do efeito total dessa associação.

Palavras-chave: Alimentos ultraprocessados; Padrões alimentares; *Bullying*; Comportamento desviante; Adolescentes.

ABSTRACT

Introduction: Previous studies have assessed the association between food consumption and bullying perpetration, but most of them have not assessed dietary patterns or specified different forms of bullying. Furthermore, the role of deviant behaviors as a possible mediator of this association is still unclear. **Objectives:** To evaluate the association between dietary patterns with bullying roles and its different types of perpetration (Article 1), as well as to evaluate the mediating effect of deviant behaviors in the association between the ultra-processed dietary pattern and bullying perpetration, in Brazilian adolescents (Article 2). **Methods:** Data from the Sao Paulo Project for the social development of children and adolescents (SP-PROSO) were used, referring to a representative sample of 9th grade students of middle school, from public and private schools in Sao Paulo (n=2.680). Through exploratory factor analysis and considering the frequency of consumption in the last week to the survey of several food, healthy and unhealthy dietary patterns (Article 1) and the ultra-processed dietary pattern (Article 2) were obtained, considered as exposures. Outcomes were bullying role (victim-only, bully-only, bully-victim) and bullying perpetration (any type, social exclusion, psychological/verbal aggression, physical aggression, property destruction, sexual harassment). Deviant behaviors (mediator) were assessed through a score. Multinomial and logistic regression models were performed for the total sample and stratified by sex (only for association with sexual harassment), adjusting for covariates (Article 1). Mediation analyzes were performed through logistic regression using the KHB method (Article 2). **Results:** Adolescents who had a healthy dietary pattern were less likely to be bullies (RR: 0.67 95%CI=0.49-0.92), while adolescents with an unhealthy dietary pattern were more likely to be bully-victims (RR: 1.29 95%CI=1.12-1.48). The unhealthy dietary pattern was associated with any type of bullying (OR: 1.24 95%CI=1.12-1.38), mainly with sexual harassment (OR: 1.71 95%CI=1.13-2.60) and physical aggression (OR: 1.52 95%CI=1.18-1.95). Boys with an unhealthy dietary pattern were more likely to sexually harass another adolescent (OR: 2.10 95%CI=1.20-3.66). The mediating effect of deviant behaviors was found in the association of the ultra-processed dietary pattern with all types of perpetration, with a high mediation percentage for psychological/verbal aggression (40.1%). A small positive mediating effect of deviant behaviors was observed in the association of ultra-processed dietary pattern with physical aggression (18.3%) and property destruction (18.2%), which means that these associations have other mediators, in addition to deviant behaviors (significant direct effect). **Conclusions:** Adolescents who had a healthy dietary pattern were less likely to perpetrate bullying. The unhealthy dietary pattern was associated with bullying perpetration, especially with sexual harassment by boys. The association between the ultra-processed dietary pattern and bullying perpetration may occur via deviant behaviors. For physical aggression and property destruction, the deviant behaviors had a positive effect on bullying, but this effect explained only a small portion of the total effect of such association.

Keywords: Ultra-processed food; Dietary patterns; Bullying; Deviant behavior; Adolescents.

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ARTIGO 1

ARTIGO 2

LISTA DE ABREVIATURAS E SÍMBOLOS

BMI	*Body Mass Index*
Capes	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior
CI	*Confidence intervals*
CONEP	Comissão Nacional de Ética em Pesquisa
DAG	*Directed Acyclic Graph*
FAPESP	Fundação de Amparo à Pesquisa do Estado de São Paulo
FBSP	Fórum Brasileiro de Segurança Pública
IBGE	Instituto Brasileiro de Geografia e Estatística
IC	Intervalo de confiança
KHB	Karlson-Holm-Breen
KMO	Kaiser-Meyer-Olkin
M-PROSO	*Montevideo Project for the Social Development of Children and Adolescents*
OMS	Organização Mundial da Saúde
OR	*Odds Ratios*
PeNSE	Pesquisa Nacional de Saúde do Escolar (*Brazilian National School-Based Health Survey*)
PNAE	Programa Nacional de Alimentação Escolar (*National School Food Program*)
POF	Pesquisa de Orçamento Familiar
PSE	Programa Saúde na Escola
RR	*Relative Risk*
SP-PROSO	Projeto São Paulo para o desenvolvimento social de crianças e adolescentes (*Sao Paulo Project for the social development of children and adolescents*)
TNF-α	*Tumor Necrosis Factor - Alpha*
UNICEF	Fundo das Nações Unidas para a Infância (*United Nations Children's Fund*)
USP	Universidade de São Paulo
Z-PROSO	*Zurich Project on the Social Development of Children*

SUMÁRIO

1 INTRODUÇÃO

O período de transição da infância para a vida adulta é tido por adolescência, caracterizada por importantes transformações biológicas, cognitivas, emocionais e sociais. Essa fase ainda é marcada por crescente autonomia, independência da família e pela adoção de novos hábitos e alguns comportamentos de risco à saúde, como tabagismo, consumo de álcool, alimentação inadequada, sedentarismo, delinquência e *bullying* (IBGE, 2016; CAMPOS; SCHALL; NOGUEIRA, 2013).

O comprometimento da saúde física e mental dos adolescentes devido ao maior envolvimento em comportamentos de risco (FEIJÓ; OLIVEIRA, 2001) pode ser influenciado não somente por fatores individuais (sexo, idade, aspectos psicológicos), mas também por fatores ambientais, que estão relacionados ao ambiente/grupo em que os jovens vivem e se relacionam, como por exemplo, o grupo de amigos da escola ou do bairro (WANG et al., 2010). Geralmente, é no ambiente escolar onde há maior convivência com os pares em detrimento da família, e consequentemente, maior probabilidade de engajamento em comportamentos violentos, incluindo a prática do *bullying* e de atos desviantes, como mentir, "colar" na prova, "matar" aula, brigar e roubar (PERES et al., 2018b).

Nesse sentido, pesquisas apontam a escola como um espaço privilegiado, capaz de identificar e combater esses comportamentos, através da produção de informação e do desenvolvimento de ações de promoção e prevenção à saúde do público jovem, construindo um ambiente de aprendizagem mais acolhedor, pacífico e seguro (WHO, 2014; UNESCO, 2019; WHO, 2021). Mais recentemente, a literatura tambkém tem destacado a alimentação não-saudável como um possível fator de risco para comportamentos desviantes (BESELER, 1999; GESCH et al., 2002; BENTON, 2007; ODDY et al., 2009) e perpetração de *bullying* (BRUCKAUF; WALSH, 2018; HOLUBCIKOVA etk al., 2015; JACKSON, 2017; JACKSON; VAUGHN; SALAS-WRIGHT, 2017; ZAHEDI et al., 2014) entre adolescentes, pois a deficiência de vitaminas e minerais causada pelo alto consumo de alimentos ultraprocessados pode prejudicar a metabolização e ação de alguns neurotransmissores (exemplos: dopamina e serotonina), necessários durante a regulação e modulação do comportamento (BUTTERWORTH, 1982; SHARMA, 2009; WITT, 1985). Diante disso, a escola também consegue beneficiar a saúde mental dos adolescentes ainda que indiretamente, ao promover e incentivar o consumo de uma alimentação escolar mais saudável, reduzindo assim, os comportamentos violentos entre os estudantes (BEZERRA, 2018; BRASIL, 2020; WHO, 2021).

Portanto, diante da relevância desse contexto e apesar de alguns estudos já terem avaliado a associação entre o consumo alimentar e a perpetração de *bullying* (BRUCKAUF; WALSH, 2018; HOLUBCIKOVA et al., 2015; JACKSON, 2017; JACKSON; VAUGHN; SALAS-WRIGHT, 2017; ZAHEDI et al., 2014), nenhum enfatizou a alimentação por meio de padrões alimentares, que melhor representam os hábitos alimentares na adolescência, nem examinou essa associação considerando os diferentes tipos de *bullying*. Também é importante analisar possíveis mediadores (exemplo: comportamentos desviantes) dessa associação, para melhor entendimento dos seus mecanismos e planejamento adequado de estratégias de prevenção do *bullying*.

2 FUNDAMENTAÇÃO TEÓRICA

2.1 Violência e *bullying*: conceitos e dados epidemiológicos

A violência, sob uma perspectiva ecológica, é compreendida como resultado da interação complexa e dinâmica de fatores individuais (sexo, idade, raça/cor, etc.), relacionais (conflitos parentais e entre pares), comunitários (violência/desordem na escola e no seu entorno) e sociais (normas culturais que apoiam a violência). De acordo com a Organização Mundial de Saúde (OMS), ela pode ser definida como "o uso intencional de força física ou poder, ameaçado ou real, contra outra pessoa ou contra um grupo ou comunidade, que resulta ou tem uma alta probabilidade de resultar em morte por lesão, dano psicológico, mau desenvolvimento ou privação." (ORGANIZAÇÃO MUNDIAL DA SAÚDE, 1996).

Além dessa definição, a violência pode ser dividida em três categorias: a) **violência autodirigida**, que envolve pensamentos suicidas, tentativas de suicídio e suicídios consumados, bem como automutilação; b) **violência coletiva**, que é cometida por grupos maiores de pessoas ou por estados, devido a causas sociais, políticas ou econômicas (crimes de ódio feitos por grupos organizados, atos terroristas, guerras); e c) **violência interpessoal**, que é praticada entre indivíduos e pode ocorrer dentro do ambiente doméstico (violência familiar e entre parceiros íntimos) e na comunidade, entre pessoas que se conhecem ou não (violência juvenil: *bullying*, agressões físicas com ou sem armas e violência praticada por gangues) (KRUG et al., 2002).

Baseado na Lei nº 13.431/2017 (BRASIL, 2017), existem ainda cinco diferentes tipos de violência contra crianças e adolescentes: a) **violência física**, entendida como a ação que agride sua integridade ou saúde corporal ou que lhe cause sofrimento físico; b) **violência psicológica**, com prejuízos no seu desenvolvimento mental e emocional (discriminação, ameaças, constrangimentos, isolamento, etc.); c) **violência sexual**, que obrigue à prática ou ao

testemunho do ato sexual, presencial ou virtualmente; d) **violência institucional**, tida pela ação praticada por qualquer instituição pública que prejudique a vítima ou testemunha de violência; e e) **violência patrimonial**, caractekrizada pela retenção ou destruição parcial ou total de documentos pessoais, bens e recursos.

Mundialmente, estima-se que uma em cada duas crianças de 2 a 17 anos sofra algum tipo de violência a cada ano (HILLIS et al., 2016). No Brasil, milhares de meninos e meninas são atingidos cotidianamente pela violência, o que compromete sua qualidade de vida e seu desenvolvimento. Dados do estudo "O Panorama da Violência Letal e Sexual contra Crianças e Adolescentes no Brasil", lançado no ano de 2021 pelo Fundo das Nações Unidas para a Infância (UNICEF) e pelo Fórum Brasileiro de Segurança Pública (FBSP), mostram que cerca de 35 mil crianças e adolescentes foram mortos de forma violenta no país, de 2016 a 2020; entre essas mortes, a maioria das vítimas estava na faixa etária entre 15 e 19 anos (UNICEF; FBSP, 2021).

Especificamente em decorrência da violência interpessoal, as mortes representam apenas uma fração de toda a carga social e de saúde que é desencadeada (WHO, 2014), considerando que a maior parte dos casos pode não ser denunciada (WHO, 2015), como atos de *bullying* e brigas físicas. Quando não leva ao óbito, a violência pode acarretar à saúde dos adolescentes várias consequências negativas, como tabagismo, abuso de álcool e drogas, comportamentos sexuais de risco, depressão e ansiedade, transtornos de estresse pós-traumático, baixo desempenho acadêmico e perpetuação intergeracional do ciclo de violência, ou seja, a violência juvenil aumenta a probabilidade de envolvimento em outras formas de violência ao longo do tempo, tanto no papel de vítimas como de perpetradores (WHO, 2016). Por exemplo, um estudo no Brasil encontrou que o envolvimento anterior em violência física, vitimização por violência verbal de colegas da escola e por violência doméstica foram associados ao envolvimento em brigas com armas entre jovens escolares (PERES et al., 2018a).

Entre adolescentes, o *bullying* é considerado como um subconjunto do comportamento agressivo e pode ser identificado através de três características específicas: intencionalidade, repetitividade e desequilíbrio real ou percebido de poder (OLWEUS, 2013), ou seja, existe um padrão de comportamento agressivo, intencional e recorrente contra a vítima, que se sente vulnerável e incapaz de se defender (OLWEUS, 1993). Ele pode se apresentar de forma evidente (bater, empurrar, ofender, fazer provocações, etc.) ou encoberta (espalhar boatos, isolar do grupo) (CRAIG et al., 2009), podendo ser dos tipos direto e físico (agressões físicas e práticas de intimidação), direto e verbal (apelidar, fazer comentários racistas, "tirar sarro") ou indireto (exclusão social) (MARTINS, 2005).

Em situações de *bullying*, os adolescentes assumem uma variedade de papéis, incluindo não-envolvidos, apenas agressores, apenas vítimas ou agressores-vítima (ou seja, aqueles que são ambos agressores e vítimas) (GOLDBACH; STERZING; STUART, 2018), sendo que cada papel apresenta diferentes características comportamentais e psicossociais. Adolescentes apenas agressores geralmente são impulsivos, sem autocontrole (BJÖRKQVIST; EKMAN; LAGERSPETZ, 1982) e relatam maior adoção de comportamentos externalizantes (por exemplo: uso de álcool) (STEIN; DUKES; WARREN, 2007). Já os adolescentes apenas vítimas relatam mais sintomas de ansiedade e depressão, insegurança, solidão e relações ruins com seus pares (JUVONEN; GRAHAM; SCHUSTER, 2003; BOND et al., 2001). Os agressores-vítima podem apresentar uma impulsividade agressiva (O'BRENNAN; BRADSHAW; SAWYER, 2009), maior probabilidade de se envolver no uso de substâncias (KALTIALA-HEINO et al., 2000) e pior ajuste social (KELLY et al., 2015).

Também existem diferenças de gênero no tipo de envolvimento no *bullying*. A literatura sugere que os meninos são mais propensos a serem agressores e agressores-vítima nos tipos de violência física e verbal; enquanto que as meninas estão mais envolvidas como vítimas de violência psicológica e exclusão social (JUVONEN; GRAHAM; SCHUSTER, 2003; GOLDBACH; STERZING; STUART, 2018; UNICEF, 2014).

Estudos internacionais e nacionais sugerem que um número significativo de adolescentes esteja envolvido em comportamentos de *bullying*. Dados recentes de 33 países que implementaram a Pesquisa Global de Saúde de Escolares (*Global School-based Student Health Survey*) entre 2003 e 2018 indicaram que um em cada quatro estudantes (26%) nas Américas relatou ter sofrido *bullying* pelo menos uma vez nos últimos 30 dias, apresentando diferentes taxas entre os países, com variação de 13% em Barbados a 47% no Peru (PROBST et al., [202-]; PAHO, 2020). Um estudo realizado com adolescentes de 40 países mostrou uma prevalência de 12,6% para vitimização e de 10,7% para perpetração, sendo as agressões físicas e verbais as mais relatadas (CRAIG et al., 2009). No Brasil, os resultados da PeNSE 2019 (Pesquisa Nacional de Saúde do Escolar) indicaram que 23% dos adolescentes afirmaram ter sofrido *bullying* duas vezes ou mais, nos 30 dias anteriores à pesquisa, sendo essa vitimização mais prevalente no sexo feminino (26,5% *vs*. 19,5%: sexo masculino), entre os estudantes de 13 a 15 anos (sexo feminino: 27,7% *vs*. 24,2% de 16 e 17 anos; sexo masculino: 20,4% *vs*. 17,8% de 16 e 17 anos) e na região Centro-Oeste (25,5% *vs*. 18,8%: região Norte). Não houve diferença na proporção de vítimas em escolas públicas (23%) e privadas (22,9%). Ter sofrido *bullying* devido a aparência do corpo (16,5%) e do rosto (11,6%) foram os motivos mais relatados pelos estudantes (IBGE, 2021).

Além da vítima, a violência também deve ser avaliada do ponto de vista do agressor, uma vez que a perpetração de *bullying* pode levar a consequências socioemocionais negativas. Uma meta-análise de estudos longitudinais, realizada em 2011, relatou prejuízos à saúde mental e psicológica daqueles que praticam o *bullying*, tornando-os mais propensos a ter depressão futuramente (TTOF et al., 2011). Perpetradores que também são vítimas de *bullying* apresentam baixos níveis de funcionalidade, incluindo depressão e outros problemas de saúde, comparado a quem é apenas vítima ou agressor (VEENSTRA et al., 2005). Ainda de acordo com a PeNSE 2019, 12% dos adolescentes brasileiros de 13 a 17 anos relataram ter praticado *bullying* contra seus pares, sendo esse percentual maior entre os meninos (14,6% *vs*. 9,5%: meninas) e entre os estudantes de escolas privadas (13,5% *vs*. 11,8%: escolas públicas) (IBGE, 2021).

2.2 Consumo alimentar na adolescência: padrões alimentares

Nas últimas décadas, diferentes regiões e países do mundo têm passado por um notável processo de transição nutricional, incluindo o Brasil. Esse processo é caracterizado por aceleradas mudanças demográficas, sociais e econômicas, que impactam no perfil nutricional e na saúde dos indivíduos (OLIVEIRA, 2004), com destaque para a transição da alimentação tradicional (rica em fibras e com baixo teor de lipídios) para uma dieta com maior consumo de alimentos processados, ultraprocessados e refeições fora de casa (POPKIN, 1993, 2015). Concomitante às alterações no padrão alimentar, também há mudanças no nível de atividade física, na composição corporal e no desenvolvimento de doenças relacionadas à nutrição, como *diabetes mellitus* tipo 2 e obesidade (POPKIN, 2002).

Essas mudanças no padrão alimentar são muito evidentes entre os adolescentes, que têm substituído gradativamente o consumo de alimentos *in natura* ou minimamente processados pelo consumo de alimentos ultraprocessados (LOUZADA et al., 2015a, 2018). De acordo com a classificação NOVA (MONTEIRO et al., 2017), que embasou as recomendações e orientações do Guia Alimentar para a População Brasileira (BRASIL, 2014) e classifica os alimentos de acordo com a natureza, extensão e finalidade do processamento industrial a que são submetidos, alimentos ultraprocessados são formulações resultantes de uma série de processos industriais, feitas principalmente ou inteiramente de substâncias derivadas de alimentos (açúcares, óleos, gorduras, sal, lactose, glúten, etc.) e aditivos destinados a torná-las mais palatáveis e atraentes (conservantes, antioxidantes, estabilizantes, corantes, realçadores de sabor, etc.), com pouco ou nenhum alimento intacto na sua composição. Em países de média renda, como o Brasil, pesquisas indicam uma acentuada tendência geral de aumento do

consumo desses alimentos (MARTINS et al., 2013; CROVETTO; UAUY, 2012, MONTEIRO et al., 2013).

Pesquisas de Orçamento Familiar (POF) realizadas no Canadá (MOUBARAC et al., 2014), Chile (CROVETTO; UAUY, 2012) e Suécia (JUUL; HEMMINGSSON, 2015) mostram um considerável aumento na compra de alimentos ultraprocessados e redução na compra de alimentos *in natura*. No Brasil, as POF também indicam essa tendência, com mudanças significativas no total de calorias determinado pela aquisição domiciliar de alimentos, no período entre 2002/2003 e 2017/2018, sendo que a participação calórica dos alimentos *in natura* ou minimamente processados reduziu (de 53,3% para 49,5%) e a participação dos alimentos ultraprocessados aumentou (de 12,6% para 18,4%) (IBGE, 2020b). Entre os adolescentes, a participação dos alimentos ultraprocessados representou 26,7% do total de calorias determinado pelo consumo alimentar pessoal (IBGE, 2020a).

Estudos também mostram que a maior autonomia adquirida pelos adolescentes em relação à influência dos pais é um fator de risco para suas escolhas alimentares, que passam a ser preferencialmente por alimentos não saudáveis (NEUMARK-SZTAINER et al., 1999; VIDEON; MANNING, 2003; FITZGERALD *et al*., 2010). Nesse público, entre as maiores tendências de consumo estão as refeições feitas fora de casa (MEHTA; CHANG, 2008), os salgadinhos de pacote (KERR et al., 2009; JAHNS; SIEGA-RIZ; POPKIN, 2001), *fast foods* (FRENCH et al., 2001) e refrigerantes (NIELSEN; POPKIN, 2004; FRENCH; LIN; GUTHRIECH, 2003). Um estudo de base populacional realizado em São Paulo (Brasil) mostrou uma piora na qualidade alimentar dos adolescentes (12-19 anos) ao longo de cinco anos, com a diminuição do consumo de legumes e hortaliças alaranjados e verde-escuros, grãos totais e azeite; e maior consumo de alimentos ricos em gorduras totais, saturadas e *trans*, alimentos com açúcar de adição, e álcool. Além disso, comparado aos adultos e idosos, os jovens tiveram os piores resultados relacionados a qualidade da dieta (ANDRADE et al., 2016).

A PeNSE 2019 avaliou ingestão de alimentos marcadores de alimentação saudável e não saudável por meio da frequência de consumo em cinco dias ou mais (consumo regular), na semana anterior à entrevista. Entre os escolares de 13 a 17 anos, 59% consumiram feijão, 28,8% consumiram legumes e verduras e 26,9% consumiram frutas frescas, regularmente. Já com relação a ingestão de guloseimas e refrigerantes, o consumo regular atingiu 32,8% e 17,2%, respectivamente. A pesquisa também avaliou o consumo de 13 alimentos ultraprocessados, com estimativas de que 97,3% dos estudantes brasileiros de 13 a 17 anos consumiram pelo menos um alimento ultraprocessado no dia anterior à pesquisa. Os maiores percentuais de adolescentes com consumo de alimentos ultraprocessados foram encontrados para biscoitos salgados

(49,3%) e biscoitos doces (46,8%), e os menores, para refeições prontas congeladas (20,8%) e iogurte com sabor (16,4%) (IBGE, 2021).

Na literatura, muitos estudos avaliam os efeitos do consumo de ultraprocessados com foco na análise de nutrientes ou alimentos isolados (um de cada vez) (LOUZADA et al., 2015b; SOLNICK; HEMENWAY, 2011; STEELE et al., 2016; BRUCKAUF; WALSH, 2018; HOLUBCIKOVA et al., 2015; PENGPID; PELTZER, 2019; ZAHEDI et al., 2014). No entanto, essa análise individual não fornece uma abordagem abrangente dos hábitos alimentares do adolescente, considerando que diferentes alimentos são consumidos em combinação, cujos efeitos podem ser observados somente quando se considera o padrão alimentar como um todo. A análise fatorial é um método que tem sido muito utilizado na literatura epidemiológica nutricional (NEWBY; TUCKER, 2004) e que permite uma avaliação da alimentação por meio do padrão alimentar (KHANI et al., 2004), pois ela reduz e/ou agrupa diferentes itens alimentares em padrões, com base nas intercorrelações que existem entre eles (por exemplo, composição nutricional semelhante) (HU, 2002; KANT, 2004). Sendo a alimentação um fator modificável, sua investigação tem implicações relevantes para a saúde pública e deve ser realizada de forma mais ampla, entendendo que os adolescentes consomem refeições que contêm muitos alimentos e nutrientes (LOUZADA et al., 2015a; SILVA; DO CARMO; CARVALHO, 2021).

2.3 Comportamentos de *bullying*: fatores de risco e sua associação com o consumo alimentar

Na adolescência, os comportamentos de *bullying* podem ser determinados por vários fatores, como situações de tensão na escola (tensão induzida pelo professor, baixa segurança escolar) (GLEW et al., 2005; MOON; HWANG; MCCLUSKEY, 2011), baixo autocontrole (MOON; ALARID, 2015), uso de substâncias (ZYCH et al., 2020), conflitos e falta de supervisão parental (MOON; MORASH; MCCLUSKEY, 2012; HEMPHILL; HEERDE, 2014), violência familiar e/ou punição corporal (ESPELAGE et al., 2013; FUJIKAWA et al., 2015), vitimização de pares (MOON; MORASH; MCCLUSKEY, 2012) e obesidade (JANSSEN et al., 2004). A alimentação não saudável, apesar de já ser considerada em vários estudos como um possível fator de risco para comportamentos problemáticos (agressividade, impulsividade, hiperatividade, delinquência, etc.) (BANTA et al., 2013; JACKSON, 2016; ODDY et al., 2009; ØVERBY; HØIGAARD, 2012) e transtornos mentais comuns (ansiedade, depressão) (MESAS et al., 2022; SILVA; DO CARMO; CARVALHO, 2021; SOUSA et al., 2020; TRAPP et al., 2016), ainda tem ganhado destaque na literatura mais recente, com poucos

estudos investigando sua associação especificamente com a perpetração de *bullying* (BRUCKAUF; WALSH, 2018; HOLUBCIKOVA et al., 2015k; JACKSON, 2017; ZAHEDI et al., 2014).

Esses estudos encontraram resultados semelhantes, avaliando o consumo de diferentes alimentos. Em 2014, Zahedi e colkaboradores (ZAHEDI et al., 2014) encontraram que adolescentes com consumo diário de bebidas açucaradas, *fast foods* e salgadinhos tinham maior probabilidade de perpetrar o *bullying*. Outro estudo (HOLUBCIKOVA et al., 2015) encontrou associação entre o consumo diário de refrigerantes e o envolvimento dos adolescentes na perpetração do *bullying*, sendo essa associação parcialmente mediada por nervosismo e irritabilidade. Ademais, adolescentes de países da América do Norte e Europa que tinham uma alimentação de baixa qualidade (baixo consumo de frutas e vegetais, alto consumo de doces e refrigerantes) apresentaram maior probabilidade de perpetrar esse tipo de violência (JACKSON, 2017), assim como adolescentes de 26 países industrializados, que tinham um alto consumo de açúcar (doces, chocolates e refrigerantes) (BRUCKAUF; WALSH, 2018).

