Universidade Federal do Rio Grande do Norte
Centro de Ciências da Saúde
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ESCOLHAS PARA UMA VIDA SAUDÁVEL: INTERVENÇÃO NUTRICIONAL EM ADOLESCENTES ESCOLARES

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Tese apresentada ao Programa de Pós-Graduação em Saúde Coletiva, Centro de Ciências da Saúde da Universidade Federal do Rio Grande do Norte, como requisito para a obtenção do título de Doutor em Saúde Coletiva.

Orientadora: Prof.ª Dr.ª Grasiela Piuvezam

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GIDYENNE CHRISTINE BANDEIRA SILVA DE MEDEIROS

Dedico esta tese a...

Deus, o maior orientador da minha vida. Ele é o principio da sabedoria. Tudo que tenho e sou, vem d'Ele.

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"*É impossível que duas mentes se unam sem que se crie, consequentemente, uma terceira força invisível, intangível, comparável a uma terceira mente (Mente Mestra).*"

Napoleon Hills

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Eclesiastes 4:9,10

APRESENTAÇÃO

Neste trabalho – nossa Tese de Doutorado – investigamos como intervir por meio da educação em saúde na vida dos adolescentes, a fim de proporcionar uma vida mais ativa e alimentação adequada e saudável.

Nosso propósito maior é o de desenvolver um método sustentável, aplicável e com baixo custo voltado para a população de adolescentes escolares com a finalidade de promover uma alimentação adequada e saudável e uma vida ativa, os quais podem ajudar a prevenir o sobrepeso, obesidade, hipertensão e outras doenças crônicas como diabetes, doenças cardiovasculares e câncer.

Neste contexto, e pautados nas evidências que a literatura apresenta, o grupo de trabalho em que estou inserida no Programa de Pós Graduação em Saúde Coletiva (PPGSCol) da Universidade Federal do Rio Grande do Norte (UFRN) desenvolveu o Programa AME – Atitude, Movimento e Escolhas para uma vida saudável. Um programa de intervenção multicomponente baseado na escola que apresenta três eixos temáticos: Educação Alimentar e Nutricional (EAN), redução do comportamento sedentário e prática de atividade física.

O Programa AME estrutura-se sobre o tripé do ensino, pesquisa e extensão. No ensino foi realizada capacitação de alunos de graduação de cursos da saúde (nutrição, educação física, saúde coletiva, enfermagem) da UFRN e de outras instituições para participarem da coleta de dados do ensaio clínico.

A pesquisa apresenta-se como um projeto estruturante do PPGSCoL intitulado "Efeitos de uma intervenção de base escolar sobre a função executiva, comportamento sedentário e estado nutricional de adolescentes" com o desenvolvimento de três teses de doutorado do referido programa. A pesquisa foi aprovada com financiamento interno pelo Edital N° 01/2019 – Edital de Bolsas de Iniciação Científica e Tecnológica da UFRN.

A presente tese de doutorado apresenta a construção do embasamento técnico-científico para o desenvolvimento de estratégias do eixo de EAN do Programa AME. Foram realizadas duas revisões sistemáticas, uma sobre os efeitos de intervenções de EAN baseado na escola sobre o consumo alimentar de adolescentes e outra sobre a associação do consumo de carne vermelha e a morbimortalidade por doenças cardiovasculares (DCV). Assim, as estratégias do eixo de EAN foram fundamentadas nos resultados das revisões sistemáticas e na literatura da área.

Na extensão foi realizada capacitação para professores que atuam nas escolas que receberão a intervenção proposta pelo Programa AME. Esta é uma das etapas que precede a

implementação da intervenção nas escolas. Nesta formação foram trabalhadas estratégias para incentivar uma alimentação adequada e saudável e o estilo de vida ativo dos adolescentes escolares, com o intuito de apresentar sugestões e construir alternativas para a atuação profissional na escola que permita a discussão, estímulo e orientação dos adolescentes sobre estes temas nas disciplinas curriculares do Ensino Fundamental II. Como produto desta ação de ensino foi produzido um material de apoio para inserção dos temas norteadores do Programa AME no currículo escolar que está em etapa de editoração pela Secretaria de Educação a Distância da UFRN.

O evento de capacitação foi aprovado e financiado pelo Edital para eventos integrados para 2019 (UFRN/PROEX/PROGRAD/PPG/PROPESQ 02/2019) com o título: “Prática da atividade física, estilo de vida não sedentário e alimentação saudável nas disciplinas curriculares do Ensino Fundamental”.

Também na extensão foi submetido e aprovado, em primeiro lugar, no