Na literatura, a associação entre alimentação não saudável e perpetração de *bullying* pode ser elucidada por dois mecanismos principais. Frequentemente, a alimentação dos adolescentes é composta por alimentos ultraprocessados (LOUZADA et al., 2015a, 2017) ricos em frutose, corantes e conservantes (STITT, 1999). Esse tipo de alimentação faz com que o cérebro careça de nutrientes essenciais, como vitaminas, Ômega-3 e minerais, o que pode levar a desequilíbrios químicos, alterações das funções neurais e na comunicação entre neurotransmissores (serotonina e dopamina) (BUTTERWORTH, 1982; GESCH et al., 2002; SHARMA, 2009; WITT, 1985), que podem estar associados ao aumento de comportamentos delinquentes/desviantes e problemas de conduta (mentira, roubo, mudanças repentinas de humor, acessos de raiva), consequentemente relacionados a perpetração de *bullying* (BENTON, 2007; HIBBELN et al., 1998; ODDY et al., 2009). Geralmente, uma alimentação não saudável também é muito rica em gorduras saturadas, como por exemplo, o ácido palmítico, considerado como um dos componentes do óleo de palma. Esse óleo tem sido muito utilizado durante os processos industriais de formulação dos alimentos ultraprocessados, substituindo o uso de gordura *trans* na sua composição (IZAR et al., 2021). Um estudo anterior concluiu que uma dieta rica ácido palmítico pode aumentar a secreção de TNF-ά no organismo (COLL et al., 2008; SUAREZ; LEWIS; KUHN, 2002) e desencadear um processo inflamatório central (CINTRA et al., 2012), levando a maior raiva e hostilidade (KIEN et al., 2013) e, consequentemente, a perpetração de *bullying*.

A ideia é que quanto maior o consumo de alimentos não saudáveis (ultraprocessados), menor será a disponibilidade de nutrientes e substâncias químicas necessárias para nutrir o cérebro, levando assim a mais violência (DU, 2019). Há evidências, por exemplo, de que adolescentes que fazem escolhas alimentares inadequadas podem apresentar deficiência marginal de tiamina (vitamina B1), aumentando assim sua irritação, impulsividade e agressividade (LONSDALE; SHAMBERGER, 1980) devido à alteração das neurofunções cerebrais e de vários neurotransmissores do sistema nervoso central, provocada por essa deficiência (BUTTERWORTH, 1982; SHARMA, 2009; WITT, 1985). Ainda entre adolescentes, a deficiência de ferro também pode ser prejudicial à função cerebral e levar ao comportamento agressivo (WEBB; OSKI, 1974), sendo esse mineral um cofator necessário para a metabolização e neurotransmissão da dopamina, serotonina e norepinefrina (YOUDIM; BEN-SHACHAR; YEHUDA, 1989; WERBACH, 1992), essenciais para a modulação do comportamento. Por fim, estudos sugerem que a quantidade de triptofano na alimentação (aminoácido essencial, precursor da serotonina) também é importante para a regulação do comportamento agressivo (GIAMMANCO et al., 1990; WERBACH, 1992).

O segundo mecanismo da associação entre alimentação não saudável e perpetração de *bullying* propõe que o consumo diário de refrigerantes (que contém aspartame) pode desencadear nervosismo e irritabilidade (HOLUBCIKOVA et al., 2015) devido a altas flutuações nos níveis de glicose sanguínea (TANDEL, 2011) causadas pelo déficit funcional nos neurônios serotoninérgicos no sistema nervoso central (KANAREK, 1994), o que pode levar a comportamento desviante e perpetração de *bullying* (BENTON, 2007).

2.4 Comportamentos desviantes e seu papel mediador na associação entre alimentação não saudável e perpetração de *bullying*

Comportamentos desviantes podem ser definidos como atos deliquentes de violação das normas sociais ou até mesmo da lei vigente, sendo muitos deles considerados como problemas de conduta (MURRAY; FARRINGTON, 2010). Comportamentos que vão desde mentir, fugir e brigar até roubar, vender drogas e andar armado são tidos como desviantes, e entre adolescentes, eles estão fortemente relacionados com os comportamentos de *bullying* (HENGGELER; SHEIDOW, 2012; LOEBER et al., 1993). Recentemente, um estudo realizado com adolescentes da Coorte de Nascimentos de Pelotas - 2004 identificou que 25,6% relataram ter comportamentos desviantes (exemplos: roubo, venda de drogas ilegais/objetos roubados, invasão de propriedades particulares, porte de armas, envolvimento em brigas físicas, etc.) aos

15 anos de idade, sendo mais prevalentes no sexo masculino (31,1%) do que no sexo feminino (19,8%) (BOZZINI et al., 2023).

Estudos mostram que esses atos podem ser cometidos precocemente por futuros perpetradores (GONZALVO, 2002), já que adolescentes com problemas de conduta são mais propensos à prática do *bullying* (FANTI; KIMONIS, 2012; HANISH; GUERRA, 2002; VIDING et al., 2009) por tolerarem e normalizarem esse tipo de violência como um modelo de comportamento aceitável e útil para resolver conflitos (BANDURA, 1978).

O maior envolvimento em comportamentos de *bullying* por adolescentes com comportamentos desviantes (KUMPULAINEN; RÄSÄNEN; PUURA, 2001; SALMON et al., 2000; WOLKE et al., 2000) está relacionado a déficits no funcionamento adequado das regiões frontais do cérebro, dificultando a tomada de decisão, planejamento, aprendizado e desenvolvimento de comportamentos sociais, bem como a inibição de comportamentos inadequados, como agressividade e impulsividade (GRIGSBY; STEVENS, 2000). Como apresentado anteriormente, uma alimentação rica em alimentos ultraprocessados provoca deficiências nutricionais (ainda que pequenas) que também podem causar prejuízos ao sistema nervoso central, devido às alterações na metabolização e ação dos neurotransmissores responsáveis pela regulação do comportamento desses jovens (BUTTERWORTH, 1982; SHARMA, 2009; WITT, 1985), levando ao aumento de atos desviantes e perpetração de *bullying* (BENTON, 2007; ODDY et al., 2009). Nesse sentido, considerando os comportamentos desviantes como uma possível consequência de uma alimentação não saudável (BESELER, 1999; GESCH et al., 2002; BENTON, 2007; ODDY et al., 2009) e que provavelmente são adotados anteriormente à prática de *bullying* (GONZALVO, 2002; VIDING et al., 2009), é de grande relevância investigar seu papel como possível mediador da associação entre consumo alimentar e comportamentos de *bullying*.

Um estudo publicado em 2017 (JACKSON; VAUGHN; SALAS-WRIGHT, 2017) avaliou a associação entre o consumo de alimentos não saudáveis (*junk food*) e a prática de *bullying* por escolares americanos, sendo a amostra estratificada em dois grupos: adolescentes envolvidos em comportamentos desviantes (e com colegas desviantes) e adolescentes não envolvidos em nenhum comportamento. Nesses últimos, a prática do *bullying* foi mais fortemente associada ao alto consumo de alimentos não saudáveis, pois de acordo com a hipótese do impulso social (RAINE, 2013), jovens desprovidos de risco ambiental, ou seja, que não estão envolvidos em comportamentos desviantes, são possivelmente mais influenciados por fatores de risco biossociais (exemplo: alto consumo de *junk food*) devido a sua maior sensibilidade biológica às inadequações nutricionais causadas por uma alimentação não

saudável, que por sua vez, podem “impulsioná-los” para atos agressivos, comparado aos jovens que se encontram num contexto de maior risco para comportamentos desviantes. Esses resultados sugerem a existência de outros possíveis mediadores da associação entre consumo alimentar e perpetração de *bullying*, além dos comportamentos desviantes.

Nos últimos anos, alguns estudos (BUCCI; STAFF, 2020; JACKSON et al., 2023; WIDDOWSON; SIENNICK; HAY, 2016) têm realizado análises de mediação através do método KHB (KARLSON; HOLM; BREEN, 2012), caracterizado por uma técnica estatística que se destina principalmente a modelos binários (regressão logística), mas que também pode ser utilizada com modelos de probabilidade não lineares (ordenados e multinomiais) e regressão linear.

Em modelos de regressão linear, decompor o efeito total em efeitos diretos e indiretos/espúrios é simples. A decomposição é feita comparando o coeficiente estimado da exposição entre um modelo reduzido (sem variável mediadora) e um modelo completo (com uma ou mais variáveis mediadoras adicionadas). A diferença entre os coeficientes estimados, nos dois modelos, expressa o valor pelo qual o efeito da exposição é confundido pela(s) variável(eis) mediadora(s). Se ela for considerada uma consequência da exposição, a diferença será comumente denominada como "efeito indireto"; se a hipótese da variável mediadora for a causa da exposição, a diferença é denominada "efeito espúrio" (KARLSON; HOLM; BREEN, 2012).

Essa estratégia, descrita para modelos lineares, não pode ser usada em modelos de probabilidade não lineares, porque os coeficientes estimados entre esses modelos não podem ser comparados diretamente. O motivo é um reescalonamento do modelo, que ocorre após a adição da(s) variável(eis) mediadora(s), sendo o método KHB capaz de ajustá-lo e fornecer uma estimativa da proporção da associação entre a exposição e o desfecho que é explicada por um determinado mediador (KARLSON; HOLM; BREEN, 2012; JACKSON et al., 2023).

O método KHB também permite a inclusão de possíveis variáveis de confusão no modelo de regressão. Essas variáveis não desempenham o papel das variáveis mediadoras, mas sim como um conjunto de variáveis de ajuste que é incluído para garantir que os efeitos do modelo completo e do modelo reduzido não sejam confundidos por essas variáveis (KARLSON; HOLM; BREEN, 2012).

2.5 O papel da escola na prevenção e enfrentamento de comportamentos desviantes e *bullying* e na promoção de uma alimentação saudável

Na adolescência, a busca por autonomia e a construção de uma identidade própria são aspectos relevantes e necessários para o indivíduo, que se dão por meio do afastamento dos pais e familiares e maior convivência com os pares, que passam a ter maior influência sobre o comportamento do adolescente. É nessa fase que ele entra em contato com hábitos, valores e crenças diferentes dos que foram ensinados em casa e tende a se colocar em situações de risco (violência, delinquência, etc.), resistindo às orientações parentais/familiares. Nesse sentido, se envolver em comportamentos desviantes, bem como praticar o *bullying*, faz parte do processo de crescimento e amadurecimento desse adolescente, como forma de confrontar os limites que lhes são impostos desde a infância (PERES et al., 2018b).

Com o maior distanciamento dos pais, a escola passa a ser o espaço social mais frequentado e de maior influência para os adolescentes, onde eles devem aprender não somente as disciplinas básicas de ensino, como também valores de tolerância, solidariedade, igualdade e respeito ao outro e à diversidade (PERES et al., 2018b; UNESCO, 2019). Através do incentivo a uma cultura inclusiva, que proporcione ambientes de aprendizagem seguros e sem violência, os estudantes se sentem mais confiantes para relatar as situações de violência vivenciadas ou presenciadas no ambiente escolar, reduzindo assim os comportamentos de *bullying* (UNESCO, 2019).

Ao contrário, certas atitudes compartilhadas por estudantes e professores, como encorajar os agressores e deixar de intervir ao testemunhar a vitimização de um adolescente (SUTTON; SMITH, 1999), podem contribuir para um clima escolar negativo e consequentemente, para o aumento da perpetração de *bullying*, como se esse tipo de violência tivesse o apoio e uma ampla aceitação por parte da escola (UNNEVER; CORNELL, 2003). A nível escolar, algumas estratégias podem ser utilizadas para prevenir e enfrentar os comportamentos desviantes e o *bullying*. Uma delas é estabelecer e implementar uma política de combate a esses dois comportamentos, em todo o ambiente escolar, envolvendo principalmente professores e estudantes. Os professores são os profissionais mais próximos dos adolescentes e ocupam uma posição importante dentro do contexto escolar, pois podem perceber e identificar possíveis mudanças de comportamento nos jovens e assim, aplicar técnicas dentro de sala de aula para gerenciá-las (WHO, 2021). Eles podem, por exemplo, reforçar o conteúdo de cartazes com mensagens anti-*bullying* e utilizar abordagens pedagógicas positivas de disciplina, a fim de reduzir esses comportamentos. Para isso, os professores

precisam ser treinados para adquirir as habilidades necessárias à prevenção e ao combate da delinquência e do *bullying* (UNESCO, 2019), bem como construir parcerias com os pais dos adolescentes, que passam a entender mais facilmente as normas morais da escola (OBSUTH et al., 2023; SMETANA; JAMBON; BALL, 2018; WANG et al., 2015) e a saber como responder ao *bullying* da melhor forma (WHO, 2021), manifestando comportamentos menos agressivos e delinquentes (OBSUTH et al., 2023; WANG et al., 2015) e garantindo a melhoria do clima escolar (HORNBY, 2000).

Ainda no nível escolar, promover comportamentos saudáveis, como a adoção de uma alimentação saudável, pode incentivar os adolescentes a fazerem melhores escolhas alimentares e consequentemente, a terem melhor qualidade de vida (WANG; STEWART, 2013; WHO, 2021). Essa qualidade de vida também está associada a menor prevalência de comportamentos desviantes e perpetração de *bullying* entre os escolares, e entender como a alimentação pode estar associada a esses comportamentos é essencial para o planejamento e implementação de iniciativas que tornem a alimentação escolar mais saudável, com maior consumo de alimentos *in natura* ou minimamente processados e menor consumo de alimentos ultraprocessados (JACKSON, 2016; WANG; STEWART, 2013; WHO, 2021), reduzindo assim esses comportamentos.

No Brasil, existem políticas públicas que visam contribuir para um ambiente escolar mais saudável e sem violência. O Programa Saúde na Escola - PSE (BRASIL, 2007) foi instituído pelo governo federal com a finalidade de construir políticas intersetoriais (articulação entre saúde e educação) que proporcionem à comunidade escolar práticas de promoção à saúde e de prevenção de doenças, garantindo o pleno desenvolvimento de crianças, adolescentes e jovens da educação básica. Entre as várias ações no âmbito do PSE, estão a promoção da cultura de paz, cidadania e direitos humanos, bem como a promoção da alimentação saudável nas escolas, que colaboram para uma melhor qualidade de vida dos estudantes.

Ainda nas escolas públicas brasileiras, para promover uma alimentação adequada e saudável e beneficiar o desenvolvimento e desempenho escolar dos estudantes, foi implementado o Programa Nacional de Alimentação Escolar - PNAE (BRASIL, 2020). Vários estudos mostram que a oferta de merenda escolar pelo PNAE está associada ao aumento do consumo de alimentos saudáveis e a diminuição do consumo de alimentos não-saudáveis/ultraprocessados (AZEREDO et al., 2016; BENTO et al., 2017; LOCATELLI; CANELLA; BANDONI, 2018; NOLL et al., 2019), afetando positivamente a qualidade geral da alimentação dos adolescentes, possibilitando não somente a prevenção e combate da obesidade (SILVA; BORTOLINI; JAIME, 2013) e das doenças crônicas (LOCATELLI;

CANELLA; BANDONI, 2018), mas também da delinquência e da prática do *bullying* entre os estudantes, ainda que de maneira indireta.

De acordo com a legislação vigente (BRASIL, 2020), os cardápios escolares devem ser elaborados por um nutricionista Responsável Técnico do PNAE, priorizando a utilização de alimentos *in natura* ou minimamente processados, levando em conta as necessidades nutricionais, os hábitos alimentares, a cultura alimentar local, a sustentabilidade, a sazonalidade e a diversificação agrícola da região. Inclusive, pelo menos 75% dos recursos fornecidos ao programa devem ser utilizados para a aquisição de alimentos *in natura* ou minimamente processados, sendo que deve ser fornecido, no mínimo, 280g e 520g de frutas, legumes e verduras por estudante, por semana, em escolas que ofertam alimentação escolar em período parcial e integral, respectivamente. Alimentos ultraprocessados, como bebidas açucaradas, embutidos e doces, são proibidos ou têm participação restrita no cardápio escolar.

No Brasil, a criação de ambientes alimentares saudáveis nas escolas também pode ser influenciada pela existência de leis estaduais e municipais que proíbem a venda de alimentos não saudáveis (por exemplo, refrigerantes) dentro desse espaço, o que contribui para a maior disponibilidade de escolhas alimentares saudáveis e promoção da educação alimentar e nutricional aos estudantes (AZEREDO et al., 2020).

Portanto, a escola pode contribuir tanto na promoção de uma alimentação saudável (atividades de educação nutricional, oferta e incentivo ao consumo da merenda escolar), como na identificação e manejo dos comportamentos desviantes e do *bullying*, favorecendo a saúde mental dos adolescentes (BEZERRA, 2018; WHO, 2021).

2.6 SP-PROSO: Projeto São Paulo para o desenvolvimento social de crianças e adolescentes

O projeto São Paulo para o desenvolvimento social de crianças e adolescentes (SP-PROSO) é um estudo epidemiológico transversal, desenvolvido em 2017 pelo Departamento de Medicina Preventiva da Faculdade de Medicina da Universidade de São Paulo (USP), em parceria com o *Violence Research Centre*, da Universidade de Cambridge. Semelhante à metodologia utilizada nos projetos Z-PROSO (*Zurich Project on the Social Development from Childhood to Adulthood*) e M-PROSO (*Montevideo Project for the Social Development of Children and Adolescents*), respectivamente na Suíça e no Uruguai, o SP-PROSO teve como objetivo identificar a prevalência de vitimização e perpetração de *bullying* e outras violências entre adolescentes de 14 a 15 anos do município de São Paulo, Brasil, associada a fatores de risco sociodemográficos, individuais, relacionais (família e pares) e contextuais. Também

foram avaliados aspectos relacionados à alimentação e atividade física dos adolescentes (PERES et al., 2018b).

O projeto contou com a participação de uma amostra representativa de estudantes do 9º ano do ensino fundamental (n=2.680), de escolas públicas e privadas selecionadas aleatoriamente em São Paulo, que foram convidados a responder questionários estruturados em sala de aula, na presença de pesquisadores treinados (aferição de peso e altura dos estudantes, após o autopreenchimento e entrega dos questionários). Os diretores das escolas participantes também foram convidados a responder o Questionário do Diretor (PERES et al., 2018b).

O projeto foi aprovado pelo Comitê de Ética e Pesquisa da Faculdade de Medicina da USP (parecer 1.719.856), pela Comissão Nacional de Ética em Pesquisa (CONEP) (parecer 2.014.816) e pelo Comitê de Ética em Pesquisa do Instituto de Criminologia da Universidade de Cambridge. As instituições financiadoras da pesquisa foram a *British Academy/Newton Foundation* e a Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) (PERES et al., 2018b).

Maior detalhamento sobre o SP-PROSO pode ser encontrado no relatório do projeto (PERES et al., 2018b).

3 OBJETIVOS

Objetivo Geral

Avaliar a associação entre consumo alimentar e perpetração de *bullying* entre adolescentes brasileiros.

Objetivos Específicos

Avaliar a associação entre padrões alimentares com papéis no *bullying* e tipos de perpetração entre adolescentes brasileiros, estratificado por sexo (Artigo 1).

Avaliar o efeito mediador de comportamentos desviantes na associação entre padrão alimentar e perpetração de *bullying* entre adolescentes brasileiros (Artigo 2).

4 ARTIGO 1: Association between dietary patterns and bullying among adolescents in Sao Paulo – Brazil

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Association between dietary patterns and bullying among adolescents in Sao Paulo – Brazil

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Short title Food consumption and bullying in adolescence

Keywords Peer violence, Bullying, Aggression, Food consumption, Nutrition, Adolescents

Abstract

Previous studies have assessed the association between food consumption and bullying perpetration, but most of them have not broadly assessed food consumption, neither the distinction between forms of bullying. The aim of the study was to evaluate the association between dietary patterns with bullying roles and its different types of bullying perpetration among adolescents. Data on a representative sample of 9th-grade students (N=2,163; mean age=14.8y) taken from Sao Paulo Project for the social development of children and adolescents (SP-PROSO) were used. The independent variables were healthy and unhealthy dietary patterns obtained by exploratory factor analysis. The dependent variables were bullying role (victim-only, bully-only, bully-victim) and bullying perpetration (any type, social exclusion, psychological/verbal aggression, physical aggression, property destruction, sexual harassment). Multinomial and logistic regression models were performed for the total sample and stratified by sex (only for association with sexual harassment), adjusting for covariates. Adolescents who engaged in a healthy dietary pattern were less likely to be bullies (RR 0.67 [0.49, 0.92]), while adolescents with an unhealthy dietary pattern were more likely to be bully-victims (RR 1.29 [1.12, 1.48]). Unhealthy dietary pattern was associated with any type of bullying perpetration (OR 1.24 [1.12, 1.38]), mainly with sexual harassment and physical aggression. Boys who had an unhealthy dietary pattern were more likely to sexually harass another adolescent (OR 2.10 [1.20, 3.66]). In conclusion, adolescents who had a healthy dietary pattern were less likely to perpetrate bullying. Unhealthy dietary pattern was associated with bullying perpetration, especially with sexual harassment by boys.

Keywords Peer violence, Bullying, Aggression, Food consumption, Nutrition, Adolescents.

Introduction

School bullying is considered a worldwide public health problem (Krug, Mercy, Dahlberg, & Zwi, 2002), and it is identified by a power imbalance between victim and bully, involving repetitive and intentional aggressive attitudes against peers (Olweus, 1993). Bullying can occur through overt forms, such as physical aggression (hitting, pushing) and verbal aggression (teasing, name-calling, racial or sexual harassment, threats), or covert forms, such as spreading rumors and social exclusion (Craig et al., 2009). In bullying situations, adolescents may take on various bullying roles, including noninvolved, bully-only, victim-only, or bully-victim (i.e., an adolescent who is both the victim and perpetrator of bullying) (Goldbach, Sterzing, & Stuart, 2018).

Evidence from a study conducted with adolescents from 40 countries found a prevalence of 12.6% for victimization and 10.7% for perpetration, being physical and verbal aggressions the most reported bullying behaviors (Craig et al., 2009). In Brazil, studies have found a prevalence of victims ranging from 8.3% to 18.2%. Regarding bullies and bully-victims, the prevalence ranges from 4.8% to 21.2% and from 2.0% to 10.4%, respectively (Loch et al., 2020; Silva, Lima, Acioli, & Barreira, 2019).

Individual determinants of bullying victimization and perpetration have been identified in the literature. For instance, male gender, attention deficit and hyperactivity, and substance use may be predictors of involvement in bullying perpetration and victimization (Zych, Farrington, Llorent, Ribeaud, & Eisner, 2020). More recently, the role of diet in bullying has been investigated. As a handful of studies have pointed similar results (Bruckauf & Walsh, 2018; Zahedi et al., 2014), a study with adolescents from countries in North America and Europe found an association between low diet quality and bullying perpetration (Jackson, 2017). Another one (Trapp et al., 2016) found that a higher score for a Western dietary pattern at 14 years was associated with an increase in conduct problems and aggressive behavior at 17 years, suggesting that food consumption could be associated with future problem behaviors.

Among children and adolescents, the literature indicates that the association kbetween bullying behaviors and food consumption may be bidirectional, with victimization associated with greater adoption of unhealthy eating (Jackson, Leal, Posick, Vaughn, & Olivan, 2018; Smith et al., 2021) and an unhealthy diet increasing odds of perpetration (Bruckauf & Walsh, 2018; Holubcikova, Kolarcik, Geckova, Reijneveld, & van Dijk, 2015; Jackson, 2017; Solnick & Hemenway, 2012; Zahedi et al., 2014). The link between diet and bullying perpetration may occur through mechanisms in which

unhealthy eating increases adolescents' involvement in externalizing behaviors and affects their mood, thereby increasing bullying perpetration (Holubcikova, Kolarcik, Geckova, Reijneveld, & van Dijk, 2015; Kien et al., 2013; Oddy et al., 2009).

Previous literature has assessed food consumption with a focus on one specific type/category of food (e.g., soft drinks, junk food, sweets) or a diet quality index (Bruckauf & Walsh, 2018; Holubcikova, Kolarcik, Geckova, Reijneveld, & van Dijk, 2015; Jackson, 2017; Solnick & Hemenway, 2012; Zahedi et al., 2014), limiting the understanding of the role of dietary patterns in bullying. Dietary patterns represent a combination of foods that may be better associated with bullying than just one nutrient or food, as factor analysis can reduce and/or group data into patterns based upon intercorrelations (e.g. similar dietary composition) between different food items. This akpproach is an alternative method that assesses eating habits more comprehensively, understanding that people usually eat meals that contain lots of foods and nutrients (Kant, 2004; Newby & Tucker, 2004). Moreover, previous studies have assessed bullying perpetration without distinction between forms of bullying, and it is reasonable to suggest that dietary patterns have stronger associations with more overt forms of bullying perpetration, since previous literature has shown that lower quality diets are associated with fighting, acting aggressively, and engaging in delinquent behaviors (Jackson, 2016; Jackson & Vaughn, 2021; Oddy et al., 2009; Trapp et al., 2016).

Therefore, the purpose of this study was to evaluate the association between dietary patterns with bullying roles and its different types of perpetration among school adolescents.

Method

Study population, sampling and data collection

We used data from the cross-sectional study Sao Paulo Project for the social development of children and adolescents – SP-PROSO (Projeto São Paulo para o desenvolvimento social de crianças e adolescentes) carried out in 2017. This study includes a representative sample of 9th-grade students from public and private schools in Sao Paulo, Brazil (Peres et al., 2018).

The sampling strategy included stratification by school type (state public schools, municipal public schools and private schools in Sao Paulo) and clustering by school class. The school participation was voluntary, and data collection was carried out only in schools whose principals agreed to participate in the research by Informed Consent Term.

To estimate the classes to be drawn in each stratum, information was used on the number of adolescents enrolled per class and school in the 9th-grade, recorded in School Census 2015.

Participants were also invited to sign a consent form (after parents' consent) and to complete a paper–pencil questionnaire based on questionnaires used in the longitudinal study Zurich Project on the Social Development of Children (Z-PROSO) and Montevideo Project for the Social Development of Children and Adolescents (M-PROSO), later translated to Portuguese. The questionnaire included demographics and familiar questions, related to relationships with friends and school environment, and aspects of adolescents' food consumption and physical activity.

Data collection was carried out from August to November 2017. Of the 2,816 9th-grade students present on the survey day, 2,680 answered the questionnaire. However, 57 did not report their sex and were excluded from the analysis. We also excluded adolescents missing information on age (n=44), healthy (n=157) and unhealthy eating markers (n=177), as well as types of bullying victimization (n=57) and perpetration (n=25). The final sample size included in this study comprised 2,163 participants. More details of the sampling process are available in the SP-PROSO report (Peres et al., 2018).

Healthy and unhealthy dietary patterns assessment – independent variables

First, food consumption was obtained by the weekly frequency of beans, raw/cooked vegetables, fruit/fruit salad, fried food/French fries, sausages, biscuits/cookies, package snacks/potato chips, candies and sugary beverages consumption. We grouped the frequencies in a dichotomous variable (< 5 times/week or ≥ 5 times/week), hereinafter referred to as regular consumption (Azeredo et al., 2014; Jaime et al., 2015). The SP-PROSO questions about the frequency of food consumption in the previous seven days are similar to the questions from the previously validated PeNSE questionnaire (Brazilian National School-Based Health Survey), and the indicator for regular consumption of healthy and unhealthy food provides satisfactory accuracy and validity compared to three 24-hour recalls (Tavares et al., 2014). Then dietary patterns were obtained by exploratory factor analysis. In factor analysis, only shared variance between variables appears in the solution, and the shared variance is partitioned from its unique variance and error variance (Costello & Osborne, 2005). The Kaiser-Meyer-Olkin (KMO) criteria was used to assess sampling adequacy. KMO takes values between 0 and 1, with small values generally meaning that variables have too little in common to justify

a factor analysis. A value of KMO=0.84 was obtained, meaning good adequacy (Hutcheson & Sofroniou, 1999). The exploratory factor analysis was performed on the total sample.

Assessment of bullying roles and bullying perpetration - dependent variables

Bullying role was assessed through questions about victimization and perpetration. In August 2017, the adolescents self-reported the frequency of bullying victimization in the previous 12 months through five questions regarding specific types of victimization, following the general question: "Since August 2016, how often have you 1) been ignored or excluded on purpose, 2) been made fun of or called names, 3) been punched, kicked, bitten or had your hair pulled, 4) had some of your belongings taken, broken or hidden on purpose, and 5) been sexually harassed?". Possible answers were 0= never; 1= once or twice; 3= from 3 to 10 times; 4= once a month; 5= once a week; 6= every day. We classified as *victim-only* those who reported having suffered at least one of the five types of bullying at least once a month in the last year. The same five questions were asked for bullies following the general question: "Since August 2016, how often have you (type of bullying; i.e. ignored or excluded on purpose) other adolescent?". We classified as *bully-only* those who reported having perpetrated at least one type of bullying, at least once a month in the last year. Adolescents who reported being a victim and having perpetrated at least one type of bullying, at least once a month in the last year, were classified as *bully-victims*. Those who reported not being victims neither perpetrators of any type of bullying were the reference category (*noninvolved*). Each type of bullying perpetration (any type, social exclusion, psychological/verbal aggression, physical aggression, property destruction and sexual harassment) was also considered as a dependent variable.

Despite the lack of association between dietary patterns and the odds of being victim-only (Table 3), also found in other studies (Jackson, 2017; Jackson & Vaughn, 2018), we assessed the association with the individual types of victimizations and how expected, we found no significant association (data not shown). In addition, the literature suggests this association in the opposite direction (bullying victimization associated with greater consumption of unhealthy eating) (Jackson, Leal, Posick, Vaughn, & Olivan, 2018; Smith et al., 2021).

Covariates

We assessed sex (male, female), age (in years), color/race (white, non-white, non-response), maternal educational level (incomplete middle school, complete middle school, complete high school, complete higher education, non-response), physical fitness (<420 min/week, ≥ 420 min/week), screen-based sedentary activities (<3h/day, ≥3h/day, non-response) and Body Mass Index (BMI) (normal weight, underweight, overweight, non-response).

Statistical analyses

The analyses were performed taking into consideration the sample design and weights to represent the population of school adolescents from Sao Paulo.

First, a descriptive analysis of the sample (total and according to sex) was performed to obtain the percentages and its respective confidence intervals (95%CI) of the variables of interest.

We calculate relative risk (RR) and 95% confidence intervals (CI) for the association between each dietary pattern and bullying role using multinomial regression models. Crude and adjusted odds ratios (OR) were obtained in the association analysis of each variable (healthy/unhealthy dietary pattern) with types of bullying perpetration by simple and multiple logistic regression.

Interaction analysis was performed to evaluate whether the associations of interest differed according to sex. The interaction term was statistically significant only for the association between healthy dietary pattern and sexual harassment. Therefore, such association was presented stratified by sex. P-values<0.05 were considered significant. All statistical analyses were performed using Stata SE version 13.0 software (StataCorp, 2013).

Ethical aspects

SP-PROSO was approved by the Ethics and Research Committee of the University of Sao Paulo School of Medicine (research project 1.719.856), National Commission for Research Ethics (research project 2.014.816), and the 1964 Helsinki Declaration and its later amendments. No identification of the student or school was required in questionnaires (schools and students had an identification number in the questionnaire).

Results

Adolescents showed a similar distribution regarding sex (52.6% male) and had an average age of 14.8y. Regular consumption (≥ 5 times/week) of beans was more frequent in boys (63.8%), whereas girls regularly consumed more raw/cooked vegetables (44.2%), biscuits/cookies (44.2%), candies (45.7%) and sugary beverages (48.7%). The regular consumption of fruit/fruit salad (38.3%), fried food/French fries (20.1%), sausages (21.6%), and package snacks/potato chips (22.5%) were similar between sexes (Table 1).

We found that 23.1% of girls and 14.5% of boys were only victims, whereas 6.6% of boys and 3.1% of girls were only bullies. Almost 12% of boys and 7.3% okf girls were bully-victims. Regarding bullying perpetration, 18.4% of boys and 10.7% of girls perpetrated any type of bullying. Psychological/verbal bullying was the most frequent type of bullying perpetrated by boys (12.4%) and girls (6.8%) (Table 1).

For the whole sample, two dietary patterns were retained, explaining 53.05% of the variance. The first pattern was labelled 'unhealthy dietary pattern' and included fried food/French fries, sausages, biscuits/cookies, package snacks/potato chips, candies and sugary beverages. The second pattern was labelled 'healthy dietary pattern' and included beans, raw/cooked vegetables and fruit/fruit salad (Table 2).

In the adjusted multinomial regression models, adolescents who engaged in a healthy dietary pattern were less likely to be only bullies (RR 0.67 95%CI 0.49–0.92). Adolescents who had an unhealthy dietary pattern were more likely to be bully-victims (RR 1.29 95%CI 1.12–1.48) (Table 3).

In the adjusted logistic regression models, the unhealthy dietary pattern was associated with any type of bullying perpetration (OR 1.24 95%CI 1.12–1.38), mainly with sexual harassment (OR 1.71 95%CI 1.13-2.60) and physical aggression (OR 1.52 95%CI 1.18-1.95) (Table 4). The stratified analyses found that boys who had an unhealthy dietary pattern were more likely to sexually harass another adolescent (OR 2.10 95%CI 1.20-3.66) (Table 5).

Discussion

Our results show that having a healthy dietary pattern was inversely associated with bullying perpetration, whereas unhealthy dietary pattern was positively associated with bully-victim role. Moreover, adolescents who engaged in an unhealthy dietary pattern showed a higher probability of perpetrating all bullying types, especially sexual

harassment and physical aggression. Stratified analyses showed that boys who had an unhealthy dietary pattern were more likely to sexually harass another adolescent.

The literature suggests a bidirectional relationship between bullying behaviors and food consumption (Smith et al., 2021; Solnick & Hemenway, 2012), recently pointing out that unhealthy eating is associated with bullying perpetration in children and adolescents (Holubcikova, Kolarcik, Geckova, Reijneveld, & van Dijk, 2015; Jackson, 2017), which is in line with our findings. A recent study (Bruckauf & Walsh, 2018) found an association between sweets, chocolates and non-diet soft drinks consumption with involvement in physical fighting and bullying perpetration. Another one (Zahedi et al., 2014) found that adolescents with daily consumption of sweetened beverages, fast foods and salty snacks were more likely to be bullies. However, these studies considered each type of food as different exposures, separately associated with bullying perpetration. Our study assessed food consumption more broadly through dietary patterns, grouping or reducing several foods into a single pattern (only one exposure) associated with bullying behaviors. This approach has moved towards knowledge of that association since combinations of many foods characterize people's usual diet.

We found that adolescents who engaged in a healthy dietary pattern were less likely to be bullies. Adolescents identified as bullies have been found to be aggressive, hostile, a little anxious or insecure (Byrne, 1994; Craig, 1998; Olweus, 1995), impulsive and lacking in self-control (Björkqvist, Ekman, & Lagerspetz, 1982), with positive attitudes towards aggression and negative attitudes towards peers (Lagerspetz, Björkqvist, Berts, & King, 1982). Studies have suggested that healthy eating can improve adolescents' mental health and reduce some of these characteristics and feelings (Kulkarni, Swinburn, & Utter, 2015), which could trigger bullying perpetration (e.g. verbal and physical aggression) (Craig, 1998).

In addition, adolescents who had an unhealthy dietary pattern were more likely to be bully-victims. The literature shows associations between low diet quality (OR 1.79 95%CI 1.57–2.03; Jackson, 2017) and high junk food consumption (OR 1.46 95%CI 1.36–1.56; Jackson & Vaughn, 2018) with being a bully-victim. Some studies have explored the characteristics of adolescents who both bully and have been victimized. Bully-victims may have more depressive symptoms and aggressive impulsivity (O'Brennan, Bradshaw, & Sawyer, 2009), greater likelihood of engaging in substance use (Kaltiala-Heino, Rimpelä, Rantanen, & Rimpelä, 2000) and worse social adjustment (Kelly et al., 2015). It seems that an unhealthy diet reinforces the greater presence of these

characteristics in bully-victims adolescents, increasing their vulnerability (Kulkarni, Swinburn, & Utter, 2015; Marques, Azeredo, & de Oliveira, 2018; Puloka, Utter, Denny, & Fleming, 2017).

According to our analysis, adolescents who had an unhealthy dietary pattern were more likely to perpetrate bullying. Our finding is in line with recent studies showing a possible association between a diet low in fruits and vegetables and plentiful in sweets/soft drinks with bullying behaviors (Holubcikova, Kolarcik, Geckova, Reijneveld, & van Dijk, 2015; Jackson, Vaughn, & Salas-Wright, 2017; Trapp et al., 2016; Zahedi et al., 2014). Such association may be explained through two potential mechanisms. First, unhealthy eating (e.g. Western dietary pattern) could be associated with greater involvement in externalizing behaviors such as delinquent and/or aggressive behavior and conduct problems linked to bullying perpetration (Oddy et al., 2009). A study found that a high-palmitic acid diet (similar to the Western diet fat composition) was associated with anger and hostility (Kien et al., 2013), probably due to a central inflammatory process (Cintra et al., 2012) induced by increased secretion of TNF-ά by peripheral blood monocytes (Coll et al., 2008; Suarez, Lewis, & Kuhn, 2002), which could heighten anger and bullying perpetration. Second, daily consumption of components of soft drinks (e.g. aspartame) may lead to aggressive behavior through high fluctuations in the blood glucose levels (Tandel, 2011), which could be related to behavior deviations and violence (Benton, 2007). Moreover, the association between unhealthy eating and adolescents' involvement in bullying perpetration may be mediated by frequent nervousness and irritability (Holubcikova, Kolarcik, Geckova, Reijneveld, & van Dijk, 2015), and low self-control (Jackson, 2017; Moon & Alarid, 2015; Wills, Isasi, Mendoza, & Ainette, 2007).

Five types of bullying perpetration were considered for our analysis, obtaining different magnitudes of the association between unhealthy dietary pattern and each type of perpetration, with a stronger association for physical aggression (OR 1.52 95%CI 1.18-1.95). Physical aggression and verbal bullying are considered overt aggression, and it is possible that adolescents who perpetrate such type of violence have lower levels of fear reactivity and effortful control, compared to perpetrators of covert aggressive acts (Terranova, Morris, & Boxer, 2008). There is a lack of studies that evaluate several types of bullying separately, which prevents us from comparing our results and better understanding the associations.

We also found that boys who had an unhealthy dietary pattern showed higher probability of sexually harass another adolescent. Gender is a significant risk factor for perpetrating sexual harassment, as boys are more likely than girls to engage in sexually harassing behaviors (Clear et al., 2014; DeSouza & Ribeiro, 2005; Fineran, Bennett & Sacco, 2001) and to admit they had sexually harassed other students (Clear et al., 2014; Hill & Kearl, 2011). Moreover, sexual harassment is overt aggression, and recent studies show that boys are more likely to perpetrate and experience such type of violence, whereas girls are more involved in covert forms of bullying, such as psychological violence and social exclusion (Bradshaw, Waasdorp, & Johnson, 2015; United Nations Children's Fund, 2014).

Limitations and strengths

Despite the contribution of the present study, some limitations should be considered. The cross-sectional design of the study does not allow us to establish temporality between the variables of interest. Thus, future research is required to explore the possible causal links between healthy and unhealthy dietary patterns and the outcomes (types of bullying perpetration), as well as the potential mediators of such associations.

Our study used self-reported information, which may have provided some misreporting (differential information bias) in questions about bullying involvement (Cornell, Lovegrove, & Baly, 2014) and, consequently, underestimated prevalence. Despite this, the scores from 10-item self-report measure of bullying perpetration in adolescents (Z-PROSO) were validated and provided a reasonable general measure of perpetration that can be used across early to late adolescence and in both sexes (Murray et al., 2019). Moreover, the survey instrument covered bullying perpetration by the cut-off of at least once a month in the previous 12 months, taking into account the repetitive feature of this violence (Olweus, 1993), which resulted in significant associations with dietary patterns. Other studies have also used similar questions for the same exposures (Barros et al., 2017; Tavares, Castro, Levy, Cardoso, & Claro, 2014) and outcomes (Murray, Zych, Ribeaud, & Eisner, 2020), suggesting we had adequate ascertainment of such variables and allowing comparison with our results.

Only students present in class at the time the questionnaire was applied were included in the sample, which may affect the generalization of our results and generate some selection bias. In addition, the survey SP-PROSO does not account for adolescents not enrolled in regular education and perpetrators of bullying are more likely to miss

classes and drop out of school (Gubbels, van der Put, & Assink, 2019); thus, some of them may not have been included in the analysis. Nevertheless, the study analyzed a significant sample of adolescents. It is also possible that there are differences regarding adolescents of age groups distinct from those reported in this study.

Despite its limitations, our study has strengths. To the best of our knowledge, this is the first study in Brazil to evaluate the association between food consumption and perpetration of bullying. The use of dietary patterns allowed a broad assessment of food consumption, considering possible antagonistic and synergistic relationships between nutrients (Collins, Watson, & Burrows, 2010; Hu, 2002), since people commonly do not eat isolated foods or nutrients, but combinations of several of these. Bullying was assessed through five types of perpetration, allowing the obtainment of different magnitudes of the association of dietary patterns with each type of perpetration.

In addition, the instrument used in Z-PROSO and M-PROSO was translated into Portuguese following recommendations for culturally sensitive translations (Behr & Shishido, 2016; Eisner & Ribeaud, 2007). Then the complete instrument was pre-tested in five schools to better assess the phrasing, understanding of the questions and the logical structure of the survey (Peres et al., 2018).

Conclusion

Adolescents with a healthy dietary pattern were less likely to be bullies, while those who had an unhealthy dietary pattern were more likely to be bully-victims. Moreover, unhealthy dietary pattern was associated with all types of bullying perpetration. In boys, unhealthy dietary pattern was strongly associated with peer sexual harassment. Our study underscores that improving dietary patterns may be an important key point in attenuating several bullying behaviors among adolescents, and indirectly reducing its negative health consequences such as psychosomatic symptoms, depression and anxiety, and behavioral problems (Kieselbach & Butchart, 2015; Pepler, Jiang, Craig, & Connolly, 2008; Smokowski & Kopasz, 2005). Studies suggest that promoting nutrition for young people in schools can significantly benefit their food choices, making healthier eating with greater consumption of fruits and vegetables, fiber, water and healthy snacks, and lower intake of unhealthy foods (Wang & Stewart, 2012). This school-level approach can be most effective if done in partnership with health services, the family and the community (Stewart, Sun, Patterson, Lemerle, & Hardie, 2004). In addition, schools could also adopt policies to identify bullying behaviors, mainly peer

371 sexual harassment, thus reducing intolerance and protecting adolescents through the
372 development of healthier school environments (Gaffney, Ttofi, & Farrington, 2018).

References

Azeredo, C. M., de Rezende, L. F. M., Canella, D. S., Claro, R. M., de Castro, I. R. R., Luiz, O. do C., & Levy, R. B. (2014). Dietary intake of Brazilian adolescents. *Public Health Nutrition, 18*(7), 1215–1224. doi:10.1017/S1368980014001463.

Barros, M. B. de A., Lima, M. G., Azevedo, R. C. S. de, Medina, L. B. de P., Lopes, C. de S., Menezes, P. R., & Malta, D. C. (2017). Depression and health behaviors in Brazilian adults – PNS 2013. *Revista de Saúde Pública*, *51*(suppl 1). doi:10.1590/s1518-8787.2017051000084

Behr, D., & Shishido, K. (2016). The translation of measurement instruments for cross-cultural surveys. In: Wolf, C., Joye, D., Smith, T. W., Fu, Y. (eds). *The SAGE handbook of survey methodology*. Sage, London, pp 269–287.

Benton, D. (2007). The impact of diet on anti-social, violent and criminal behaviour. *Neuroscience & Biobehavioral Reviews*, *31*(5), 752–774. doi:10.1016/j.neubiorev.2007.02.002

Björkqvist, K., Ekman, K., & Lagerspetz, K. (1982). Bullies and victims: Their ego picture, ideal ego picture and normative ego picture. *Scandinavian Journal of Psychology*, *23*(1), 307–313. doi:10.1111/j.1467-9450.1982.tb00445.x

Bradshaw, C. P., Waasdorp, T. E., & Johnson, S. L. (2015). Overlapping Verbal, Relational, Physical, and Electronic Forms of Bullying in Adolescence: Influence of School Context. *Journal of Clinical Child & Adolescent Psychology*, *44*(3), 494–508. doi:10.1080/15374416.2014.893516

Bruckauf, Z., & Walsh, S. D. (2018). Adolescents' multiple and individual risk behaviors: Examining the link with excessive sugar consumption across 26 industrialized countries. *Social Science & Medicine*, *216*, 133–141. doi:10.1016/j.socscimed.2018.08.029

Byrne, B. J. (1994). Bullies and victims in a school setting with reference to some Dublin schools. *The Irish Journal of Psychology*, *15*(4), 574–586. doi:10.1080/03033910.1994.10558031

Cintra, D. E., Ropelle, E. R., Moraes, J. C., Pauli, J. R., Morari, J., de Souza, C. T., … Velloso, L. A. (2012). Unsaturated Fatty Acids Revert Diet-Induced

Hypothalamic Inflammation in Obesity. *PLoS ONE*, *7*(1), e30571. doi:10.1371/journal.pone.0030571

Clear, E. R., Coker, A. L., Cook-Craig, P. G., Bush, H. M., Garcia, L. S., Williams, C. M., … Fisher, B. S. (2014). Sexual Harassment Victimization and Perpetration Among High School Students. *Violence Against Women*, *20*(10), 1203–1219. doi:10.1177/1077801214551287

Coll, T., Eyre, E., Rodríguez-Calvo, R., Palomer, X., Sánchez, R. M., Merlos, M., ... Vázquez-Carrera, M. (2008). Oleate Reverses Palmitate-induced Insulin Resistance and Inflammation in Skeletal Muscle Cells. *Journal of Biological Chemistry*, *283*(17), 11107–11116. doi:10.1074/jbc.M708700200

Collins, C. E., Watson, J., & Burrows, T. (2010). Measuring dietary intake in children and adolescents in the context of overweight and obesity. *International Journal of Obesity*, *34*(7), 1103–1115. doi:10.1038/ijo.2009.241

Cornell, D. G., Lovegrove, P. J., & Baly, M. W. (2014). Invalid Survey Response Pattems Among Middle School Students. *Psychological Assessment*, *26*(1), 277–287. doi:10.I037/a0034808

Costello, A. B., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research, and Evaluation*, *10*(7). doi:10.7275/JYJ1-4868

Craig, W., Harel-Fisch, Y., Fogel-Grinvald, H., Dostaler, S., Hetland, J., Simons-Morton, B., … HBSC Bullying Writing Group. (2009). A cross-national profile of bullying and victimization among adolescents in 40 countries. *International Journal of Public Health*, *54*(Suppl 2), 216–224. doi:10.1007/s00038-009-5413-9

Craig, W. M. (1998). The relationship among bullying, victimization, depression, anxiety, and aggression in elementary school children. *Personality and Individual Differences*, *24*(1), 123–130. doi:10.1016/S0191-8869(97)00145-1

DeSouza, E. R., & Ribeiro, J. (2005). Bullying and Sexual Harassment Among Brazilian High School Students. *Journal of Interpersonal Violence*, *20*(9), 1018–1038. doi:10.1177/0886260505277731

433 Eisner, M., & Ribeaud, D. (2007). Conducting a Criminological Survey in a Culturally
434 Diverse Context: Lessons from the Zurich Project on the Social Development of
435 Children. *European Journal of Criminology*, *4*(3), 271–298.
436 doi:10.1177/1477370807077183

437 Fineran, S., Bennett, L., & Sacco, T. (2001). Peer sexual harassment and peer violence:
438 South African children at risk. *Social Work*, 37, 211-221.

439 Gaffney, H., Ttofi, M. M., & Farrington, D. P. (2018). Evaluating the effectiveness of
440 school-bullying prevention programs: An updated meta-analytical review.
441 *Aggression and Violent Behavior*. doi:10.1016/j.avb.2018.07.001

442 Goldbach, J. T., Sterzing, P. R., & Stuart, M. J. (2018). Challenging Conventions of
443 Bullying Thresholds: Exploring Differences between Low and High Levels of
444 Bully-Only, Victim-Only, and Bully-Victim Roles. *Journal of Youth and*
445 *Adolescence*, *47*(3), 586–600. doi:10.1007/s10964-017-0775-4

446 Gubbels, J., van der Put, C. E., & Assink, M. (2019). Risk Factors for School
447 Absenteeism and Dropout: A Meta-Analytic Review. *Journal of Youth and*
448 *Adolescence*, *48*(9), 1637–1667. doi:10.1007/s10964-019-01072-5

449 Hill, C., & Kearl, H. (2011). *Crossing the line: Sexual harassment at school*. American
450 Association of University Women.

451 Holubcikova, J., Kolarcik, P., Geckova, A. M., Reijneveld, S. A., & van Dijk, J. P.
452 (2015). The mediating effect of daily nervousness and irritability on the
453 relationship between soft drink consumption and aggressive behaviour among
454 adolescents. *International Journal of Public Health*, *60*(6), 699–706.
455 doi:10.1007/s00038-015-0707-6

456 Hu, F. B. (2002). Dietary pattern analysis: A new direction in nutritional epidemiology:
457 *Current Opinion in Lipidology*, *13*(1), 3–9. doi:10.1097/00041433-200202000-
458 00002

459 Hutcheson, G. D., & Sofroniou, N. *The multivariate social scientist: Introductory*
460 *statistics using generalized linear models*. London: Sage Publications, 1999.

461 Jackson, D. B. (2016). The link between poor quality nutrition and childhood antisocial
462 behavior: A genetically informative analysis. *Journal of Criminal Justice, 44*,
463 13–20. doi:10.1016/j.jcrimjus.2015.11.00

464 Jackson, D. B. (2017). Diet quality and bullying among a cross-national sample of
465 youth. *Preventive Medicine*, *105*, 359–365. doi:10.1016/j.ypmed.2017.06.033

466 Jackson, D. B., Vaughn, M. G., & Salas-Wright, C. P. (2017). Poor nutrition and
467 bullying behaviors: A comparison of deviant and non-deviant youth. *Journal of*
468 *Adolescence, 57*, 69–73. doi:10.1016/j.adolescence.2017.03

469 Jackson, D. B., Leal, W. E., Posick, C., Vaughn, M. G., & Olivan, M. (2018). The Role
470 of Adolescent Victimization in Energy Drink Consumption: Monitoring the
471 Future, 2010–2016. *Journal of Community Health*, *43*(6), 1137–1144.
472 doi:10.1007/s10900-018-0532-y

473 Jackson, D. B., & Vaughn, M. G. (2018). The bully-victim overlap and nutrition among
474 school-aged youth in North America and Europe. *Children and Youth Services*
475 *Review, 90*, 158–165. doi:10.1016/j.childyouth.2018.05.

476 Jackson, D. B., & Vaughn, M. G. (2021). Diet Quality and Physical Fighting Among
477 Youth: A Cross-National Study. *Journal of Interpersonal Violence, 36*(3-4),
478 NP1180-1192NP. doi:10.1177/0886260518754874

479 Jaime, P. C., Stopa, S. R., Oliveira, T. P., Vieira, M. L., Szwarcwald, C. L., & Malta, D.
480 C. (2015). Prevalência e distribuição sociodemográfica de marcadores de
481 alimentação saudável, Pesquisa Nacional de Saúde, Brasil 2013. *Epidemiologia*
482 *e Serviços de Saúde*, *24*(2), 267–276. doi:10.5123/S1679-49742015000200009

483 Kaltiala-Heino, R., Rimpelä, M., Rantanen, P., & Rimpelä, A. (2000). Bullying at
484 school—An indicator of adolescents at risk for mental disorders. *Journal of*
485 *Adolescence*, *23*(6), 661–674. doi:10.1006/jado.2000.0351

486 Kant, A. K. (2004). Dietary patterns and health outcomes. *Journal of the American*
487 *Dietetic Association*, *104*(4), 615–635. doi:10.1016/j.jada.2004.01.010

488 Kelly, E. V., Newton, N. C., Stapinski, L. A., Slade, T., Barrett, E. L., Conrod, P. J., &
489 Teesson, M. (2015). Suicidality, internalizing problems and externalizing

problems among adolescent bullies, victims and bully-victims. *Preventive Medicine*, *73*, 100–105. doi:10.1016/j.ypmed.2015.01.020

Kien, C. L., Bunn, J. Y., Tompkins, C. L., Dumas, J. A., Crain, K. I., Ebenstein, D. B., … Muoio, D. M. (2013). Substituting dietary monounsaturated fat for saturated fat is associated with increased daily physical activity and resting energy expenditure and with changes in mood. *The American Journal of Clinical Nutrition*, *97*(4), 689–697. doi:10.3945/ajcn.112.051730

Kieselbach, B., & Butchart, A. (2015). Preventing youth violence: An overview of the evidence. *World Health Organization*.

Krug, E. G., Mercy, J. A., Dahlberg, L. L., & Zwi, A. B. (2002). The world report on violence and health. *The Lancet*, *360*(9339), 1083–1088. doi:10.1016/S0140-6736(02)11133-0

Kulkarni, A. A., Swinburn, B. A., & Utter, J. (2015). Associations between diet quality and mental health in socially disadvantaged New Zealand adolescents. *European Journal of Clinical Nutrition*, *69*(1), 79–83. doi:10.1038/ejcn.2014.130

Lagerspetz, K. M. J., Björkqvist, K., Berts, M., & King, E. (1982). Group aggression among school children in three schools. *Scandinavian Journal of Psychology*, *23*(1), 45–52. doi:10.1111/j.1467-9450.1982.tb00412.x

Loch, A. P., Astolfi, R. C., Leite, M. A., Papa, C. H. G., Ryngelblum, M., Eisner, M., & Peres, M. F. T. (2020). Victims, bullies and bully–victims: Prevalence and association with negative health outcomes from a cross-sectional study in São Paulo, Brazil. *International Journal of Public Health*, *65*(8), 1485–1495. doi:10.1007/s00038-020-01481-5

Marques, E. S., Azeredo, C. M., & de Oliveira, A. G. e S. (2018). Co-occurrence of Health Risk Behaviors Among Brazilian Adolescent Victims of Family Violence. *Journal of Interpersonal Violence*, 1–17. doi:10.1177/0886260518786493

Moon, B., & Alarid, L. F. (2015). School Bullying, Low Self-Control, and Opportunity. *Journal of Interpersonal Violence*, *30*(5), 839–856. doi:10.1177/0886260514536281

Murray, A. L., Eisner, M., Ribeaud, D., Kaiser, D., McKenzie, K., & Murray, G. (2019). Validation of a Brief Self-Report Measure of Adolescent Bullying Perpetration and Victimization. *Assessment*, *28*(1), 128–140. doi:10.1177/1073191119858406

Murray, A. L., Zych, I., Ribeaud, D., & Eisner, M. (2020). Developmental relations between ADHD symptoms and bullying perpetration and victimization in adolescence. *Aggressive Behavior*, *47*(1), 58–68. doi:10.1002/ab.21930

Newby, P. K., & Tucker, K. L. (2004). Empirically Derived Eating Patterns Using Factor or Cluster Analysis: A Review. *Nutrition Reviews*, *62*(5), 177–203. doi:10.1111/j.1753-4887.2004.tb00040.x

O'Brennan, L. M., Bradshaw, C. P., & Sawyer, A. L. (2009). Examining developmental differences in the social-emotional problems among frequent bullies, victims, and bully/victims: Bullying and Social-Emotional Problems. *Psychology in the Schools*, *46*(2), 100–115. doi:10.1002/pits.20357

Oddy, W. H., Robinson, M., Ambrosini, G. L., O′Sullivan, T. A., de Klerk, N. H., Beilin, L. J., … Stanley, F. J. (2009). The association between dietary patterns and mental health in early adolescence. *Preventive Medicine*, *49*(1), 39–44. doi:10.1016/j.ypmed.2009.05.009

Olweus, D. (1993). *Bullying at school. What we know and what we can do*. Oxford, UK: Blackwell.

Olweus, D. (1995). Bullying or peer abuse at school: Facts and interventions. *Current Directions in Psychological Science*, 4, 196-200.

Pepler, D., Jiang, D., Craig, W., & Connolly, J. (2008). Developmental trajectories of bullying and associated factors. *Child Development, 79*(2), 325–338. doi:10.1111/j.1467-8624.2007.01128.x.

Peres, M. F. T., Eisner, M., Loch, A. P., Nascimento, A., Papa, C. H. G., Azeredo, C. M., ... Astolfi, R. (2018). *Violência, bullying e repercussões na saúde: Resultados do projeto São Paulo para o desenvolvimento social de crianças e adolescentes (SP-PROSO)* (p. 154). Departamento de Medicina Preventiva/FMUSP.

Puloka, 'I., Utter, J., Denny, S., & Fleming, T. (2017). Dietary behaviours and the mental well-being of New Zealand adolescents: Diet and mental health. *Journal of Paediatrics and Child Health*, *53*(7), 657–662. doi:10.1111/jpc.13524

Silva, G. R. R. e, Lima, M. L. C. de, Acioli, R. M. L., & Barreira, A. K. (2019). Prevalence and factors associated with bullying: Differences between the roles of bullies and victims of bullying. *Jornal de Pediatria*, *96*(6), 693–701. doi:10.1016/j.jped.2019.09.005

Smith, L., Jacob, L., Shin, J. I., Tully, M. A., Pizzol, D., López-Sánchez, G. F., … Koyanagi, A. (2021). Bullying victimization and obesogenic behaviour among adolescents aged 12 to 15 years from 54 low- and middle-income countries. *Pediatric Obesity*, *16*(1), e12700. doi:10.1111/ijpo.12700

Smokowski, P. R., & Kopasz, K. H. (2005). Bullying in School: An Overview of Types, Effects, Family Characteristics, and Intervention Strategies. *Children & Schools, 27*(2), 101–110. doi:10.1093/cs/27.2.101

Solnick, S. J., & Hemenway, D. (2012). The 'Twinkie Defense': The relationship between carbonated non-diet soft drinks and violence perpetration among Boston high school students. *Injury Prevention*, *18*(4), 259–263. doi:10.1136/injuryprev-2011-040117

StataCorp (2013). *Stata statistical software: Release 13*. College Station, TX: StataCorp LP.

Stewart, D., Sun, J., Patterson, C., Lemerle, K., & Hardie, M. (2004). Promoting and building resilience in primary school communities: evidence from a comprehensive 'health promoting school' approach. *International Journal of Mental Health Promotion, 6*(3), 26–33. doi:10.1080/14623730.2004.9721936

Suarez, E. C., Lewis, J. G., & Kuhn, C. (2002). The relation of aggression, hostility, and anger to lipopolysaccharide-stimulated tumor necrosis factor (TNF)-α by blood monocytes from normal men. *Brain, Behavior, and Immunity*, *16*(6), 675–684. doi:10.1016/S0889-1591(02)00019-3

Tandel, K. (2011). Sugar substitutes: Health controversy over perceived benefits. *Journal of Pharmacology and Pharmacotherapeutics*, *2*(4), 236. doi:10.4103/0976-500X.85936

Tavares, L. F., Castro, I. R. R. de, Levy, R. B., Cardoso, L. O., Passos, M. D. dos, & Brito, F. dos S. B. (2014). Validade relativa de indicadores de práticas alimentares da Pesquisa Nacional de Saúde do Escolar entre adolescentes do Rio de Janeiro, Brasil. *Cadernos de Saúde Pública, 30*(5), 1029–1041. doi:10.1590/0102-311x00000413

Tavares, L. F., Castro, I. R. R. de, Levy, R. B., Cardoso, L. de O., & Claro, R. M. (2014). Dietary patterns of Brazilian adolescents: Results of the Brazilian National School-Based Health Survey (PeNSE). *Cadernos de Saúde Pública*, *30*(12), 2679–2690. doi:10.1590/0102-311x00016814

Terranova, A. M., Morris, A. S., & Boxer, P. (2008). Fear Reactivity and Effortful Control in Overt and Relational Bullying: A Six-Month Longitudinal Study. *Aggressive Behavior, 34*(1), 104-115. doi:10.1002/ab.20232

Trapp, G. S. A., Allen, K. L., Black, L. J., Ambrosini, G. L., Jacoby, P., Byrne, S., … Oddy, W. H. (2016). A prospective investigation of dietary patterns and internalizing and externalizing mental health problems in adolescents. *Food Science & Nutrition*, *4*(6), 888–896. doi:10.1002/fsn3.355

United Nations Children's Fund. (2014). *Hidden in plain sight: A statistical analysis of violence against children*. UNICEF.

Wang, D., & Stewart, D. (2012). The implementation and effectiveness of school-based nutrition promotion programmes using a health-promoting schools approach: a systematic review. *Public Health Nutrition, 16*(6), 1082–1100. doi:10.1017/s1368980012003497

Wills, T. A., Isasi, C. R., Mendoza, D., & Ainette, M. G. (2007). Self-Control Constructs Related to Measures of Dietary Intake and Physical Activity in Adolescents. *Journal of Adolescent Health*, *41*(6), 551–558. doi:10.1016/j.jadohealth.2007.06.013

Zahedi, H., Kelishadi, R., Heshmat, R., Motlagh, M. E., Ranjbar, S. H., Ardalan, G., … Qorbani, M. (2014). Association between junk food consumption and mental health in a national sample of Iranian children and adolescents: The CASPIAN-IV study. *Nutrition*, *30*(11–12), 1391–1397. doi:10.1016/j.nut.2014.04.014

611 Zych, I., Farrington, D. P., Llorent, V. J., Ribeaud, D., & Eisner, M. P. (2020).
612 Childhood Risk and Protective Factors as Predictors of Adolescent Bullying
613 Roles. *International Journal of Bullying Prevention*. doi:10.1007/s42380-020-
614 00068-1

Table 1
Characteristics of the students' sample (SP-PROSO).

Variables	**Female** 47.4% % (95% CI)	**Male** 52.6% % (95% CI)	**Total** % (95% CI)
Age (mean)	14.73 (14.69-14.77)	14.93 (14.88-14.98)	14.81 (14.77-14.85)
Race/color			
White	45.4 (41.9-48.9)	43.1 (40.2-46.0)	45.6 (42.9-48.4)
Non-white	53.5 (50.0-59.2)	56.4 (53.6-59.2)	53.5 (50.7-56.2)
Non-response	1.1 (0.5-2.4)	0.5 (0.2-1.1)	0.9 (0.5-1.6)
Maternal educational level			
Incomplete middle school	11.8 (9.7-14.1)	12.4 (10.3-14.8)	11.3 (9.9-12.9)
Complete middle school	11.1 (9.3-13.2)	10.3 (8.7-12.3)	10.4 (9.0-11.9)
Complete high school	25.7 (22.5-29.2)	27.4 (24.4-30.7)	27.3 (24.4-30.5)
Complete higher education	27.0 (23.4-30.8)	22.8 (20.0-25.9)	26.4 (23.4 (29.8)
Non-response	24.4 (21.6-27.5)	27.0 (24.3-29.9)	24.5 (22.2-27.0)
Physical fitness			
< 420 min/week	92.7 (90.6-94.4)	88.0 (85.0-90.5)	93.5 (92.0-94.7)
≥ 420 min/week	7.2 (5.6-9.4)	12.0 (9.5-15.0)	6.5 (5.3-8.0)
Screen-based sedentary activities			
< 3h/day	33.8 (30.5-37.3)	32.6 (29.3-36.1)	33.2 (30.7-35.8)
≥ 3h/day	65.5 (62.1-68.7)	66.0 (62.4-69.5)	65.8 (63.2-68.2)
Non-response	0.6 (0.2-1.6)	1.3 (0.7-2.6)	1.0 (0.6-1.7)
Body Mass Index (BMI)			
Normal weight	67.5 (64.5-70.4)	68.0 (64.5-71.4)	67.8 (65.3-70.2)
Underweight	1.0 (0.5-1.9)	3.4 (2.3-5.1)	2.2 (1.5-3.3)
Overweight	31.0 (28.0-34.1)	27.5 (24.2-31.0)	29.2 (26.7-31.8)
Non-response	0.4 (0.2-1.1)	1.0 (0.5-2.0)	0.7 (0.4-1.3)
Food consumption*			
Beans	55.7 (51.8-59.5)	63.8 (60.0-67.4)	59.8 (57.1-62.4)
Raw/cooked vegetables	44.2 (40.7-47.6)	40.5 (37.4-43.6)	42.3 (39.8-44.7)
Fruit/fruit salad	39.5 (35.9-43.3)	37.1 (33.6-40.8)	38.3 (35.8-40.9)
Fried food/French fries	20.2 (17.6-23.2)	20.0 (17.0-23.5)	20.1 (18.2-22.3)
Sausages	21.6 (18.8-24.8)	21.5 (18.4-25.0)	21.6 (19.2-24.1)
Biscuits/cookies	44.2 (40.9-47.5)	37.1 (33.8-40.5)	40.6 (38.5-42.7)
Package snacks/Potato chips	24.1 (21.1-27.4)	21.0 (18.1-24.3)	22.5 (20.4-24.9)
Candies	45.7 (42.3-49.0)	30.7 (27.6-34.0)	38.0 (35.7-40.3)
Sugary beverages	48.7 (45.2-52.2)	44.1 (40.5-47.7)	46.3 (43.7-49.0)
Bullying role			
Noninvolved	66.4 (62.6-70.0)	67.1 (63.8-70.3)	66.8 (64.3-69.2)
Victim-only	23.1 (20.4-26.1)	14.5 (12.2-17.3)	18.7 (17.0-20.7)
Bully-only	3.1 (2.0-4.7)	6.6 (5.1-8.5)	4.9 (3.9-6.0)
Bully-victim	7.3 (5.4-9.7)	11.7 (9.6-14.2)	9.5 (8.1-11.2)
Bullying perpetration			
Any type	10.7 (8.6-13.3)	18.4 (16.2-21.0)	14.7 (13.1-16.6)
Social exclusion	3.4 (2.4-4.7)	5.1 (4.0-6.5)	4.3 (3.5-5.2)
Psychological/verbal	6.8 (5.3-8.8)	12.4 (10.6-14.5)	9.7 (8.5-11.2)
Physical aggression	2.2 (1.2-3.9)	4.1 (2.9-5.6)	3.2 (2.4-4.2)

Property destruction	2.8 (1.8-4.2)	7.6 (6.0-9.6)	5.3 (4.2-6.6)
Sexual harassment	1.3 (0.7-2.4)	2.0 (1.2-3.3)	1.6 (1.1-2.5)

*regular consumption: ≥ 5 times/week.

Table 2

Factor structure of food consumption among 9th-grade students from Sao Paulo, Brazil.

	Unhealthy dietary pattern	**Healthy dietary pattern**
Variables	Factor 1	Factor 2
Beans	0.1682	**0.5124**
Raw/cooked vegetables	0.0583	**0.8328**
Fruit/fruit salad	0.2092	**0.7556**
Fried food/French fries	**0.7460**	0.1376
Sausages	**0.7129**	0.1374
Biscuits/cookies	**0.7205**	0.1648
Package snacks/Potato chips	**0.7845**	0.1413
Candies	**0.6946**	0.0993
Sugary beverages	**0.6238**	0.0786
Eigenvalue	3.52	1.25
Explained variance (%)	34.96	18.09
Cumulative explained variance (%)	34.96	53.05

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Bold data reflect that the variable has loaded in the pattern.

Table 3

Multinomial regression (RR) of the association between dietary pattern and bullying role.

	Bullying role		
	Victim-only	**Bully-only**	**Bully-victim**
Dietary pattern	RR (95%CI)*	RR (95%CI)*	RR (95%CI)*
Healthy**	1.02 (0.89-1.17)	**0.67 (0.49-0.92)**	1.04 (0.87-1.25)
Unhealthy***	1.01 (0.88-1.17)	1.17 (0.97-1.42)	**1.29 (1.12-1.48)**

*adjusted for sociodemographic variables (sex, age, race/color and maternal educational level), physical activity, screen-based sedentary activities and BMI.

**Reference: not having a healthy dietary pattern.

***Reference: not having an unhealthy dietary pattern.

Bold data reflect significant risk relatives.

Table 4

Logistic regression (OR) of the association between dietary pattern and bullying perpetration.

	Bullying perpetration					
	Any type	**Social exclusion**	**Psychological/ verbal aggression**	**Physical aggression**	**Property destruction**	**Sexual harassment**
Dietary pattern	OR (95%CI)*	OR (95%CI)*	OR (95%CI)*	OR (95%CI)*	OR (95%CI)*	OR (95%CI)*
Healthy**	0.90 (0.77-1.06)	1.10 (0.80-1.51)	0.90 (0.74-1.10)	0.83 (0.63-1.08)	1.04 (0.86-1.25)	0.97 (0.69-1.36)
Unhealthy***	**1.24 (1.12-1.38)**	**1.39 (1.05-1.85)**	**1.24 (1.05-1.46)**	**1.52 (1.18-1.95)**	**1.38 (1.11-1.71)**	**1.71 (1.13-2.60)**

*adjusted for sociodemographic variables (sex, age, race/color and maternal educational level), physical activity, screen-based sedentary activities and BMI.

**Reference: not having a healthy dietary pattern.

***Reference: not having an unhealthy dietary pattern.

Bold data reflect significant odds ratios.

The association between dietary patterns and sexual harassment was also presented stratified by sex (interaction term statistically significant).

Table 5

Logistic regression (OR) of the association between dietary pattern and sexual harassment.

	Bullying perpetration	
	Sexual harassment	
	Male	Female
Dietary pattern	OR (95%CI)*	OR (95%CI)*
Healthy**	0.84 (0.50-1.43)	1.28 (0.76-2.17)
Unhealthy***	**2.10 (1.20-3.66)**	1.22 (0.60-2.48)

*adjusted for sociodemographic variables (age, race/color and maternal educational level), physical activity, screen-based sedentary activities and BMI.
**Reference: not having a healthy dietary pattern.
***Reference: not having an unhealthy dietary pattern.
Bold data reflect significant odds ratios.

5 ARTIGO 2: Association between ultra-processed dietary pattern and bullying: the role of deviant behaviors.

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Association between ultra-processed dietary pattern and bullying: the role of deviant behaviors.

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Abstract

Background: Ultra-processed foods has been associated with several negative outcomes, but it is not clear whether they are related to bullying perpetration. Moreover, no previous study has investigated the potential role of deviant behaviors as a mediator of this association. Our objective was to evaluate the association between ultra-processed dietary pattern and bullying, and the mediating effect of deviant behaviors in this association, among school adolescents. **Methods:** We used data from a representative sample of 9th grade Brazilian adolescents (N=2,212) from the Sao Paulo Project for the social development of children and adolescents (SP-PROSO). Exploratory factor analysis was used to obtain the dietary patterns, through questions of frequency of consumption in the last week of several food. The ultra-processed dietary pattern was considered as exposure. The outcomes were the types of bullying (any type, social exclusion, psychological/verbal aggression, physical aggression, property destruction, and sexual harassment). Deviant behaviors (mediator) were assessed through a score. Mediation analyses were carried out using logistic regression based on the KHB method. **Results:** After adjusting for covariates, the mediating effect of deviant behaviors was found in the association between ultra-processed dietary pattern and all the types of bullying perpetration, with a high mediation percentage for psychological/verbal aggression (40.1%). A small mediating effect of deviant behaviors in the association of ultra-processed dietary pattern with physical aggression (18.3%) and property destruction (18.2%) was observed, but this effect explained only a small portion of the total effect of such association (significant direct effect). **Conclusions:** The ultra-processed dietary pattern is associated with bullying, and the association is mediated through deviant behaviors. Policies and actions for improving the adolescent's diet and managing the adoption of deviant and bullying behaviors by this public are required.

Keywords: Ultra-processed food; Dietary patterns; Bullying; Deviant behavior; Mediation, Adolescents

Introduction

Bullying has become a major public health problem around the world [1,2] and is recognized as a subset of violent behavior that can be defined through three specific characteristics: intentionality, some repetitiveness, and power imbalance [3]. In Brazil, findings from PeNSE 2019 (Brazilian National School-Based Health Survey) indicated that 12% of adolescents aged 13 to 17 years reported having practiced bullying against their peers, with a higher percentage among boys (14.6%) than among girls (9.5%) [4].

In recent years, only a few studies have investigated the association between food consumption and violent behaviors [5,6], especially bullying perpetration [7-9]. Our latest research [10] found that adolescents who had an unhealthy dietary pattern were more likely to perpetrate overt (e.g. physical aggression) and covert (e.g. social exclusion) forms of bullying. The lack of investigation of this association is striking, considering the significant body of literature that joins nutritional elements to mental health [11,12], and ties problem behavior in childhood to specific aspects of brain development [13].

For optimal brain function, it is necessary to consume a sufficient amount of vitamins, minerals, and other nutrients such as folate, zinc, iron, magnesium, and polyunsaturated fatty acids [12], which are predominantly found *in natura* or minimally processed foods [14]. In Brazil, especially among adolescents [15], the consumption of these foods has been gradually replaced by the consumption of ultra-processed foods, defined according to the *NOVA* food classification system [16] as industry products, mostly or completely made from ingredients and containing little or no whole foods in its formulation. The physiological element of diet on bullying, in addition to social and environmental elements, proposes that an unhealthy diet may influence adolescent's behaviors by affecting the brain's structural development, brain neurotransmitters, and brain functions [17,18], which would contribute to engagement in bullying perpetration.

Among adolescents, there is a strong interrelationship between interpersonal violence, bullying behaviors and delinquency [19,20], which are offensive acts of violation of major rules, social norms and even the current judicial order [21]. Research shows that these deviant acts - e.g. bragging, lying, truancy, stealing, running away, and fighting - may be the result of an unhealthy eating [22,23] through the proposed physiological pathway [17,18] and are committed at an earlier age among future perpetrators [24]. This mechanism warrants the importance of investigate deviant behaviors as a possible mediator of the association between food consumption and bullying in adolescence.

Although the consumption of ultra-processed foods is increasing in the Brazilian diet [25] and the association between unhealthy eating and bullying perpetration has been reported in the literature [7-10], no study to date has evaluated bullying associated with the consumption of these foods through the dietary pattern [26], understanding that it can represent a wide combination of ultra-processed foods that are usually part of the adolescent's eating habits. Furthermore, as deviant behavior is a characteristic of those who bully especially the overt form [27], its mediating effect on the association between the consumption of ultra-processed foods and bullying needs to be clarified. In that regard, this study intends to elucidate the role of deviant behaviors on this association and assess different forms of bullying, possibly finding different mediation percentages of deviant behaviors for each type of perpetration, associated with the dietary pattern.

Therefore, the present study aims to evaluate the association between the consumption of ultra-processed foods and bullying perpetration, and to explore the mediating effect of deviant behaviors on this association, among school adolescents.

Methods

Data collection and sampling

We used data from the Sao Paulo Project for the social development of children and adolescents – SP-PROSO (*Projeto São Paulo para o desenvolvimento social de crianças e adolescentes*), a cross-sectional study conducted from August to November 2017 with a representative sample of 9th grade students from public and private schools in Sao Paulo, Brazil [28].

The sampling strategy used stratification by school type (state public schools, municipal public schools and private schools in Sao Paulo) and clustering by school class, considered as the primary sampling unit. Of the 156 schools selected, 128 were randomly selected to start data collection. The remaining schools were drawn as reserves, if it was necessary to complete the sample. After refusals (26 private schools and 8 public schools) and school non-response (3 private schools), 119 were included in the final sample. Eligible adolescents were those who were present in the classroom on the day of data collection, whose parents did not disallow them from participating, and who did not present any serious difficulty that might avoid understanding questions or prevent to answer them anonymously.

Participants were invited to sign an Informed Consent Term and to answer a paper-pencil structured questionnaire, with questions about sociodemographic and familiar characteristics, school environment, violence, and students' food consumption and physical activity. The questionnaire was based on models previously used in the longitudinal study Zurich Project on the Social Development of Children (Z-PROSO) and Montevideo Project for the Social Development of Children and Adolescents (*Proyecto Montevideo para el desarrollo social de niños y adolescentes*, M-PROSO), later translated to Portuguese.

Of the 2,816 ninth-grade students present on the survey day, 2,680 answered the questionnaire. The final sample size included in this study comprised 2,212 participants (Figure 1). More details of the sampling process are available in the SP-PROSO report [28].

Ultra-processed dietary pattern - exposure

The student's food consumption was evaluated by the weekly consumption of healthy (beans, raw/cooked vegetables, and fruit/fruit salad) and ultra-processed foods (sausages, biscuits/cookies, package snacks/potato chips, candies, and sugary beverages). The frequencies were grouped in a dichotomous variable (<5 times/week or ≥5 times/week), hereinafter referred to as regular consumption [29]. Subsequently, exploratory factor analysis was performed on the total sample to obtain the dietary patterns. This statistical method aggregates specific food items based upon the degree to which they are correlated with one another in the data set. Orthogonal (varimax) rotation was applied for greater interpretability. The number of selected factors was chosen through the scree plot preview. Food items with a loading factor greater than 0.30 were considered in identifying the two dietary patterns [30]. Only one of them – "ultra-processed dietary pattern" - was considered as the study's exposure. The sampling adequacy was assessed through the Kaiser-Meyer-Olkin (KMO) criteria, which takes values between 0 and 1, with small values generally meaning that variables have too little in common to justify a factor analysis. A value of KMO = 0.81 was obtained, meaning good adequacy [31].

Types of bullying perpetration - outcomes

In August 2017, the adolescents self-reported the frequency of bullying perpetration in the previous 12 months through five questions regarding specific types of perpetration, following the general question: "Since August 2016, how often have you (1) ignored or excluded on purpose, (2) made fun of or called names, (3) punched, kicked, bitten, or pulled the hair of, (4) taken, broken, or hidden on purpose some of the belongings of, and (5) sexually harassed other adolescent?". Possible answers were 1=never; 2=once or twice; 3=from 3 to 10 times; 4=once a month; 5=once a week;

6=every day. We classified as bullying perpetration when students reported having practiced this violence at least once a month in the last year [32]. Each type of bullying perpetration (any type, social exclusion, psychological/verbal aggression, physical aggression, property destruction, and sexual harassment) was considered as an outcome of the present study.

Deviant behaviors – mediator

We have some arguments that scientifically support us to consider deviant behaviors as a possible mediator of the association between ultra-processed dietary pattern and bullying perpetration. In addition to the physiological pathway explored in the literature [18,23,24], we examined whether ultra-processed dietary pattern was associated with bullying after controlling for deviant acts. After the adjustment, the ultra-processed dietary pattern remained significantly associated only with physical aggression and sexual harassment ($p<0.05$), which means that the association between exposure and the other types of bullying perpetration (social exclusion, psychological/verbal aggression, and property destruction) may occur via deviant behaviors.

We also have performed interaction analysis to test whether deviant behaviors would modify associations between the ultra-processed dietary pattern and our outcomes. As the interaction term was statistically significant only for the association between ultra-processed dietary pattern and sexual harassment ($p<0.05$), there is not enough evidence of effect modification by deviant behaviors, which leads us to test it as a mediator of our associations of interest.

Deviant behaviors were measured by the adolescent's engagement or not in 19 different types of delinquent acts in the previous 12 months to the survey, adapted from Nivette et al [33]. Acts included skipping class on purpose, cheating on school test, running away from home, stealing at home, stealing at school, shoplifting something worth more than 150 reais, shoplifting something worth less than 150 reais, vehicle theft, driving without a license, illegally downloading files from the internet, burglary and stealing from a car, drug dealing, using the train, bus or subway without having paid the ticket, graffitiing, vandalism, carrying a weapon, threatening and extortion, robbery, and assault. We opted for a variety score because it is generally considered a more valid indicator of an individual's involvement in deviant behavior (intensity of deviance) compared to frequency measures of the total number of deviant acts [34].

Covariates

We assessed sex (male, female), age (in years), skin color/race (white, non-white, nonresponse), maternal educational level (incomplete middle school, complete middle school, complete high school, complete higher education, non-response), physical fitness (<420 minutes/week, ≥420 minutes/week), screen-based sedentary activities (<3 hours/day, ≥3 hours/day, non-response), students' perception of community violence (low, medium, high), and school administrative status (private, public, non-response). These covariates may be considered as confounding variables, which are associated with both the outcome variable (bullying perpetration) and the exposure variable (ultra-processed dietary pattern), and should be appropriately controlled in the statistical analyses [35].

Data analyses

The analyses were performed taking into consideration the sample design and weights to represent the population of school adolescents from Sao Paulo. Figure 2 presents a directed acyclic graph (DAG) for the association between the ultra-processed dietary pattern and bullying perpetration, which was constructed using the DAGitty graphical interface [36]. All covariates were also included in the DAG, which graphically represents the probable causal structure between the study variables, in addition to identifying those that must be controlled to avoid analytical errors that can lead to false effect estimates [37]. First, a descriptive analysis of the total sample was performed

to obtain the percentages and their respective confidence intervals (95%CI) of the variables of interest. Mean and standard deviation for deviant behaviors (mediation variable) were also obtained. Then, to assess the role of deviant behaviors (see Figure 2) in the association between ultra-processed dietary pattern and bullying perpetration, mediational analyses were performed using logistic regression based on the KHB method proposed by Karlson, Holm, and Breen [37]. It decomposes the total effect (the effect of ultra-processed dietary pattern on bullying perpetration without the mediation variable) into direct effect (the effect of ultra-processed dietary pattern on bullying perpetration when controlling for the mediation variable) and indirect (mediating) effect (the effect of ultra-processed dietary pattern on bullying perpetration through the mediation variable).

The KHB method also allows for the calculation of the proportion of mediating effect, which is considered as the percentage of the main association that can be explained by the mediators. The mediational analyses were also controlled for all the above-mentioned covariates. Results were expressed as coefficients with their respective 95% confidence intervals. P-values <.05 were considered statistically significant, and all statistical analyses were performed using Stata SE version 13.0 software [38].

Results

The study sample characteristics are summarized in Table 1. Adolescents showed a similar distribution regarding sex (52.6% male) and had an average age of 14.9 years. Regular consumption (≥5 times/week) of sugary beverages (46.1%) and biscuits/cookies (40.9%) were the most frequent among adolescents. Regarding bullying perpetration, 14.6% of students perpetrated any type of bullying, with psychological/verbal bullying being the most frequent type (10.1%). The mean and standard deviation of deviant acts committed by adolescents were also presented.

For the whole sample, two dietary patterns were retained, explaining 53.66% of the variance. The first pattern consisting of sausages, biscuits/cookies, package snacks/potato chips, candies, and sugary beverages was labeled “ultra-processed dietary pattern” – the study's exposure. The other pattern which includes beans, raw/cooked vegetables, and fruit/fruit salad was labeled “healthy dietary pattern” (Table 2).

The results from the mediation analyses are shown in Table 3. After adjusting for potential confounders, the mediating effect (indirect effect) of deviant behaviors in the association of ultra-processed dietary pattern with all types of bullying perpetration was observed, highlighting that 38.2% of the association between ultra-processed dietary pattern and perpetration of any type of bullying was mediated by deviant behaviors. A similar mediation percentage (40.1%) was found for psychological/verbal aggression. The mediation percentages for the perpetration of social exclusion and sexual harassment were 20.8% and 12.4%, respectively. Our findings also indicated that deviant behaviors had positive effect on perpetration of physical aggression and property destruction, but this effect explained only a small portion of the effect of ultra-processed dietary pattern on these types of bullying (18.3% and 18.2%, respectively); in contrast, the direct effect of ultra-processed dietary pattern on perpetration of physical aggression (81.7%) and property destruction (81.8%) was major.

Discussion

This study found a mediating effect of deviant behaviors in the association of the ultra-processed dietary pattern with all types of bullying, with a high mediation percentage for psychological/verbal aggression (40.1%). Moreover, significant direct effects were found when analyzing the mediation of deviant behaviors in the association with physical aggression and property destruction.

There are two possible mechanisms to explain the association between the ultra-processed dietary pattern and bullying perpetration. The first shows that unhealthy diets, such as the Western dietary pattern, could be associated with greater involvement in delinquent and/or aggressive behaviors (e.g., lying, stealing, arguing, sudden mood swings, and temper tantrums), related to the

perpetration of bullying [23]. The Western diet is predominantly composed of foods rich in fructose, food dyes and preservatives [39] and that lack essential nutrients such as vitamins, Omega3 and minerals, denominated as ultra-processed foods [14]. Fried foods (chicken and fish 'nuggets'), commercially-baked goods (cakes, cookies, crackers), and packaged snacks (popcorn, potato chips, candy) [40] may lead to alterations in brain functions and communication between neurotransmitters like serotonin and dopamine [41]. Consequently, these alterations may be associated with an increase in deviant behavior, aggression and violence perpetrated by adolescents [22,41,42]. Furthermore, a previous study found that a high-palmitic acid diet (similar to the Western diet fat composition) induced a central inflammatory process in the body [43] by increasing the secretion of TNF-ά [44,45], which lead to more anger and hostility [46] and, consequently, to the perpetration of bullying.

In the second mechanism proposed, daily consumption of soft drink components (e.g., aspartame) may trigger frequent nervousness and irritability [47] due to high fluctuations in blood glucose levels [48] caused by the functional deficit in serotonergic neurons in the central nervous system [49], which can lead to deviant behavior and perpetration of bullying [22]. Some soft drinks (e.g. Coke) contain caffeine, which can be associated with conduct disorders and violent behavior among adolescents, due to several physiological actions in the central and peripheral nervous system [50].

According to our results, the deviant behaviors had a small positive mediating effect on the perpetration of physical aggression (18.3%) and property destruction (18.2%), which means that the association of the ultra-processed dietary pattern with these types of bullying (significant direct effect) may have occurred through mediators other than the deviant behaviors, which could not be tested in this study. To date, only one recent research [51] has evaluated the association between poor nutrition (e.g., high junk food intake) and bullying perpetration among deviant and non-deviant youths. The findings showed that bullying perpetration of non-deviant youth was more tightly influenced by high junk food intake than the bullying perpetration of deviant youth, due to their higher biological sensitivity to the effects of an unhealthy diet. According to the social push hypothesis [52], aggressive youths devoid of environmental risk - not involved in deviant behavior and without deviant peer affiliations - are often prone to be influenced by biosocial risk factors (such as nutritional inadequacies arising from unhealthy eating) that can "push" them towards aggressive acts, in relation to youths who are within a context of greater risk for deviant behavior. The idea is that the greater the intake of junk food, the less space available for the nutrients and chemicals needed to nourish the brain, which may lead to more violence [53]. The literature also indicates that adolescents who perpetrate overt forms of bullying (e.g. physical aggression and property destruction) have lower levels of fear reactivity and effortful control and commit more direct aggressive acts that generally break social norms [26], compared to perpetrators of covert violence [54].

Understanding how food consumption could be associated with bullying perpetration (e.g. via deviant behaviors) is essential for the adoption of approaches that can prevent or mitigate the violent behaviors among adolescents, since unhealthy eating represents a modifiable risk factor that can be improved through nutrition promotion initiatives [51,55] which incorporate healthy dietary components (e.g. vegetable and fruit consumption) into the adolescents' diet [56]. Some studies suggest incorporating these dietary components during the earliest stages of the life course [57,58], as they may help to reduce early-onset deviant behaviors and, in turn, decrease the perpetration of bullying. However, nutritional interventions during later stages of the life course can also generate beneficial effects [18,59], especially in schools, which can encourage the adoption of healthy behaviors (e.g. healthy diets, physical activity, rather than substance use, and delinquency) that improve adolescents' quality of life [60]. In Brazil, specifically in public schools, the National School Feeding Program (*Programa Nacional de Alimentação Escolar* - PNAE) encourages and ensures the right to adequate and healthy food for children and adolescents [61].

In schools, the literature indicates that teachers may influence the way students interact with each other [62], guiding and shaping their behavior through classroom pedagogical strategies [63-65] such as the circle time (or "group thinking time"). In this activity, students sit in a circle and teacher encourages them to explore issues relevant to the class (e.g. respecting the rights of others, bullying)

[60]. Thus, the adolescents acquire school connectedness [66] and internalize the moral norms of a safer and equal school environment, manifesting less aggressive and delinquent behaviors [67,68]. The partnership between teachers, school adolescents, and family is very important for young people to understand moral norms about deviant behavior and bullying and what is right and wrong in peer relationships [69,70].

Study strengths and limitations

There is a lack of international and national studies that evaluate the mediation of deviant behaviors in the association between food consumption and perpetration of bullying. To the best of our knowledge, this is the first study that assessed the association between an ultra-processed dietary pattern and different types of bullying, valuing its intentionality and repetitive feature [71], and also the mediating role of deviant behaviors on this association. This analysis allowed the obtainment of different mediation percentages depending on the type of perpetration reported by a significant sample of adolescents (overall response rate: 94.8%).

The SP-PROSO questions about food consumption in the past 7 days are similar to questions from the previously validated PeNSE questionnaire (Brazilian National School-Based Health Survey) in Brazil, allowing a broad assessment of food consumption even considering a small number of healthy and ultra-processed foods in the dietary patterns. A better evaluation of adolescent's eating habits was possible, through a combination of different food items and nutrients [27,72]. Moreover, following recommendations for culturally sensitive translations [73,74], the instrument was translated into Portuguese and pre-tested in five schools to better assess the phrasing and understanding of the questions by the students [28].

Despite the strengths, some limitations in our study warrant consideration. First, the study's cross-sectional design does not allow us to establish causal inferences between the ultra-processed dietary pattern and types of bullying perpetration. Future longitudinal studies should explore the possible causal links between these variables. Second, considering that SP-PROSO is a school-based survey, only adolescents attending school and present in class on data collection moments were included, which means that our results may not apply to perpetrators of bullying who miss classes or are not enrolled in regular education [75]. There was a notable sample loss, but a representative number of Brazilian 9th grade students was still assessed.

Our data were self-reported, which could result in some degree of misreporting (non-differential information bias) in questions about bullying engagement [76] and consequently underestimate the prevalence of this violence. Nonetheless, scores on the 10-item self-report measure of adolescent bullying (Z-PROSO) were validated and provided a reasonable general measure of perpetration that can be used for adolescents of all age groups [77]. Other studies have used similar questions for the same exposure [78,79] and outcomes [80], suggesting that we have properly identified them and enabling comparisons with our results.

Conclusion

The association between ultra-processed dietary pattern and bullying may occur via deviant behaviors (mediating effect), with different mediation percentages for each type of bullying perpetration. For physical aggression and property destruction, such association can also happen through pathways other than the mediator tested in this study. These findings are important for the planning and implementation of actions to prevent and manage delinquent behaviors and the practice of school violence, as well as actions to encourage healthy eating among adolescents.

Abbreviations: CI: Confidence intervals; DAG: directed acyclic graph; FAPESP: *Fundação de Amparo à Pesquisa do Estado de São Paulo*; KHB: Karlson, Holm, and Breen; KMO: Kaiser-Meyer-Olkin; M-PROSO: Montevideo Project for the Social Development of Children and Adolescents; PeNSE: Brazilian National School-Based Health Survey; PNAE: *Programa Nacional de Alimentação Escolar*; SP-PROSO: Sao Paulo Project for the social development of children and adolescents; TNF-ά: Tumor Necrosis Factor - Alpha; Z-PROSO: Zurich Project on the Social Development of Children.

Declarations

Ethics approval and consent to participate

SP-PROSO was approved by the Ethics and Research Committee of the University of Sao Paulo School of Medicine (research project 1.719.856), National Commission for Research Ethics (research project 2.014.816), and the 1964 Helsinki Declaration and its later amendments. No identification of the student or school was required in questionnaires, guaranteeing their anonymity.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

LMO and CMA participated in the conception and design of the study, statistical analyses, data interpretation, and manuscript writing. ESM, RBL, and MFTP participated in the interpretation of data, manuscript writing, and review. All authors (LMO, ESM, RBL, MFTP, and CMA) carried out a critical review of the manuscript's important intellectual content, approved the submitted final version, and agreed to be responsible for all aspects of the work, ensuring that issues related to the accuracy or integrity of any part of the work are investigated and resolved appropriately.

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References

1. Akanni OO, Olashore AA, Osasona SO, Uwadiae E. Predictors of bullying reported by perpetrators in a sample of senior school students in Benin City, Nigeria. S Afr J Psychiatr. 2020; 26: a1359. https://doi.org/10.4102/sajpsychiatry.v26i0.1359

2. Krug EG, Mercy JA, Dahlberg LL, Zwi AB. The world report on violence and health. Lancet. 2002; 360:1083–1088. https://doi.org/10.1016/S0140-6736(02)11133-0

3. Olweus D. School Bullying: Development and Some Important Challenges. Annu Rev Clin Psychol. 2013; 9: 751–780. https://doi.org/10.1146/annurev-clinpsy-050212-185516

4. Instituto Brasileiro de Geografia e Estatística. Pesquisa nacional de saúde do escolar: 2019. Coordenação de População e Indicadores Sociais, Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística [Internet]. 2021: 162 p. Available from: https://biblioteca.ibge.gov.br/visualizacao/livros/liv101852.pdf

5. Solnick SJ, Hemenway D. The 'Twinkie Defense': The relationship between carbonated non-diet soft drinks and violence perpetration among Boston high school students. Inj Prev. 2012; 18: 259–263. https://doi.org/10.1136/injuryprev-2011-040117

6. Trapp GS, Allen KL, Black LJ, Ambrosini GL, Jacoby P, Byrne S, et al. A prospective investigation of dietary patterns and internalizing and externalizing mental health problems in adolescents. Food Sci Nutr. 2016; 4: 888–896. https://doi.org/10.1002/fsn3.355

7. Bruckauf Z, Walsh SD. Adolescents' multiple and individual risk behaviors: Examining the link with excessive sugar consumption across 26 industrialized countries. Soc Sci Med. 2018; 216: 133–141. https://doi.org/10.1016/j.socscimed.2018.08.029

8. Jackson DB. Diet quality and bullying among a cross-national sample of youth. Prev Med. 2017; 105: 359–365. https://doi.org/10.1016/j.ypmed.2017.06.033

9. Zahedi H, Kelishadi R, Heshmat R, Motlagh ME, Ranjbar SH, Ardalan G, et al. Association between junk food consumption and mental health in a national sample of Iranian children and adolescents: The CASPIAN-IV study. Nutrition. 2014; 30: 1391–1397. https://doi.org/10.1016/j.nut.2014.04.014

10. Okada LM, Marques ES, Levy RB, Peres MFT, Azeredo CM. Association between dietary patterns and bullying among adolescents in Sao Paulo-Brazil. Int J Offender Ther Comp Criminol. 2022; 306624X221095017. https://doi.org/10.1177/0306624X221095017.

11. Black MM. Effects of Vitamin B12 and Folate Deficiency on Brain Development in Children. Food Nutr Bull. 2008; 29: S126–S131. https://doi.org/10.1177/15648265080292s117

12. Gómez-Pinilla F. Brain foods: the effects of nutrients on brain function. Nat Rev Neurosci. 2008; 9: 568–578. https://doi.org/10.1038/nrn2421

13. Schoemaker K, Mulder H, Deković M, Matthys W. Executive Functions in Preschool Children with Externalizing Behavior Problems: A Meta-Analysis. J Abnorm Child Psychol. 2012; 41: 457–471. https://doi.org/10.1007/s10802-012-9684-x

14. Monteiro CA, Cannon G, Levy RB, Moubarac J-C, Louzada MLC, Rauber F, et al. Ultra-processed foods: what they are and how to identify them. Public Health Nutr, Oxford. 2019;22: 936–41. https://doi.org/10.1017/S1368980018003762

15. Louzada MLC, Baraldi LG, Steele EM, Martins APB, Canella DS, Moubarac J-C, et al. Consumption of ultra-processed foods and obesity in Brazilian adolescents and adults. Prev Med. 2015; 81: 9–15. https://doi.org/10.1016/j.ypmed.2015.07.018

16. Monteiro CA, Cannon G, Moubarac J-C, Levy RB, Louzada MLC, Jaime PC. The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing. Public Health Nutr, Oxford. 2017; 21: 5–17. https://doi.org/10.1017/S1368980017000234

17. Beseler L. Effects on behavior and cognition: Diet and artificial colors, flavors, and preservatives. Int Pediatr. 1999; 14: 41-43.

18. Gesch CB, Hammond SM, Hampson SE, Eves A, Crowder MJ. Influence of supplementary vitamins, minerals and essential fatty acids on the antisocial behaviour of young adult prisoners: Randomized, placebo-controlled trial. Br J Psychiatry. 2002; 181: 22-28. https://doi.org/10.1192/bjp.181.1.22

19. Henggeler SW, Sheidow AJ. Empirically supported family-based treatments for conduct disorder and delinquency in adolescents. J Marital Fam Ther. 2012; 38: 30–58. https://doi.org/10.1111/j.1752-0606.2011.00244.x

20. Loeber R, Wung P, Keenan K, Giroux B, Southamer-Loeber M, van Kammen WB. Developmental pathways in disruptive child behavior. Dev Psychopathol. 1993; 5: 103–133. https://doi.org/10.1017/S0954579400004296

21. Murray J, Farrington DP. Risk factors for conduct disorder and delinquency: Key findings from longitudinal studies. Can J Psychiatry. 2010; 55: 633–642. https://doi.org/10.1177/070674371005501003

22. Benton D. The impact of diet on anti-social, violent and criminal behavior. Neurosci Biobehav Rev. 2007; 31: 752-774. https://doi.org/10.1016/j.neubiorev.2007.02.002

23. Oddy WH, Robinson M, Ambrosini GL, O'Sullivan TA, de Klerk NH, Beilin LJ, et al. The association between dietary patterns and mental health in early adolescence. Prev Med. 2009; 49: 39–44. https://doi.org/10.1016/j.ypmed.2009.05.009

24. Gonzalvo GO. Delinquent adolescents: health problems and health care guidelines for juvenile correctional facilities. An Esp Pediatr. 2002; 57: 345–353. PMID: 12392669

25. Martins APB, Levy RB, Claro RM, Moubarac JC, Monteiro CA. Participação crescente de produtos ultraprocessados na dieta brasileira (1987-2009). Rev Saude Publica. 2013; 47: 656–665. https://doi.org/10.1590/s0034-8910.2013047004968

26. Newby PK, Tucker KL. Empirically derived eating patterns using factor or cluster analysis: A review. Nutr Rev. 2004; 62: 177–203. https://doi.org/10.1111/j.1753-4887.2004.tb00040.x

27. Aslund C, Starrin B, Leppert J, Nilsson KW. Social status and shaming experiences related to adolescent overt aggression at school. Aggress Behav. 2009; 35: 1–13. https://doi.org/10.1002/ab.20286

28. Peres MFT, Eisner M, Loch AP, Nascimento A, Papa CHG, Azeredo CM, et al. Violência, *bullying* e repercussões na saúde: resultados do projeto São Paulo para o desenvolvimento social de crianças e adolescentes (SP-PROSO). Departamento de Medicina Preventiva/FMUSP [Internet]. 2018; 154 p. Available from: https://sites.usp.br/sp-proso/wp-content/uploads/sites/526/2019/06/relatorio_sp_proso_26_05_2019.pdf

29. Azeredo CM, Rezende LF, Canella DS, Claro RM, Castro IRR, Luiz OC, et al. Dietary intake of Brazilian adolescents. Public Health Nutr. 2015; 18: 1215–1224. https://doi.org/10.1017/S1368980014001463

30. Costello AB, Osborne J. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. Pract Assess Res Eval. 2005; 10: 7. https://doi.org/10.7275/JYJ1-4868

31. Hutcheson GD, Sofroniou N. The multivariate social scientist: Introductory statistics using generalized linear models. 1999; SAGE.

32. Trajtenberg N, Eisner M. Towards a more effective violence prevention policy in Uruguay. Institute of Criminology. 2015; University of Cambridge. ISBN: 978-9974-8470-6-4

33. Nivette A, Echelmeyer L, Weerman F, Eisner M, Ribeaud D. Understanding Changes in Violent Extremist Attitudes During the Transition to Early Adulthood. J Quant Criminol. 2022; 38: 949-978. https://doi.org/10.1007/s10940-021-09522-9

34. Sweeten G. Scaling criminal offending. J Quant Criminol. 2012; 28: 533–557. https://doi.org/10.1007/s10940-011-9160-8

35. Skelly AC, Dettori JR, Brodt ED. Assessing bias: the importance of considering confounding. Evid Based Spine Care J. 2012; 3: 9–12. https://doi.org/10.1055/s-0031-1298595

36. *DAGitty Online Browser*. Available online at: http://www.dagitty.net/dags.html# (accessed Jan 23, 2023).

37. Greenland S, Pearl J, Robins JM. Causal diagrams for epidemiologic research. Epidemiology. 1999; 10: 37-48. PMID: 9888278

38. Breen R, Karlson KB, Holm A. Total, Direct, and Indirect Effects in Logit and Probit Models. Sociol Methods Res. 2013; 42: 164-191. https://doi.org/10.1177/0049124113494572

39. StataCorp. (2013). Stata statistical software: Release 13. StataCorp LP.

40. Stitt BR. Food & Behavior - Nutritional Guidelines for Correcting Behavior. 1999.

41. Simopoulos AP. Genetic variation and nutrition. Nutr Rev. 1999; 57: 10-19. https://doi.org/10.1111/j.1753-4887.1999.tb01783.x

42. Sharma J. Nutritional correlates of aggressive behavior. Violence and Conflict Resolution. 2009; Contemporary Perspectives, 157-163.

43. Hibbeln JR, Umhau JC, Linnoila M, George DT, Ragan PW, Shoaf SE, et al. A replication study of violent and nonviolent subjects: Cerebrospinal fluid metabolites of serotonin and dopamine are predicted by plasma essential fatty acids. Biol Psychiatry. 1998; 44: 243-249. https://doi.org/10.1016/s0006-3223(98)00143-7

44. Cintra DE, Ropelle ER, Moraes JC, Pauli JR, Morari J, Souza CT, et al. Unsaturated fatty acids revert diet-induced hypothalamic inflammation in obesity. PLoS One. 2012; 7: e30571. https://doi.org/10.1371/journal.pone.0030571

45. Coll T, Eyre E, Rodríguez-Calvo R, Palomer X, Sánchez RM, Merlos M, et al. Oleate reverses palmitate-induced insulin resistance and inflammation in skeletal muscle cells. J Biol Chem. 2008; 283: 11107–11116. https://doi.org/10.1074/jbc.M708700200

46. Suarez EC, Lewis JG, Kuhn C. The relation of aggression, hostility, and anger to lipopolysaccharide-stimulated tumor necrosis factor (TNF)-alpha by blood monocytes from normal men. Brain Behav Immun. 2002; 16: 675–684. https://doi.org/10.1016/S0889-1591(02)00019-3

47. Kien CL, Bunn JY, Tompkins CL, Dumas JA, Crain KI, Ebenstein DB, et al. Substituting dietary monounsaturated fat for saturated fat is associated with increased daily physical activity and resting energy expenditure and with changes in mood. Am J Clin Nutr. 2013; 97: 689–697. https://doi.org/10.3945/ajcn.112.051730

48. Holubcikova J, Kolarcik P, Madarasova Geckova A, Reijneveld SA, van Dijk JP. The mediating effect of daily nervousness and irritability on the relationship between soft drink consumption and aggressive behaviour among adolescents. Int J Public Health. 2015; 60: 699–706. https://doi.org/10.1007/s00038-015-0707-6

501 49. Tandel KR. Sugar substitutes: Health controversy over perceived benefits. J Pharmacol
502 Pharmacother. 2011; 2: 236–243. https://doi.org/10.4103/0976-500X.85936

503 50. Kanarek RB. Nutrition and violent behavior. Understanding and Preventing Violence. 1994; 2:
504 1-33.

505 51. Kristjansson AL, Sigfusdottir ID, Frost SS, James JE. Adolescent Caffeine Consumption and
506 Self-Reported Violence and Conduct Disorder. J Youth Adolesc. 2013; 42: 1053–1062.
507 https://doi.org/10.1007/s10964-013-9917-5

508 52. Jackson DB, Vaughn MG, Salas-Wright CP. Poor nutrition and bullying behaviors: A
509 comparison of deviant and non-deviant youth. J Adolesc. 2017; 57: 69–73.
510 https://doi.org/10.1016/j.adolescence.2017.03.008

511 53. Raine A. The anatomy of violence: The biological roots of crime. 2013; Vintage.

512 54. Du Y. You may be what you eat, can you be violent due to your food? European j biomed
513 pharm sci. 2019; 6: 20-28. ISSN 2349-8870

514 55. Terranova AM, Morris AS, Boxer P. Fear reactivity and effortful control in overt and relational
515 bullying: A six-month longitudinal study. Aggress Behav. 2008; 34: 104–115.
516 https://doi.org/10.1002/ab.20232

517 56. Wang D, Stewart D. The implementation and effectiveness of school-ased nutrition promotion
518 programmes using a health-promoting schools approach: A systematic review. Public Health Nutr.
519 2013; 16: 1082–1100. https://doi.org/10.1017/S1368980012003497

520 57. Jackson DB. The link between poor quality nutrition and childhood antisocial behavior: A
521 genetically informative analysis. J Crim Justice. 2016; 44: 13–20.
522 https://doi.org/10.1016/j.jcrimjus.2015.11.007

523 58. Raine A, Mellingen K, Liu J, Venables P, Mednick SA. Effects of environmental enrichment at
524 ages 3–5 years on schizotypal personality and antisocial behavior at ages 17 and 23 years. Am J
525 Psychiatry. 2003; 160: 1627–1635. https://doi.org/10.1176/appi.ajp.160.9.1627

526 59. Benton D. The influence of children's diet on their cognition and behavior. Eur J Nutr. 2008;
527 47: 25–37. https://doi.org/10.1007/s00394-008-3003-x

528 60. Zaalberg A, Nijman H, Bulten E, Stroosma L, van der Staak C. Effects of nutritional
529 supplements on aggression, rule-breaking, and psychopathology among young adult prisoners.
530 Aggress Behav. 2009; 36: 117–126. https://doi.org/10.1002/ab.20335

531 61. World Health Organization. Mental health in schools: a manual. Cairo: WHO Regional Office
532 for the Eastern Mediterranean; 2021. Licence: CC BY-NC-SA 3.0 IGO.

533 62. Ministry of Education. Resolution No. 6, of May 8, 2020. National Education Development
534 Fund; 2020. https://www.fnde.gov.br/index.php/acesso-a-
535 informacao/institucional/legislacao/item/13511-resolu%C3%A7%C3%A3o-n%C2%BA-6,-de-08-
536 de-maio-de-2020 Accessed 25 feb 2023.

537 63. Nivette A, Obsuth I, Ribeaud D, Eisner M. Fair Teachers, Fair Police? Assessing the Pathways
538 between Perceptions of Teacher and Police Authority in Childhood and Adolescence. J Youth
539 Adolesc. 2022; 51: 193–207. https://doi.org/10.1007/s10964-021-01537-6

540 64. Berkowitz MW. What works in values education. Int J Educ Res. 2011; 50: 153–158.
541 https://doi.org/10.1016/j.ijer.2011.07.003

542 65. Buzzelli CA. The moral implications of teacher-child discourse in early childhood classrooms.
543 Early Child Res Q. 1996; 11: 515–534. https://doi.org/10.1016/S0885-2006(96)90020-4

544 66. Nucci LP. Education in the Moral Domain. 2001; Cambridge: Cambridge University Press.

545 67. Loukas A, Roalson LA, Herrera DE. School Connectedness Buffers the Effects of Negative
546 Family Relations and Poor Effortful Control on Early Adolescent Conduct Problems. J Res
547 Adolesc. 2010; 20: 13–22. https://doi.org/10.1111/j.1532-7795.2009.00632.x

548 68. Obsuth I, Murray AL, Knoll M, Ribeaud D, Eisner M. Teacher-student relationships in
549 childhood as a protective factor against adolescent delinquency up to age 17: A propensity score
550 matching approach. Crime Delinq. 2023; 69: 727-755.
551 https://doi.org/10.1177/00111287211014153.

552 69. Wang C, Swearer SM, Lembeck P, Collins A, Berry B. Teachers matter: An examination of
553 student-teacher relationships, attitudes towards bullying, and bullying behavior. J Appl Sch
554 Psychol. 2015; 31: 219–238. https://doi.org/10.1080/15377903.2015.1056923

555 70. Smetana JG, Jambon M, Ball C. Normative changes and individual differences in early moral
556 judgments: a constructivist developmental perspective. Hum Dev. 2018; 61: 264–280.
557 https://doi.org/10.1159/000492803

558 71. Stewart D, Sun J, Patterson C, Lemerle K, Hardie M. Promoting and building resilience in
559 primary school communities: Evidence from a comprehensive 'health promoting school' approach.
560 Int. J. Ment. Health Promot. 2004; 6: 26–33. https://doi.org/10.1080/14623730.2004.9721936

561 72. Olweus D. Bullying at school. What we know and what we can do. 1993; Blackwell.

562 73. Kant AK. Dietary patterns and health outcomes. J Am Diet Assoc. 2004; 104: 615–635.
563 https://doi.org/10.1016/j.jada.2004.01.010

564 74. Behr D, Shishido K. The translation of measurement instruments for cross-cultural surveys. In:
565 Wolf C, Joye D, Smith TW, Fu Y. (Eds.), The SAGE handbook of survey methodology (pp. 269–
566 287); 2016; SAGE.

567 75. Eisner M, Ribeaud D. Conducting a criminological survey in a culturally diverse context:
568 Lessons from the Zurich Project on the social development of children. Eur. J. Criminol. 2007; 4:
569 271–298. https://doi.org/10.1177/1477370807077183

570 76. Gubbels J, van der Put CE, Assink M. Risk factors for school absenteeism and dropout: A meta-
571 analytic review. J Youth Adolesc. 2019; 48: 1637–1667. https://doi.org/10.1007/s10964-019-
572 01072-5

573 77. Cornell DG, Lovegrove PJ, Baly MW. Invalid survey response patterns among middle school
574 students. Psychol Assess. 2014; 26: 277–287. https://doi.org/10.1037/a0034808

575 78. Murray AL, Eisner M, Ribeaud D, Kaiser D, McKenzie K, Murray G. Validation of a brief self-
576 report measure of adolescent bullying perpetration and victimization. Assessment. 2021; 28: 128–
577 140. https://doi.org/10.1177/1073191119858406

578 79. Barros MBA, Lima MG, Azevedo RCS, Medina LBP, Lopes CS, Menezes PR, et al. Depression
579 and health behaviors in Brazilian adults - PNS 2013. Rev Saude Publica, 2017; 51, 8s.
580 https://doi.org/10.1590/S1518-8787.2017051000084

581 80. Tavares LF, Castro IR, Levy RB, Cardoso LO, Claro RM. Dietary patterns of Brazilian
582 adolescents: Results of the Brazilian National School-Based Health Survey (PeNSE). Cad Saude
583 Publica. 2014; 30: 2679–2690. https://doi.org/10.1590/0102-311X00016814

584 81. Murray AL, Zych I, Ribeaud D, Eisner M. Developmental relations between ADHD symptoms
585 and bullying perpetration and victimization in adolescence. Aggress Behav. 2021; 47: 58–68.
586 https://doi.org/10.1002/ab.21930

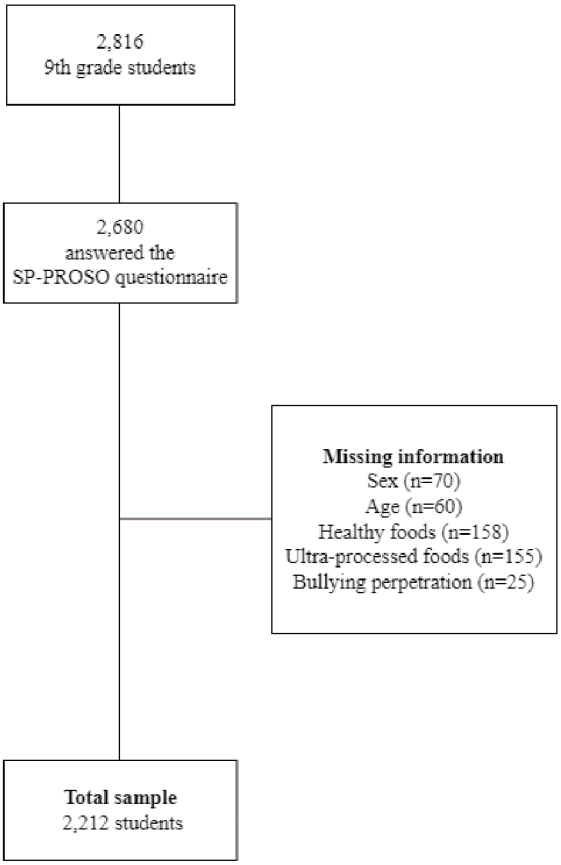

Figure 1. Flowchart of the total study sample (9th grade students), SP-PROSO.

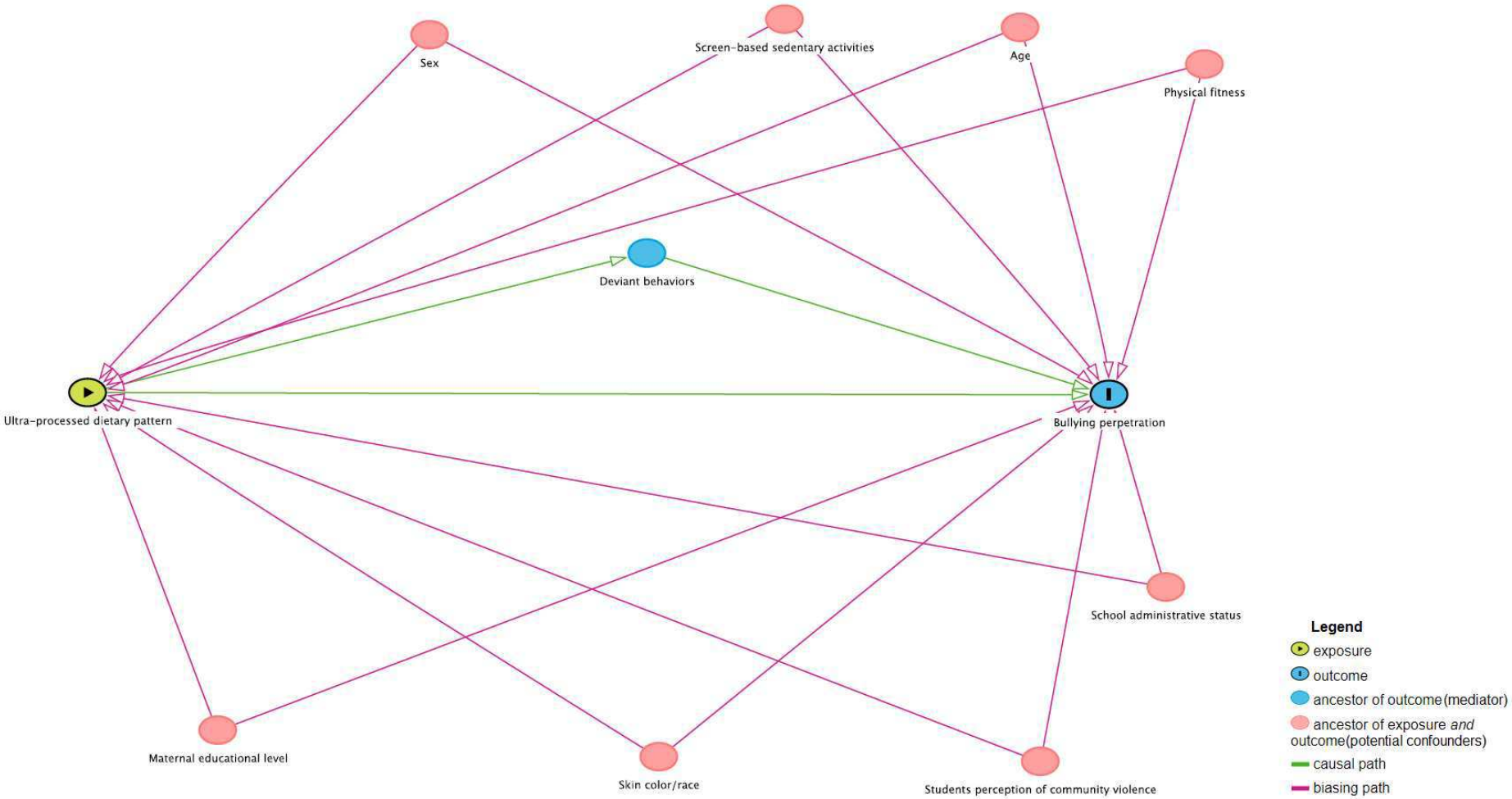

Figure 2. Directed acyclic graph (DAG) for the association between ultra-processed dietary pattern and bullying perpetration.

Table 1. Description of the sample (9th grade students), SP-PROSO. (n=2,680)

Variables	Total
Sex	
Male	52.6 (50.9-54.3)
Female	47.4 (45.7-49.1)
Age (mean)	14.88 (0.69)
Race/color	
White	43.8 (41.3-46.4)
Non-white	55.2 (52.7-57.8)
Non-response	0.9 (0.5-1.5)
Maternal educational level	
Incomplete middle school	12.4 (10.9-14.0)
Complete middle school	10.6 (9.4-12.0)
Complete high school	26.3 (23.6-29.3)
Complete higher education	24.8 (21.9-27.8)
Non-response	25.8 (23.7-28.1)
Physical fitness	
< 420 min/week	89.7 (87.5-91.5)
≥ 420 min/week	10.3 (8.4-12.5)
Screen-based sedentary activities	
< 3h/day	34.5 (32.2-37.0)
≥ 3h/day	62.3 (59.8-64.8)
Non-response	3.1 (2.2-4.3)
Students' perception of community violence	
Low	36.8 (34.1-39.6)
Medium	33.1 (30.8-35.4)
High	30.1 (27.5-32.8)
School administrative status	
Private	30.2 (28.4-32.2)
Public	66.0 (61.0-70.6)
Non-response	3.7 (1.1-12.1)
Food consumption[a]	
Sausages	21.8 (19.6-24.2)
Biscuits/cookies	40.9 (38.9-43.0)
Package snacks/Potato chips	23.3 (21.3-25.4)
Candies	37.8 (35.5-40.0)
Sugary beverages	46.1 (43.6-48.7)
Bullying perpetration	
Any type	14.6 (12.8-16.6)
Social exclusion	4.4 (3.6-5.4)
Psychological/verbal	10.1 (8.9-11.4)
Physical aggression	3.2 (2.4-4.2)
Property destruction	5.6 (4.5-7.0)
Sexual harassment	1.8 (1.3-2.6)
Deviant behaviors (mean)	2.44 (2.13)

Data presented as % (95% CI) or mean (standard deviation).
[a]regular consumption: ≥ 5 times/week.

Table 2. Factor structure of food consumption among 9th grade students, SP-PROSO. (n=2,212)

	Ultra-processed dietary pattern	**Healthy dietary pattern**
Variables	Factor 1	Factor 2
Beans	0.1855	**0.4999**
Raw/cooked vegetables	0.0481	**0.8366**
Fruit/fruit salad	0.2032	**0.7579**
Sausages	**0.6616**	0.1685
Biscuits/cookies	**0.7594**	0.1539
Package snacks/Potato chips	**0.7779**	0.1524
Candies	**0.7336**	0.0807
Sugary beverages	**0.6690**	0.0600
Eigenvalue	3.05	1.23
Explained variance (%)	33.54	20.12
Cumulative explained variance (%)	33.54	53.66

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Bold data reflect that the variable has loaded in the pattern.

Table 3. Logistic regression analyses of the association between ultra-processed dietary pattern and bullying perpetration (outcome) with deviant behaviors as mediator (KHB method), SP-PROSO. (n=2,209)

	Bullying perpetration											
	Any type		Social exclusion		Psychological/verbal		Physical aggression		Property destruction		Sexual harassment	
Mediators	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Total	**0.18**	**(0.04-0.32)**	**0.27**	**(0.01-0.52)**	0.14	(-0.02-0.31)	**0.48**	**(0.21-0.75)**	**0.29**	**(0.06-0.52)**	**0.50**	**(0.03-0.99)**
Direct	0.11	(-0.03-0.25)	0.21	(-0.04-0.47)	0.08	(-0.08-0.25)	**0.39**	**(0.12-0.66)**	**0.24**	**(0.01-0.46)**	0.44	(-0.03-0.92)
Indirect	**0.07**	**(0.04-0.10)**	**0.06**	**(0.02-0.09)**	**0.06**	**(0.03-0.09)**	**0.09**	**(0.04-0.13)**	**0.05**	**(0.02-0.08)**	**0.06**	**(0.02-0.10)**
Mediation percentage	**38.2%**	__	**20.8%**	__	**40.1%**	__	**18.3%**	__	**18.2%**	__	**12.4%**	__

Notes: All models were adjusted for sex, age, race/color, maternal educational level, physical fitness, screen-based sedentary activities, students' perception of community violence, and school administrative status. CI = confidence interval. In bold, significant associations ($p<0.05$).

6 REFERÊNCIAS

ANDRADE, S. C.; PREVIDELLI, Á. N.; CESAR, C. L.; MARCHIONI, D. M.; FISBERG, R. M. Trends is diet quality among adolescentes, adults and older adults: a population based study. **Preventive Medicine Reports**, [*s. l.*], v. 4, p. 391-396, Jul. 2016. DOI: https://doi.org/10.1016/j.pmedr.2016.07.010. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4990660/pdf/main.pdf. Acesso em: 25 mar. 2023.

AZEREDO, C. M.; DE REZENDE, L. F. M.; CANELLA, D. S.; CLARO, R. M.; PERES, M. F. T.; LUIZ, O. C.; FRANÇA-JUNIOR, I.; KINRA, S.; HAWKESWORTH, S.; LEVY, R. B. Food environments in schools and in the immediate vicinity are associated with unhealthy food consumption among Brazilian adolescents. **Preventive Medicine**, [*s. l.*], v. 88, p. 73–79, Jul. 2016. DOI: https://doi.org/10.1016/j.ypmed.2016.03.026. Disponível em: https://pubmed.ncbi.nlm.nih.gov/27050024/. Acesso em: 25 mar. 2023.

AZEREDO, C. M.; LEITE, M. A.; RAUBER, F.; RICARDO, C. Z.; LEVY. R. B. Are laws restricting soft drinks sales in Brazilian schools able to lower their availability? **Revista de Saúde Pública**, São Paulo, v. 54, n. 42, Apr. 2020. DOI: https://doi.org/10.11606/s1518-8787.2020054001227. Disponível em: https://www.scielo.br/j/rsp/a/6C87DTgrwFYyjrmTx8hcrXz/?lang=en. Acesso em: 25 mar. 2023.

BANDURA, A. Social learning theory of aggression. **The Journal of Communication**, [*s. l.*], v. 28, n. 3, p. 12-29, Summer. 1978. DOI: https://doi.org/10.1111/j.1460-2466.1978.tb01621.x. Disponível em: https://pubmed.ncbi.nlm.nih.gov/690254/. Acesso em: 25 mar. 2023.

BANTA, J. E.; KHOIE-MAYER, R. N.; SOMAIYA, C. K.; MCKINNEY, O.; SEGOVIA-SIAPCO, G. Mental health and food consumption among California children 5-11 years of age. **Nutrition and Health**, [*s. l.*], v. 22, n. 3-4, p. 237-253, Jul-Oct. 2013. DOI: https://doi.org/10.1177/0260106015599511. Disponível em: https://pubmed.ncbi.nlm.nih.gov/26399270/. Acesso em: 25 mar. 2023.

BEZERRA, J. A. B. **Educação alimentar e nutricional**: articulação de saberes. Fortaleza: Edições UFC, 2018.

BENTO, B. M. A.; MOREIRA, A. DA C.; DO CARMO, A. S.; DOS SANTOS, L. C.; HORTA, P. M. A higher number of school meals is associated with a less-processed diet. **Jornal de Pediatria**, Rio de Janeiro, v. 94, n. 4, p. 404-409, Jul-Aug. 2018. DOI: https://doi.org/10.1016/j.jped.2017.07.016. Disponível em: https://www.sciencedirect.com/science/article/pii/S0021755717301936?via%3Dihub. Acesso em: 25 mar. 2023.

BENTON, D. The impact of diet on anti-social, violent and criminal behaviour. **Neuroscience and biobehavioral reviews**, [*s. l.*], v. 31, n. 5, p. 752–774, 2007. DOI: https://doi.org/10.1016/j.neubiorev.2007.02.002. Disponível em: https://www.sciencedirect.com/science/article/abs/pii/S0149763407000206?via%3Dihub. Acesso em: 25 mar. 2023.

BESELER, L. Effects on behavior and cognition: diet and artificial colors, flavors, and preservatives. **International Pediatrics**, [*s. l.*], v. 14, n. 1, p. 41-43, 1999. Disponível em: http://www.int-pediatrics.org/Volume%2014/14-1toc.htm. Acesso em: 25 mar. 2023.

BJÖRKQVIST, K.; EKMAN, K.; LAGERSPETZ, K. Bullies and victims: their ego picture, ideal ego picture and normative ego picture. **Scandinavian Journal of Psychology**, [*s. l.*], v. 23, n.1, p. 307-313, 1982. DOI: https://doi.org/10.1111/j.1467-9450.1982.tb00445.x. Disponível em: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-9450.1982.tb00445.x. Acesso em: 25 mar. 2023.

BOND, L.; CARLIN, J. B.; THOMAS, L.; RUBIN, K.; PATTON, G. Does bullying cause emotional problems? A prospective study of young teenagers. **British Medical Journal**, [*s. l.*], v. 323, n. 7311, p. 480-484, Sep. 2001. DOI: https://doi.org/10.1136/bmj.323.7311.480. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC48131/. Acesso em: 25 mar. 2023.

BOZZINI, A. B., MARUYAMA, J. M., SANTOS, I. S., MURRAY, J., TOVO-RODRIGUES, L., MUNHOZ, T. N., MATIJASEVICH, A. Prevalence of adolescent risk behaviors at 11 and 15 years of age: data from the 2004 Pelotas birth cohort. **Brazilian Journal of Psychiatry**, São Paulo, v. 45, n. 2, p. 102-111, Mar-Apr. 2023. DOI: https://doi.org/10.47626/1516-4446-2022-2753. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10154011/pdf/bjp-45-02-102.pdf. Acesso em: 25 mar. 2023.

BRASIL. **Decreto nº 6.286, de 5 de dezembro de 2007.** Institui o Programa Saúde na Escola - PSE, e dá outras providências. Brasília, DF: Presidência da República, 2007. Disponível em: https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/decreto/d6286.htm. Acesso em: 07 jun. 2023.

BRASIL. Ministério da Saúde. **Guia alimentar para a população brasileira.** 2.ed. 1. reimpr. Brasília: Ministério da Saúde, 2014. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/guia_alimentar_populacao_brasileira_2ed.pdf. Acesso em: 25 mar. 2023.

BRASIL. **Lei nº 13.431, de 4 de abril de 2017.** Estabelece o sistema de garantia de direitos da criança e do adolescente vítima ou testemunha de violência e altera a Lei nº 8.069, de 13 de julho de 1990 (Estatuto da Criança e do Adolescente). Brasília, DF: Presidência da República, 2017. Disponível em: http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2017/lei/l13431.htm. Acesso em: 10 fev. 2023.

BRASIL. **Resolução nº 06, de 8 de maio de 2020.** Dispõe sobre o atendimento da alimentação escolar aos alunos da educação básica no âmbito do Programa Nacional de Alimentação Escolar - PNAE. Ministério da Educação: Fundo Nacional de Desenvolvimento da Educação, 2020. Disponível em: https://www.gov.br/fnde/pt-br/acesso-a-informacao/legislacao/resolucoes/2020/resolucao-no-6-de-08-de-maio-de-2020/view#:~:text=Disp%C3%B5e%20sobre%20o%20atendimento%20da,Nacional%20de%20Alimenta%C3%A7%C3%A3o%20Escolar%20%E2%80%93%20PNAE. Acesso em: 03 mar. 2023.

BRUCKAUF, Z.; WALSH, S. D. Adolescents' multiple and individual risk behaviors: Examining the link with excessive sugar consumption across 26 industrialized countries. **Social Science & Medicine**, [*s. l.*], v. 216, p. 133-141, Nov. 2018. DOI: https://doi.org/10.1016/j.socscimed.2018.08.029. Disponível em: https://www.sciencedirect.com/science/article/abs/pii/S0277953618304532?via%3Dihub. Acesso em: 25 mar. 2023.

BUCCI, R.; STAFF, J. Pubertal timing and adolescent delinquency. **Criminology**, [*s. l.*], v. 58, n. 3, p. 537–567, Aug. 2020. DOI: https://doi.org/10.1111/1745-9125.12245. Disponível em: https://onlinelibrary.wiley.com/doi/abs/10.1111/1745-9125.12245. Acesso em: 25 mar. 2023.

BUTTERWORTH, R. F. Neurotransmitter function in thiamine deficiency encephalopathy. **Neurochemistry International**, [*s. l.*], v. 4, n. 6, p. 449-602, 1982. DOI: https://doi.org/10.1016/0197-0186(82)90033-x. Disponível em: https://pubmed.ncbi.nlm.nih.gov/20487899/. Acesso em: 25 mar. 2023.

CAMPOS, H. M.; SCHALL, V. T.; NOGUEIRA, M. J. Saúde sexual e reprodutiva de adolescentes: interlocuções com a Pesquisa Nacional de Saúde do Escolar (PeNSE). **Saúde em Debate**, [*s. l.*], v. 37, n. 97, p. 336-346, Abr/Jun. 2013. Disponível em: https://www.scielo.br/j/sdeb/a/FbbMFGQCWTQdVxvnNRQmkxP/?format=pdf&lang=pt. Acesso em: 25 mar. 2023.

CINTRA, D. E.; ROPELLE, E. R.; MORAES, J. C.; PAULI, J. R.; MORARI, J.; SOUZA, C. T.; GRIMALDI, R.; STAHL, M.; CARVALHEIRA, J. B.; SAAD, M. J.; VELLOSO, L. A. Unsaturated fatty acids revert diet-induced hypothalamic inflammation in obesity. **PloS One**, [*s. l.*], v. 7, n.1, e30571, Jan. 2012. DOI: https://doi.org/10.1371/journal.pone.0030571. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3261210/pdf/pone.0030571.pdf. Acesso em: 25 mar. 2023.

COLL, T.; EYRE, E.; RODRÍGUEZ-CALVO, R.; PALOMER, X.; SÁNCHEZ, R. M.; MERLOS, M.; LAGUNA, J. C.; VÁZQUEZ-CARRERA, M. Oleate reverses palmitate-induced insulin resistance and inflammation in skeletal muscle cells. **The Journal of Biological Chemistry**, [*s. l.*], v. 283, n. 17, p. 11107–11116, Apr. 2008. DOI: https://doi.org/10.1074/jbc.M708700200. Disponível em: https://www.jbc.org/article/S0021-9258(20)61901-9/fulltext. Acesso em: 25 mar. 2023.

CRAIG, W.; HAREL-FISCH, Y.; FOGEL-GRINVALD, H.; DOSTALER, S.; HETLAND, J.; SIMONS-MORTON, B.; MOLCHO, M.; DE MATO, M. G.; OVERPECK, M.; DUE, P.; PICKETT, W.; HBSC VIOLENCE & INJURIES PREVENTION FOCUS GROUP; HBSC BULLYING WRITING GROUP. A cross-national profile of bullying and victimization among adolescents in 40 countries. **International Journal of Public Health**, [*s. l.*], v. 54, p. 216-224, Sep. 2009. DOI: https://doi.org/10.1007/s00038-009-5413-9. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2747624/pdf/nihms136910.pdf. Acesso em: 25 mar. 2023.

CROVETTO, M.; UAUY, R. Evolución del gasto en alimentos procesados en la población del Gran Santiago en los últimos 20 años. **Revista Médica de Chile**, Santiago, v. 140, n. 3, p. 305–312, Mar. 2012. DOI: https://doi.org/10.4067/S0034-98872012000300004. Disponível em: https://www.scielo.cl/pdf/rmc/v140n3/art04.pdf. Acesso em: 25 mar. 2023.

DU, Y. You may be what you eat, so can you be violent due to your food? **European Journal of Biomedical and Pharmaceutical Sciences**, [*s. l.*], v. 6, n. 7, p. 20-28, 2019. Disponível em: https://www.researchgate.net/publication/334171599_ You_may_be_what_you_eat_can_you_be_violent_due_to_your_food. Acesso em: 19 fev. 2023.

ESPELAGE, D. L.; LOW, S.; RAO, M. A.; HONG, J. S.; LITTLE, T. D. Family violence, bullying, fighting, and substance use among adolescents: a longitudinal mediational model. **Journal of Research on Adolescence**, [*s. l.*], v. 24, n. 2, p. 337-349, Jun. 2013. DOI: https://doi.org/10.1111/jora.12060. Disponível em: https://onlinelibrary.wiley.com/doi/abs/10.1111/jora.12060. Acesso em: 25 mar. 2023.

FANTI, K. A., KIMONIS, E. R. Bullying and victimization: the role of conduct problems and psychopathic traits. **Journal of Research on Adolescence**, [*s. l.*], v. 22, n. 4, p. 617-631, Jun. 2012. DOI: https://doi.org/10.1111/j.1532-7795.2012.00809.x. Disponível em: https://onlinelibrary.wiley.com/doi/10.1111/j.1532-7795.2012.00809.x. Acesso em: 25 mar. 2023.

FEIJÓ, R. B.; OLIVEIRA, E. A. Comportamento de risco na adolescência. **Jornal de Pediatria**, Rio de Janeiro, v. 77, n. S2, p. 125-134, Nov. 2001. DOI: https://doi.org/10.2223/JPED.300. Disponível em: https://pubmed.ncbi.nlm.nih.gov/14676875/. Acesso em: 25 mar. 2023.

FITZGERALD, A.; HEARY, C.; NIXON, E.; KELLY, C. Factors influencing the food choices of Irish children and adolescents: a qualitative investigation. **Health Promotion International**, [*s. l.*], v. 25, n. 3, Sep. 2010. DOI: https://doi.org/10.1093/heapro/daq021. Disponível em: https://academic.oup.com/heapro/article/25/3/289/661258?login=false. Acesso em: 25 mar. 2023.

FRENCH, S. A.; STORY, M.; NEUMARK-SZTAINER, D.; FULKERSON, J. A.; HANNAN, P. Fast food restaurant use among adolescents: associations with nutrient intake, food choice and behavioral and psychosocial variables. **International Journal of Obesity and Related Metabolic Disorders**, [*s. l.*], v. 25, n. 12, p. 1823–1833, Dec. 2001. DOI:

https://doi.org/10.1038/sj.ijo.0801820. Disponível em: https://www.nature.com/articles/0801820. Acesso em: 25 mar. 2023.

FRENCH, S. A.; LIN, B. H.; GUTHRIE, J. F. National trends in soft drink consumption among children and adolescents age 6 to 17 years: Prevalence, amounts and sources, 1977/1978 to 1994/1998. **Journal of the American Dietetic Association**, [*s. l.*], v. 103, n. 10, p. 1326– 1331, Oct. 2003. DOI: https://doi.org/10.1016/s0002-8223(03)01076-9. Disponível em: https://www.jandonline.org/article/S0002-8223(03)01076-9/fulltext. Acesso em: 25 mar. 2023.

FUJIKAWA, S.; ANDO, S.; KOIKE, S.; MORIMOTO, Y.; KANATA, S.; SUGIMOTO, N.; TORIYAMA, R.; USAMI, S.; NISHIDA, A. Minor corporal punishment is associated with a risk of bullying involvement and depressive symptoms in preadolescence. **Journal of Adolescent Health**, [*s. l.*], v. 56, n. 2, Feb. 2015. DOI: https://doi.org/10.1016/j.jadohealth.2014.10.191. Disponível em: https://www.jahonline.org/article/S1054-139X(14)00618-1/fulltext. Acesso em: 25 mar. 2023.

GESCH, C.B.; HAMMOND, S.M.; HAMPSON, S.E.; EVES, A.; CROWDER, M.J. Influence of supplementary vitamins, minerals and essential fatty acids on the antisocial behaviour of young adult prisoners: Randomized, placebo-controlled trial. **British Journal of Psychiatry**, [*s. l.*], v. 181, n. 19, p. 22-28, Jul. 2002. DOI: https://doi.org/10.1192/bjp.181.1.22. Disponível em: https://www.cambridge.org/core/services/aop-cambridge-core/content/view/04CAABE56D2DE74F69460D035764A498/S0007125000161483a.pdf/influence-of-supplementary-vitamins-minerals-and-essential-fatty-acids-on-the-antisocial-behaviour-of-young-adult-prisoners-randomised-placebo-controlled-trial.pdf. Acesso em: 25 mar. 2023.

GIAMMANCO, S., ERNANDES, M., LOPEZ DE ONATE, R., PADERNI, M. A. Short term diet of precooked corn meal almost lacking in tryptophan and interspecific rat-mouse aggressive behaviour. **Archives Internationales de Physiologie et de Biochimie**, [*s. l.*], v. 98, n. 1, p. 23-26, Mar. 1990. DOI: https://doi.org/10.3109/13813459009115733. Disponível em: https://pubmed.ncbi.nlm.nih.gov/1692690/. Acesso em: 25 mar. 2023.

GLEW, G. M.; FAN, M. Y.; KATON, W.; RIVARA, F. P.; KERNIC, M. A. Bullying, psychosocial adjustment, and academic performance in elementary school. **Archives of Pediatrics & Adolescent Medicine**, [*s. l.*], v. 159, n. 11, p. 1026-1031, Nov. 2005. DOI: https://doi.org/10.1001/archpedi.159.11.1026. Disponível em: https://jamanetwork.com/journals/jamapediatrics/fullarticle/486162. Acesso em: 25 mar. 2023.

GOLDBACH, J. T.; STERZING, P. R.; STUART, M. J. Challenging conventions of bullying thresholds: exploring differences between low and high levels of bully-only, victim-only, and bully-victim roles. **Journal of Youth and Adolescence**, [*s. l.*], v. 47, n. 3, p. 586-600, Mar. 2018. DOI: https://doi.org/10.1007/s10964-017-0775-4. Disponível em: https://link.springer.com/article/10.1007/s10964-017-0775-4. Acesso em: 25 mar. 2023.

GONZALVO, G. O. Delinquent adolescents: health problems and health care guidelines for juvenile correctional facilities. **Anales Españoles de Pediatría**, [*s. l.*], v. 57, n. 4, p. 345–353, Oct. 2002. Disponível em: https://pubmed.ncbi.nlm.nih.gov/12392669/. Acesso em: 25 mar. 2023.

GRIGSBY, J.; STEVENS, D. **Neurodynamics of personality**. Guilford, New York, 2000.

HANISH, L. D., GUERRA, N. G. A longitudinal analysis of patterns of adjustment following peer victimization. **Development and Psychopathology**, [*s. l.*], v. 14, n. 1, p. 69-89, Winter. 2002. DOI: https://doi.org/10.1017/s0954579402001049. Disponível em: https://pubmed.ncbi.nlm.nih.gov/11893095/. Acesso em: 25 mar. 2023.

HEMPHILL, S.A.; HEERDE, J. A. Adolescent predictors of young adult cyberbullying perpetration and victimization among Australian youth. **Journal of Adolescent Health**, [*s. l.*], v. 55, n. 4, p. 580-587, Oct. 2014. DOI: https://doi.org/10.1016/j.jadohealth.2014.04.014. Disponível em: https://www.jahonline.org/article/S1054-139X(14)00192-X/fulltext. Acesso em: 25 mar. 2023.

HENGGELER, S. W., SHEIDOW, A. J. Empirically supported family-based treatments for conduct disorder and delinquency in adolescents. **Journal of Marital and Family Therapy**, [*s. l.*], v. 38, n. 1, p. 30–58, Jan. 2012. DOI: https://doi.org/10.1111/j.1752-0606.2011.00244.x. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3270911/pdf/nihms310407.pdf. Acesso em: 25 mar. 2023.

HIBBELN, J. R.; UMHAU, J. C.; LINNOILA, M.; GEORGE, D. T.; RAGAN, P. W.; SHOAF, S. E.; VAUGHAN, M. R.; RAWLINGS, R.; SALEM JR, N. A replication study of violent and nonviolent subjects: cerebrospinal fluid metabolites of serotonin and dopamine are predicted by plasma essential fatty acids. **Biological Psychiatry**, [*s. l.*], v. 44, n. 4, p. 243–249, Aug. 1998. DOI: https://doi.org/10.1016/s0006-3223(98)00143-7. Disponível em: https://www.biologicalpsychiatryjournal.com/article/S0006-3223(98)00143-7/fulltext. Acesso em: 25 mar. 2023.

HILLIS, S.; MERCY, J.; AMOBI, A.; KRESS, H. Global prevalence of past-year violence against children: a systematic review and minimum estimates. **Pediatrics**, [*s. l.*], v. 137, n. 3, e20154079, Mar. 2016. DOI: https://doi.org/10.1542/peds.2015-4079. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6496958/pdf/nihms-1017293.pdf. Acesso em: 25 mar. 2023.

HOLUBCIKOVA, J.; KOLARCIK, P.; GECKOVA, A. M.; REIJNEVELD, S. A.; VAN DIJK, J. P. The mediating effect of daily nervousness and irritability on the relationship between soft drink consumption and aggressive behaviour among adolescents. **International Journal of Public Health**, [*s. l.*], v. 60, n. 6, p. 699-706, Sep. 2015. DOI: https://doi.org/10.1007/s00038-015-0707-6. Disponível em: https://link.springer.com/article/10.1007/s00038-015-0707-6. Acesso em: 25 mar. 2023.

HORNBY, G. **Improving parental involvement.** London: Continuum, 2000.

HU, F. B. Dietary pattern analysis: a new direction in nutritional epidemiology. **Current Opinion in Lipidology**, [*s. l.*], v. 13, n. 1, p. 3–9, Feb. 2002. DOI: https://doi.org/10.1097/00041433-200202000-00002. Disponível em: https://journals.lww.com/co-lipidology/Abstract/2002/02000/Dietary_pattern_analysis__a_new_direction_in.2.aspx. Acesso em: 25 mar. 2023.

IBGE. **Pesquisa Nacional de Saúde do Escolar**: 2015. Coordenação de População e Indicadores Sociais. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2016. 132 p. Disponível em: https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo?view=detalhes&id=297870. Acesso em: 12 mar. 2023.

IBGE. **Pesquisa Nacional de Saúde do Escolar**: 2019. Coordenação de População e Indicadores Sociais. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2021. 156 p. Disponível em: https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo?view=detalhes&id=2101852. Acesso em: 17 fev 2023.

IBGE. **Pesquisa de Orçamentos Familiares 2017-2018**: análise do consumo alimentar pessoal no Brasil. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2020a. 114 p. Disponível em: https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo?view=detalhes&id=2101742. Acesso em: 18 fev. 2023.

IBGE. **Pesquisa de Orçamentos Familiares 2017-2018**: avaliação nutricional da disponibilidade domiciliar de alimentos no Brasil. Rio de Janeiro: IBGE, Instituto Brasileiro de Geografia e Estatística, 2020b, 56 p. Disponível em: https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo?view=detalhes&id=2101704. Acesso em: 18 fev. 2023.

IZAR, M. C. O.; LOTTENBERG, A. M.; GIRALDEZ, V. Z. R.; SANTOS FILHO, R. D. S.; MACHADO, R. M.; BERTOLAMI, A. *et al*. Posicionamento sobre o Consumo de Gorduras e

Saúde Cardiovascular – 2021. **Arquivos Brasileiros de Cardiologia**, Rio de Janeiro, v. 116, n.1, p. 160-212, Jan. 2021. DOI: https://doi.org/10.36660/abc.20201340. Disponível em: https://www.scielo.br/j/abc/a/Yt5zyLkkfG8ms6rKcJ7TNWc/?format=pdf&lang=pt. Acesso em: 25 mar. 2023.

JAHNS, L.; SIEGA-RIZ, A. M.; POPKIN, B. M. The increasing prevalence of snacking among US children from 1977 to 1996. **The Journal of Pediatrics**, [*s. l.*], v. 138, n. 4, p. 493–498, Apr. 2001. DOI: https://doi.org/10.1067/mpd.2001.112162. Disponível em: https://www.jpeds.com/article/S0022-3476(01)87563-6/fulltext. Acesso em: 25 mar. 2023.

JACKSON, D.B. The link between poor quality nutrition and childhood antisocial behavior: a genetically informative analysis. **Journal of Criminal Justice**, [*s. l.*], v. 44, p. 13-20, Mar. 2016. DOI: https://doi.org/10.1016/j.jcrimjus.2015.11.007. Disponível em: https://www.sciencedirect.com/science/article/abs/pii/S0047235215300155. Acesso em: 25 mar. 2023.

JACKSON, D. B. Diet quality and bullying among a cross-national sample of youth. **Preventive Medicine**, [*s. l.*], v. 105, p. 359-365, Dec. 2017. DOI: https://doi.org/10.1016/j.ypmed.2017.06.033. Disponível em: https://www.sciencedirect.com/science/article/abs/pii/S0091743517302372?via%3Dihub. Acesso em: 25 mar. 2023.

JACKSON, D. B.; JONES, M. S.; SEMENZA, D.; TESTA, A. Adverse childhood experiences and adolescent delinquency: a theoretically informed investigation of mediators during middle childhood. **International Journal of Environmental Research and Public Health**, [*s. l.*], v. 20, n. 4, Feb. 2023. DOI: https://doi.org/10.3390/ijerph20043202. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9959059/pdf/ijerph-20-03202.pdf. Acesso em: 25 mar. 2023.

JACKSON, D. B., VAUGHN, M. G., SALAS-WRIGHT, C. P. Poor nutrition and bullying behaviors: a comparison of deviant and non-deviant youth. **Journal of Adolescence**, [*s. l.*], v. 57, p. 69–73, Jun. 2017. DOI: https://doi.org/10.1016/j.adolescence.2017.03.008. Disponível em: https://www.sciencedirect.com/science/article/abs/pii/S0140197117300477?via%3Dihub. Acesso em: 25 mar. 2023.

JANSSEN, I.; CRAIG, W. M.; BOYCE, W. F.; PICKETT, W. Associations between overweight and obesity with bullying behaviors in school-aged children. **Pediatrics**, [*s. l.*], v. 113, n. 5, p. 1187-1194, May. 2004. DOI: https://doi.org/10.1542/peds.113.5.1187. Disponível em: https://publications.aap.org/pediatrics/article-abstract/113/5/1187/66701/Associations-Between-Overweight-and-Obesity-With?redirectedFrom=fulltext. Acesso em: 25 mar. 2023.

JUUL, F.; HEMMINGSSON, E. Trends in consumption of ultra-processed foods and obesity in Sweden between 1960 and 2010. **Public Health Nutrition**, [*s. l.*], v. 18, n. 17, p. 3096–3107, Mar. 2015. DOI: https://doi.org/10.1017/S1368980015000506. Disponivel em: https://www.cambridge.org/core/services/aop-cambridge-core/content/view/DC0D68826C2874C947A2C8099264AB00/S1368980015000506a.pdf/trends-in-consumption-of-ultra-processed-foods-and-obesity-in-sweden-between-1960-and-2010.pdf. Acesso em: 25 mar. 2023.

JUVONEN, J.; GRAHAM, S.; SCHUSTER, M. A. Bullying among young adolescents: the strong, the weak, and the troubled. **Pediatrics**, [*s. l.*], v. 112, p. 1231-1237, Dec. 2003. DOI: https://doi.org/10.1542/peds.112.6.1231. Disponível em: https://publications.aap.org/pediatrics/article-abstract/112/6/1231/63549/Bullying-Among-Young-Adolescents-The-Strong-the?redirectedFrom=fulltext. Acesso em: 25 mar. 2023.

KALTIALA-HEINO, R.; RIMPELA, M.; RANTANEN, P.; RIMPELA, A. Bullying at school - an indicator of adolescents at risk for mental disorders. **Journal of Adolescence**, [*s. l.*], v. 23, n. 6, p.

661-674, Dec. 2000. DOI: https://doi.org/10.1006/jado.2000.0351. Disponível em: https://www.sciencedirect.com/science/article/abs/pii/S0140197100903518?via%3Dihub. Acesso em: 25 mar. 2023.

KANAREK, R. B. Nutrition and violent behavior. **Understanding and Preventing Violence**, [*s. l.*], v. 2, p. 1-33, 1994.

KANT, A. K. Dietary patterns and health outcomes. **Journal of the American Dietetic Association**, [*s. l.*], v. 104, n. 4, p. 615–635, Apr. 2004. DOI: https://doi.org/10.1016/j.jada.2004.01.010. Disponível em: https://www.jandonline.org/article/S0002-8223(04)00011-2/fulltext. Acesso em: 25 mar. 2023.

KARLSON, K. B., HOLM, A., BREEN, R. Comparing regression coefficients between same-sample nested models using logit and probit. A new method. **Sociological Methodology**, [*s. l.*], v. 42, p. 286-313, Nov. 2012. DOI: https://doi.org/10.1177/0081175012444861. Disponível em: https://journals.sagepub.com/doi/10.1177/0081175012444861. Acesso em: 25 mar. 2023.

KELLY, E. V.; NEWTON, N. C.; STAPINSKI, L. A.; SLADE, T.; BARRETT, E. L.; CONROD, P. J.; TEESSON, M. Suicidality, internalizing problems and externalizing problems among adolescent bullies, victims and bully-victims. **Preventive Medicine**, [*s. l.*], v. 73, p. 100-105, Apr. 2015. DOI: https://doi.org/10.1016/j.ypmed.2015.01.020. Disponível em: https://www.sciencedirect.com/science/article/abs/pii/S0091743515000225?via%3Dihub. Acesso em: 25 mar. 2023.

KERR, M. A.; RENNIE, K. L.; MCCAFFREY, T. A.; WALLACE, J. M.; HANNON-FLETCHER, M. P.; LIVINGSTONE, M. B. Snacking patterns among adolescents: a comparison of type, frequency and portion size between Britain in 1997 and Northern Ireland in 2005. **The British Journal of Nutrition**, [*s. l.*], v. 101, n. 1, p. 122–131, Jan. 2009. DOI: https://doi.org/10.1017/S0007114508994769. Disponível em: https://www.cambridge.org/core/services/aop-cambridge-core/content/view/B1394D966D5A292B6F958BC1315EA59C/S0007114508994769a.pdf/snacking-patterns-among-adolescents-a-comparison-of-type-frequency-and-portion-size-between-britain-in-1997-and-northern-ireland-in-2005.pdf. Acesso em: 25 mar. 2023.

KHANI, B. R.; YE, W.; TERRY, P.; WOLK, A. Reproducibility and validity of major dietary patterns among Swedish women assessed with a food-frequency questionnaire. **The Journal of Nutrition**, [*s. l.*], v. 134, n. 6, p. 1541–1545, Jun. 2004. DOI: https://doi.org/10.1093/jn/134.6.1541. Disponível em: https://www.sciencedirect.com/science/article/pii/S0022316623028353?via%3Dihub. Acesso em: 25 mar. 2023.

KIEN, C. L.; BUNN, J. Y.; TOMPKINS, C. L.; DUMAS, J. A.; CRAIN, K. I.; EBENSTEIN, D. B.; KOVES, T. R.; MUOIO, D. M. Substituting dietary monounsaturated fat for saturated fat is associated with increased daily physical activity and resting energy expenditure and with changes in mood. **The American Journal of Clinical Nutrition**, [*s. l.*], v. 97, n. 4, p. 689–697, Apr. 2013. DOI: https://doi.org/10.3945/ajcn.112.051730. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3607650/pdf/ajcn974689.pdf. Acesso em: 25 mar. 2023.

KRUG, E. G.; MERCY, J. A.; DAHLBERG, L. L.; ZWI, A. B. The world report on violence and health. **The Lancet**, [*s. l.*], v. 360, n. 9339, p. 1083–1088, Oct. 2002. DOI: https://doi.org/10.1016/S0140-6736(02)11133-0. Disponível em: https://www.sciencedirect.com/science/article/pii/S0140673602111330?via%3Dihub. Acesso em: 25 mar. 2023.

KUMPULAINEN, K., RÄSÄNEN, E., PUURA, K. Psychiatric disorders and the use of mental health services among children involved in bullying. **Aggressive Behavior**, [*s. l.*], v. 27, n. 2, p.

102–110, Mar. 2001. DOI: https://doi.org/10.1002/ab.3. Disponível em: https://onlinelibrary.wiley.com/doi/abs/10.1002/ab.3. Acesso em: 25 mar. 2023.

LOCATELLI, N. T.; CANELLA, D. S.; BANDONI, D. H. Positive influence of school meals on food consumption in Brazil. **Nutrition**, [*s. l.*], v. 53, p. 140-144, Sep. 2018. DOI: https://doi.org/10.1016/j.nut.2018.02.011. Disponível em: https://www.sciencedirect.com/science/article/pii/S0899900718300893?via%3Dihub. Acesso em: 25 mar. 2023.

LOEBER, R., WUNG, P., KEENAN, K., GIROUX, B., STOUTHAMER-LOEBER, M., VAN KAMMEN, W., MAUGHAM, B. Developmental pathways in disruptive child behavior. **Development and Psychopathology**, [*s. l.*], v. 5, n. 1-2, p. 103-133, Winter-Spring. 1993. DOI: https://doi.org/10.1017/S0954579400004296. Disponível em: https://psycnet.apa.org/record/1993-45651-001. Acesso em: 25 mar. 2023.

LONSDALE, D., SHAMBERGER, R. Red cell transketo-lase as an indicator of nutritional deficiency. **American Journal of Clinical Nutrition**, [*s. l.*], v. 33, n.2, p. 205-211, Feb. 1980. DOI: https://doi.org/10.1093/ajcn/33.2.205. Disponível em: https://pubmed.ncbi.nlm.nih.gov/7355794/. Acesso em: 25 mar. 2023.

LOUZADA, M. L. D. C; BARALDI, L. G.; STEELE, E. M.; MARTINS, A. P.; CANELLA, D. S.; MOUBARAC, J. C.; LEVY, R. B.; CANNON, G.; AFSHIN, A.; IMAMURA, F.; MOZAFFARIAN, D.; MONTEIRO, C. A. Consumption of ultra-processed foods and obesity in Brazilian adolescents and adults. **Preventive Medicine**, [*s. l.*], v. 81, p. 9-15, Dec. 2015a. DOI: https://doi.org/10.1016/j.ypmed.2015.07.018. Disponível em: https://www.sciencedirect.com/science/article/pii/S0091743515002340?via%3Dihub. Acesso em: 25 mar. 2023.

LOUZADA, M. L. D. C.; MARTINS, A. P.; CANELLA, D. S.; BARALDI, L. G.; LEVY, R. B.; CLARO, R. M.; MOUBARAC, J. C.; CANNON, G.; MONTEIRO, C. A. Alimentos ultraprocessados e perfil nutricional da dieta no Brasil. **Revista de Saúde Pública**, São Paulo, v. 49, p. 38, Abr. 2015b. DOI: https://doi.org/10.1590/S0034-8910.2015049006132. Disponível em: https://www.scielo.br/j/rsp/a/dm9XvfGy88W3WwQGBKrRnXh/?format=pdf&lang=pt. Acesso em: 25 mar. 2023.

LOUZADA, M. L. D. C.; RICARDO, C. Z.; STEELE, E. M.; LEVY, R. B.; CANNON, G.; MONTEIRO, C. A. The share of ultra-processed foods determines the overall nutritional quality of diets in Brazil. **Public Health Nutrition**, [*s. l.*], v. 21, n. 1, p. 94-102, Jan. 2018. DOI: https://doi.org/10.1017/S1368980017001434. Disponível em: https://www.cambridge.org/core/journals/public-health-nutrition/article/share-of-ultraprocessed-foods-determines-the-overall-nutritional-quality-of-diets-in-brazil/5EBC43CD883291F89BCE0B25794FF983. Acesso em: 25 mar. 2023.

MARTINS, M. J. D. O problema da violência escolar: uma clarificação e diferenciação de vários conceitos relacionados. **Revista Portuguesa de Educação**, Portugal, v. 18, n. 1, p. 93-105, 2005.

MARTINS, A. P. B.; LEVY, R. B.; CLARO, R. M.; MOUBARAC, J. C.; MONTEIRO, C. A. Participação crescente de produtos ultraprocessados na dieta brasileira (1987-2009). **Revista de Saúde Pública**, São Paulo, v. 47, n. 4, p. 656-65, Ago. 2013. DOI: https://doi.org/10.1590/S0034-8910.2013047004968. Disponível em: https://www.scielo.br/j/rsp/a/VxDyNppnrq8vv6jQtZfSsRP/?format=pdf&lang=pt. Acesso em: 25 mar. 2023.

MEHTA, N. K.; CHANG, V. W. Weight status and restaurant availability a multilevel analysis. **American Journal of Preventive Medicine**, [*s. l.*], v. 34, n. 2, p. 127-133, Feb. 2008. DOI: https://doi.org/10.1016/j.amepre.2007.09.031. Disponível em:

https://www.sciencedirect.com/science/article/pii/S0749379707006538?via%3Dihub. Acesso em: 25 mar. 2023.

MESAS, A.E.; GONZÁLEZ, A.D.; DE ANDRADE, S.M.; MARTÍNEZ-VIZCAÍNO, V.; LÓPEZ-GIL, J.F.; JIMÉNEZ-LÓPEZ, E. Increased consumption of ultra-processed food is associated with poor mental health in a nationally representative sample of adolescent students in Brazil. **Nutrients**, [*s. l.*], v. 14, n. 24, Dec. 2022. DOI: https://doi.org/10.3390/nu14245207. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9783387/. Acesso em: 25 mar. 2023.

MONTEIRO, C. A.; MOUBARAC, J. C.; CANNON, G.; NG, S. W.; POPKIN, B. Ultraprocessed products are becoming dominant in the global food system. **Obesity Reviews**, [*s. l.*], v. 14, p. 21–28, Nov. 2013. DOI: https://doi.org/10.1111/obr.12107. Disponível em: https://onlinelibrary.wiley.com/doi/10.1111/obr.12107. Acesso em: 25 mar. 2023.

MONTEIRO, C. A.; CANNON, G.; MOUBARAC, J. C.; LEVY, R. B.; LOUZADA, M. L. C.; JAIME, P. C. The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing. **Public Health Nutrition**, [*s. l.*], v. 21, p. 5–17, Jan. 2017. DOI: https://doi.org/10.1017/S1368980017000234. Disponível em: https://www.cambridge.org/core/journals/public-health-nutrition/article/un-decade-of-nutrition-the-nova-food-classification-and-the-trouble-with-ultraprocessing/2A9776922A28F8F757BDA32C3266AC2A. Acesso em: 25 mar. 2023.

MOON, B.; ALARID, L. F. School bullying, low self-control, and opportunity. **Journal of Interpersonal Violence**, [*s. l.*], v. 30, n. 5, p. 839-856, Mar. 2015. DOI: https://doi.org/10.1177/0886260514536281. Disponível em: https://journals.sagepub.com/doi/10.1177/0886260514536281?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed. Acesso em: 25 mar. 2023.

MOON, B.; HWANG, H. W.; MCCLUSKEY, J. D. Causes of school bullying: empirical test of a general theory of crime, differential association theory, and general strain theory. **Crime & Delinquency**, [*s. l.*], v. 57, n. 6, p. 849-877, Nov. 2011. DOI: https://doi.org/10.1177/0011128708315740. Disponível em: https://www.researchgate.net/publication/238116576_Causes_of_School_Bullying_Empirical_Test_of_a_General_Theory_of_Crime_Differential_Association_Theory_and_General_Strain_Theory. Acesso em: 25 mar. 2023.

MOON, B.; MORASH, M.; MCCLUSKEY, J. D. General strain theory and school bullying: an empirical test in South Korea. **Crime & Delinquency**, [*s. l.*], v. 58, n. 6, p. 827-855, Apr. 2012. DOI: https://doi.org/10.1177/0011128710364809. Disponível em: https://journals.sagepub.com/doi/epdf/10.1177/0011128710364809. Acesso em: 25 mar. 2023.

MOUBARAC, J. C.; BATAL, M.; MARTINS, A. P.; CLARO, R.; LEVY, R. B.; CANNON, G.; MONTEIRO, C. Processed and ultra-processed food products: consumption trends in Canada from 1938 to 2011. **Canadian Journal of Dietetic Practice and Research**, [*s. l.*], v. 75, n. 1, 15–21, Spring. 2014. DOI: https://doi.org/10.3148/75.1.2014.15. Disponível em: https://dcjournal.ca/doi/10.3148/75.1.2014.15?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed. Acesso em: 25 mar. 2023.

MURRAY, J., FARRINGTON, D. P. Risk factors for conduct disorder and delinquency: key findings from longitudinal studies. **Canadian Journal of Psychiatry**, [*s. l.*], v. 55, n.10, p. 633–642, Oct. 2010. DOI: https://doi.org/10.1177/070674371005501003. Disponível em: https://journals.sagepub.com/doi/epdf/10.1177/070674371005501003. Acesso em: 25 mar. 2023.

NEUMARK-SZTAINER, D.; STORY, M.; PERRY, C.; CASEY, M. A. Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. **Journal of the American Dietetic Association**, [*s. l.*], v. 99, n. 8, p. 929–934, Aug. 1999. DOI: https://doi.org/10.1016/S0002-8223(99)00222-9. Disponível em:

https://www.sciencedirect.com/science/article/pii/S0002822399002229?via%3Dihub. Acesso em: 25 mar. 2023.

NEWBY, P. K.; TUCKER, K. L. Empirically derived eating patterns using factor or cluster analysis: a review. **Nutrition Reviews**, [*s. l.*], v. 62, n. 5, p. 177–203, May. 2004. DOI: https://doi.org/10.1111/j.1753-4887.2004.tb00040.x. Disponível em: https://pubmed.ncbi.nlm.nih.gov/15212319/. Acesso em: 25 mar. 2023.

NIELSEN, S. J.; POPKIN, B. M. Changes in beverage intake between 1977 and 2001. **American Journal of Preventive Medicine**, [*s. l.*], v. 27, n. 3, p. 205-210, Oct. 2004. DOI: https://doi.org/10.1016/j.amepre.2004.05.005. Disponível em: https://www.sciencedirect.com/science/article/pii/S0749379704001229?via%3Dihub. Acesso em: 25 mar. 2023.

NOLL, P. R. S.; NOLL, M.; DE ABREU, L. C.; BARACAT, E. C.; SILVEIRA, E. A.; SORPRESO, I. C. E. Ultra-processed food consumption by Brazilian adolescents in cafeterias and school meals. **Scientific Reports**, [*s. l.*], v. 9, n. 1, May. 2019. DOI: https://doi.org/10.1038/s41598-019-43611-x. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6509257/. Acesso em: 25 mar. 2023.

O'BRENNAN, L. M.; BRADSHAW, C. P.; SAWYER, A. L. Examining development differences in the social-emotional problems among frequent bullies, victims, and bully/victims. **Psychology in the Schools**, [*s. l.*], v. 46, n. 2, p. 100-115, 2009. DOI: https://doi.org/10.1002/pits.20357. Disponível em: https://psycnet.apa.org/record/2009-01149-002. Acesso em: 25 mar. 2023.

OBSUTH, I.; MURRAY, A. L.; KNOLL, M.; RIBEAUD, D.; EISNER, M. Teacher-student relationships in childhood as a protective factor against adolescent delinquency up to age 17: a propensity score matching approach. **Crime & Delinquency**, [*s. l.*], v. 69, n. 4, Apr. 2023. DOI: https://doi.org/10.1177/00111287211014153. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10026349/pdf/10.1177_00111287211014153.pdf. Acesso em: 25 mar. 2023.

ODDY, W. H.; ROBINSON, M.; AMBROSINI, G. L.; O'SULLIVAN, T. A.; DE KLERK, N. H.; BEILIN, L. J.; SILBURN, S. R.; ZUBRICK, S. R.; STANLEY, F. J. The association between dietary patterns and mental health in early adolescence. **Preventive Medicine**, [*s. l.*], v. 49, n. 1, p. 39-44, Aug. 2009. DOI: https://doi.org/10.1016/j.ypmed.2009.05.009. Disponível em: https://www.sciencedirect.com/science/article/pii/S0091743509002643?via%3Dihub. Acesso em: 25 mar. 2023.

OLIVEIRA, R. C. A transição nutricional no contexto da transição demográfica e epidemiológica. **Revista Mineira de Saúde Pública**, v. 3, n. 5, p.16-23, 2004. Disponível em: https://docs.bvsalud.org/biblioref/coleciona-sus/2004/28163/28163-380.pdf. Acesso em 17 fev 2023.

OLWEUS, D. Bullying at school: what we know and what we can do (understanding children's worlds). **Wiley-Blackwell**, 1993.

OLWEUS, D. School bullying: development and some important challenges. **Annual Review of Clinical Psychology**, [*s. l.*], v. 9, p. 751-780, Mar. 2013. DOI: https://doi.org/10.1146/annurev-clinpsy-050212-185516. Disponível em: https://www.annualreviews.org/doi/full/10.1146/annurev-clinpsy-050212-185516#article-denial. Acesso em: 25 mar. 2023.

ORGANIZAÇÃO MUNDIAL DA SAÚDE. Global consultation on violence and health. **Violence: a public health priority (document WHO/EHA/SPI. POA.2).** Geneva: WHO, 1996.

ØVERBY, N.; HØIGAARD, R. Diet and behavioral problems at school in Norwegian adolescents. **Food & Nutrition Research**, [*s. l.*], v, 56, Jun. 2012. DOI: https://doi.org/10.3402/fnr.v56i0.17231.

Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3387363/pdf/FNR-56-17231.pdf. Acesso em: 25 mar. 2023.

PAHO. Regional Status Report 2020: preventing and responding to violence against children in the Americas. Washington, DC: **Pan American Health Organization**, 2020. License: CC BY-NC-SA 3.0 IGO. Disponível em: https://iris.paho.org/bitstream/handle/10665.2/53038/9789275122945_eng.pdf?sequence=3&isAllowed=y. Acesso em: 25 mar. 2023.

PENGPID, S.; PELTZER, K. High carbonated soft drink intake is associated with health risk behavior and poor mental health among school-going adolescents in six southeast Asian countries. **International Journal of Environmental Research and Public Health**, [*s. l.*], v. 17, n. 1, Dec. 2019. DOI: https://doi.org/10.3390/ijerph17010132. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6981753/pdf/ijerph-17-00132.pdf. Acesso em: 25 mar. 2023.

PERES, M. F. T.; AZEREDO, C. M.; DE REZENDE, L. F. M.; ZUCCHI, E.; FRANCA-JUNIOR, I.; LUIZ, O.; LEVY, R. B. Personal, relational and school factors associated with involvement in fights with weapons among school-age youth in Brazil: a multilevel ecological approach. **International Journal of Public Health**, [*s. l.*], v. 63, n. 8, p. 957-965, Nov. 2018a. DOI: https://doi.org/10.1007/s00038-018-1128-0. Disponível em: https://link.springer.com/article/10.1007/s00038-018-1128-0. Acesso em: 25 mar. 2023.

PERES, M. F. T.; EISNER, M.; LOCH, A. P.; NASCIMENTO, A.; PAPA, C. H. G.; AZEREDO, C. M. *et al*. Violência, *bullying* e repercussões na saúde: resultados do projeto São Paulo para o desenvolvimento social de crianças e adolescentes (SP-PROSO). **Departamento de Medicina Preventiva/FMUSP**, São Paulo, 2018b, 154 p. Disponível em: https://sites.usp.br/sp-proso/wp-content/uploads/sites/526/2019/06/relatorio_sp_proso_26_05_2019.pdf. Acesso em: 25 mar. 2023.

POPKIN, B. M. Nutritional patterns and transitions. **Population and Development Review**, [*s. l.*], v. 19, n. 1, p. 138-157, Mar. 1993. DOI: https://doi.org/10.2307/2938388. Disponível em: https://www.jstor.org/stable/2938388. Acesso em: 25 mar. 2023.

POPKIN, B. M. The shift in stages of the nutrition transition in the developing world differs from past experiences! **Public Health Nutrition**, [*s. l.*], v. 5, n. 1, p. 205-214, Feb. 2002. DOI: https://doi.org/10.1079/PHN2001295. Disponível em: https://www.cambridge.org/core/journals/public-health-nutrition/article/part-ii-what-is-unique-about-the-experience-in-lowerand-middleincome-lessindustrialised-countries-compared-with-the-veryhighincome-industrialised-countries/566805E168DC6DE86EA52D76DE9387D8. Acesso em: 25 mar. 2023.

POPKIN, B. M. Nutrition transition and the global diabetes epidemic. **Current Diabetes Reports**, [*s. l.*], v. 15, n. 9, Sep. 2015. DOI: https://doi.org/10.1007/s11892-015-0631-4. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4942180/pdf/nihms799257.pdf. Acesso em: 25 mar. 2023.

PROBST, C.; KILIAN, C.; BAER, B.; CAIXETA, R.; ONDARSUHU, D. Bullying, physical violence, and injuries among students in the Region of the Americas. **Pan American Health Organization**, Washington, [202-].

RAINE, A. The anatomy of violence: the biological roots of crime. **Vintage**, 2013.

SALMON, G., JAMES, A., CASSIDY, E. L., JAVALOYES, M. A. Bullying a review: presentations to an adolescent psychiatric service and within a school for emotionally and behaviourally disturbed children. **Clinical Child Psychology and Psychiatry**, [*s. l.*], v. 5, n. 4, p. 563–579, Oct. 2000. DOI: https://doi.org/10.1177/1359104500005004010. Disponível em: https://journals.sagepub.com/doi/10.1177/1359104500005004010. Acesso em: 25 mar. 2023.

SHARMA, J. Nutritional correlates of aggressive behavior. **Violence and Conflict Resolution: Contemporary Perspectives**, [*s. l.*], p. 157-163, 2009. Disponível em: https://www.semanticscholar.org/paper/161-Nutritional-Correlates-of-Aggressive-Behaviour-Sharma/76110e9312f8b01c9f208578b5a32d49ae25220d. Acesso em: 25 mar. 2023.

SILVA, A. C. F.; BORTOLINI, G. A.; JAIME, P. C. Brazil's national programs targeting childhood obesity prevention. **International Journal of Obesity Supplements**, [*s. l.*], v. 3, n. Suppl 1, p. S9–S11, Jun. 2013. DOI: https://doi.org/10.1038/ijosup.2013.4. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4850565/pdf/ijosup20134a.pdf. Acesso em: 25 mar. 2023.

SILVA, S. A.; DO CARMO, A. S.; CARVALHO, K. M. B. Lifestyle patterns associated with common mental disorders in Brazilian adolescents: Results of the Study of Cardiovascular Risks in Adolescents (ERICA). **PLoS One**, [*s. l.*], v. 16, n. 12, Dec. 2021. DOI: https://doi.org/10.1371/journal.pone.0261261. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8670696/pdf/pone.0261261.pdf. Acesso em: 25 mar. 2023.

SMETANA, J. G.; JAMBON, M.; BALL, C. Normative changes and individual differences in early moral judgments: a constructivist developmental perspective. **Human Development**, [*s. l.*], v. 61, p. 264-280, Sep. 2018. DOI: https://doi.org/10.1159/000492803. Disponível em: https://karger.com/hde/article-abstract/61/4-5/264/161562/Normative-Changes-and-Individual-Differences-in?redirectedFrom=fulltext. Acesso em: 25 mar. 2023.

SOLNICK, S. J.; HEMENWAY, D. The "Twinkie Defense": the relationship between carbonated non-diet soft drinks and violence perpetration among Boston high school students. **Injury Prevention**, [*s. l.*], v. 18, n. 4, p. 259–263, Aug. 2011. DOI: https://doi.org/10.1136/injuryprev-2011-040117. Disponível em: https://injuryprevention.bmj.com/content/18/4/259.long. Acesso em: 25 mar. 2023.

SOUSA, K. T.; MARQUES, E. S.; LEVY, R. B.; AZEREDO, C. M. Food consumption and depression among Brazilian adults: results from the Brazilian National Health Survey, 2013. **Cadernos de Saúde Pública**, Rio de Janeiro, v. 36, n. 1, Dec. 2020. DOI: https://doi.org/10.1590/0102-311X00245818. Disponível em: https://www.scielo.br/j/csp/a/75WMGWKGMvLZXR9CbJWd7sP/?format=pdf&lang=en. Acesso em: 25 mar. 2023.

STEELE, E. M.; BARALDI, L. G.; LOUZADA, M. L. D. C.; MOUBARAC, J. C.; MOZAFFARIAN, D.; MONTEIRO, C. (2015) Ultraprocessed foods and added sugars in the US diet: evidence from a nationally representative cross-sectional study. **BMJ Open**, [*s. l.*], v. 6, n. 3, Mar. 2016. DOI: https://doi.org/10.1136/bmjopen-2015-009892. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4785287/pdf/bmjopen-2015-009892.pdf. Acesso em: 25 mar. 2023.

STEIN, J. A.; DUKES, R. L.; WARREN, J. I. Adolescent male bullies, victims, and bully-victims: a comparison of psychosocial and behavioral characteristics. **Journal of Pediatric Psychology**, [*s. l.*], v. 32, p. 273–282, Apr. 2007. DOI: https://doi.org/10.1093/jpepsy/jsl023. Disponível em: https://academic.oup.com/jpepsy/article/32/3/273/2951887?login=true. Acesso em: 25 mar. 2023.

STITT, B. R. Food & Behavior - Nutritional Guidelines for Correcting Behavior, 1999.

SUAREZ, E. C.; LEWIS, J. G.; KUHN, C. The relation of aggression, hostility, and anger to lipopolysaccharide-stimulated tumor necrosis factor (TNF)-alpha by blood monocytes from normal men. **Brain, behavior, and immunity**, [*s. l.*], v. 16, n. 6, p. 675–684, Dec. 2002. DOI: https://doi.org/10.1016/s0889-1591(02)00019-3. Disponível em: https://www.sciencedirect.com/science/article/pii/S0889159102000193?via%3Dihub. Acesso em: 25 mar. 2023.

SUTTON, J.; SMITH, P. K. Bullying as a group process: An adaptation of the participant role approach. **Aggressive Behavior**, [*s. l.*], v. 25, n.2, p. 97–111, Feb. 1999. DOI: https://doi.org/10.1002/(sici)1098-2337(1999)25:2<97::aid-ab3>3.0.co;2-7. Disponível em: https://onlinelibrary.wiley.com/doi/10.1002/%28SICI%291098-2337%281999%2925%3A2%3C97%3A%3AAID-AB3%3E3.0.CO%3B2-7. Acesso em: 25 mar. 2023.

TANDEL, K. R. Sugar substitutes: Health controversy over perceived benefits. **Journal of Pharmacology & Pharmacotherapeutics**, [*s. l.*], v. 2, n. 4, p. 236–243, Oct. 2011. DOI: https://doi.org/10.4103/0976-500X.85936. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3198517/pdf/JPP-2-236.pdf. Acesso em: 25 mar. 2023.

TRAPP, G. S.; ALLEN, K. L.; BLACK, L. J.; AMBROSINI, G. L.; JACOBY, P.; BYRNE, S.; MARTIN, K. E.; ODDY, W. H. A prospective investigation of dietary patterns and internalizing and externalizing mental health problems in adolescents. **Food Science & Nutrition**, [*s. l.*], v. 4, n. 6, p. 888-896, Nov. 2016. DOI: https://doi.org/10.1002/fsn3.355. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5090653/pdf/FSN3-4-888.pdf. Acesso em: 25 mar. 2023.

TTOF, M. M.; FARRINGTON, D. P.; FRIEDRICH, L.; ROLF, L. Do the victims of school bullies tend to become depressed later in life? A systematic review and meta-analysis of longitudinal studies. **Journal of Aggression, Conflict and Peace Research**, [*s. l.*], v. 3, n. 2, p. 63-73, May. 2011. DOI: https://doi.org/10.1108/17596591111132873. Disponível em: https://psycnet.apa.org/record/2011-13026-002. Acesso em: 25 mar. 2023.

UNESCO. Violência escolar e bullying: relatório sobre a situação mundial. Brasília: **Organização das Nações Unidas para a Educação, a Ciência e a Cultura**, 2019. 54 p. Disponível em: https://sites.usp.br/sp-proso/wp-content/uploads/sites/526/2019/07/violencia_escolar_bullying_unesco.pdf. Acesso em: 25 mar. 2023.

UNICEF. Hidden in plain sight: A statistical analysis of violence against children. **United Nations Children's Fund**, 2014. Disponível em: https://www.unicef.org/media/66916/file/Hidden-in-plain-sight.pdf. Acesso em: 25 mar. 2023.

UNICEF; FBSP. Panorama da violência letal e sexual contra crianças e adolescentes no Brasil. Brasil: **United Nations Children's Fund**, 2021. E-book. Disponível em: https://www.unicef.org/brazil/media/16421/file/panorama-violencia-letal-sexual-contra-criancas-adolescentes-no-brasil.pdf. Acesso 10 fev 2023.

UNNEVER, J. D.; CORNELL, D. G. The culture of bullying in middle school. **Journal of School Violence**, [*s. l.*], v. 2, n. 2, p. 5–27, 2003. DOI: https://doi.org/10.1300/J202v02n02_02. Disponível em: https://www.researchgate.net/profile/James-Unnever/publication/254371749_The_Culture_of_Bullying_in_Middle_School/links/558aa7ac08aea162bfd9fdb1/The-Culture-of-Bullying-in-Middle-School.pdf. Acesso em: 25 mar. 2023.

VEENSTRA, R.; LINDENBERG, S.; OLDEHINKEL, A. J.; DE WINTER, A. F.; VERHULST, F. C.; ORMEL, J. Bullying and victimization in elementary schools: a comparison of bullies, victims, bully/victims, and uninvolved preadolescents. **Developmental Psychology**, [*s. l.*], v. 41, p. 672-682, Jul. 2005. DOI: https://doi.org/10.1037/0012-1649.41.4.672. Disponível em: https://core.ac.uk/reader/12900370?utm_source=linkout. Acesso em: 25 mar. 2023.

VIDEON, T. M.; MANNING, C. K. Influences on adolescent eating patterns: the importance of family meals. **Journal of Adolescent Health**, [*s. l.*], v. 32, n. 5, p. 365–373, May. 2003. DOI: https://doi.org/10.1016/s1054-139x(02)00711-5. Disponível em:

https://www.sciencedirect.com/science/article/pii/S1054139X02007115?via%3Dihub. Acesso em: 25 mar. 2023.

VIDING, E., SIMMONDS, E., PETRIDES, K. V., FREDERICKSON, N. The contribution of callous-unemotional traits and conduct problems to bullying in early adolescence. **Journal of Child Psychology and Psychiatry**, [*s. l.*], v. 50, n. 4, p. 471–481, Apr. 2009. DOI: https://doi.org/10.1111/j.1469-7610.2008.02012.x. Disponível em: https://acamh.onlinelibrary.wiley.com/doi/10.1111/j.1469-7610.2008.02012.x. Acesso em: 25 mar. 2023.

WANG, R. H.; HSU, H. Y.; LIN, S. Y.; CHENG, C. P.; LEE, S. L. Risk behaviours among early adolescents: risk and protective factors. **Journal of Advanced Nursing**, [*s. l.*], v. 66, n. 2, p. 313–323, Jan. 2010. DOI: https://doi.org/10.1111/j.1365-2648.2009.05159.x. Disponível em: https://onlinelibrary.wiley.com/doi/10.1111/j.1365-2648.2009.05159.x. Acesso em: 25 mar. 2023.

WANG, D.; STEWART, D. The implementation and effectiveness of school-ased nutrition promotion programmes using a health-promoting schools approach: a systematic review. **Public Health Nutrition**, [*s. l.*], v. 16, n. 6, p. 1082-1100, Jun. 2013. DOI: https://doi.org/10.1017/S1368980012003497. Disponível em: https://www.cambridge.org/core/journals/public-health-nutrition/article/implementation-and-effectiveness-of-schoolbased-nutrition-promotion-programmes-using-a-healthpromoting-schools-approach-a-systematic-review/66B3708C05132ED22DE477EF64150B47. Acesso em: 25 mar. 2023.

WANG, C.; SWEARER, S. M.; LEMBECK, P.; COLLINS, A.; BERRY, B. Teachers matter: an examination of student-teacher relationships, attitudes towards bullying, and bullying behavior. **Journal of Applied School Psychology**, [*s. l.*], v. 31, n. 3, p. 219-238, Jul. 2015. DOI: https://doi.org/10.1080/15377903.2015.1056923. Disponível em: https://psycnet.apa.org/record/2015-37130-002. Acesso em: 25 mar. 2023.

WEBB, T. E.; OSKI, F. A. Behavioral status of young adolescentes with iron deficiency anemia. **The Journal of Special Education**, [*s. l.*], v. 8, n. 2, p. 153-156, Jul. 1974. DOI: https://doi.org/10.1177/002246697400800205. Disponível em: https://journals.sagepub.com/doi/abs/10.1177/002246697400800205?journalCode=seda. Acesso em: 25 mar. 2023.

WERBACH, M. R. Nutritional Influences on Aggressive Behavior. **Journal of Orthomolecular Medicine**, [*s. l.*], v. 7, n. 1, p. 45-51, 1992. Disponível em: https://isom.ca/wp-content/uploads/2020/01/JOM_1992_07_1_08_Nutritional_influences_on_Aggressive_Behavior.pdf. Acesso em: 25 mar. 2023.

WHO. Global status report on violence prevention 2014. Geneva: **World Health Organization**, 2014. Disponível em: https://www.who.int/publications/i/item/9789241564793. Acesso em: 17 fev. 2023.

WHO. Preventing youth violence: an overview of the evidence. Geneva: **World Health Organization**, 2015. Disponível em: https://www.who.int/publications/i/item/preventing-youth-violence-an-overview-of-the-evidence. Acesso em: 17 fev. 2023.

WHO. Global plan of action to strengthen the role of the health system within a national multisectoral response to address interpersonal violence, in particular against women and girls, and against children. Geneva: **World Health Organization**, 2016. Disponível em: https://www.who.int/publications/i/item/9789241511537. Acesso em: 17 fev. 2023.

WHO. Mental health in schools: a manual. Cairo: **WHO Regional Office for the Eastern Mediterranean**, 2021. Disponível em: https://apps.who.int/iris/handle/10665/347512. Acesso em: 02 mar. 2023.

WIDDOWSON, A.O.; SIENNICK, S.E.; HAY, C. The implications of arrest for college enrollment: an analysis of long-term effects andmediating mechanisms. **Criminology**, [*s. l.*], v. 54, p. 621–652, Oct. 2016. DOI: https://doi.org/10.1111/1745-9125.12114. Disponível em: https://onlinelibrary.wiley.com/doi/abs/10.1111/1745-9125.12114. Acesso em: 25 mar. 2023.

WITT, E. D. Neuroanatomical consequences of thiamine deficiency: A comparative analysis. **Alcohol and Alcoholism**, [*s. l.*], v. 20, n. 2, p. 201-221, Apr. 1985. DOI: https://doi.org/10.1093/oxfordjournals.alcalc.a044521. Disponível em: https://academic.oup.com/alcalc/article-abstract/20/2/201/165449?redirectedFrom=fulltext. Acesso em: 25 mar. 2023.

WOLKE, D., WOODS, S., BLOOMFIELD, L., KARSTADT, L. The association between direct and relational bullying and behaviour problems among primary school children. **The Journal of Child Psychology and Psychiatry**, [*s. l.*], v. 41, n. 8, p. 989–1002, Nov. 2000. DOI: https://doi.org/10.1111/1469-7610.00687. Disponível em: https://acamh.onlinelibrary.wiley.com/doi/abs/10.1111/1469-7610.00687?sid=nlm%3Apubmed. Acesso em: 25 mar. 2023.

YOUDIM, M. B., BEN-SHACHAR, D., YEHUDA, S. Putative biological mechanisms of the effect of iron deficiency on brain biochemistry and behavior. **The American Journal of Clinical Nutrition**, [*s. l.*], v. 50, n. 3 Suppl, p. 607–617, Sep. 1989. DOI: https://doi.org/10.1093/ajcn/50.3.607. Disponível em: https://www.sciencedirect.com/science/article/abs/pii/S0002916523436040?via%3Dihub. Acesso em: 25 mar. 2023.

ZAHEDI, H.; KELISHADI, R.; HESHMAT, R.; MOTLAGH, M. E.; RANJBAR, S. H.; ARDALAN, G.; PAYAB, M.; CHINIAN, M.; ASAYESH, H.; LARIJANI, B.; QORBANI, M. Association between junk food consumption and mental health in a national sample of Iranian children and adolescents: The CASPIAN-IV study. **Nutrition**, [*s. l.*], v. 30, n. 11-12, p. 1391-1397, Nov-Dec. 2014. DOI: https://doi.org/10.1016/j.nut.2014.04.014. Disponível em: https://www.sciencedirect.com/science/article/pii/S0899900714002068?via%3Dihub. Acesso em: 25 mar. 2023.

ZYCH, I.; FARRINGTON, D. P.; LLORENT, V. J.; RIBEAUD, D.; EISNER, M. P. Childhood risk and protective factors as predictors of adolescent bullying roles. **International Journal of Bullying Prevention**, [*s. l.*], v. 3, p. 138-146, May. 2020. DOI: https://doi.org/10.1007/s42380-020-00068-1. Disponível em: https://link.springer.com/article/10.1007/s42380-020-00068-1. Acesso em: 25 mar. 2023.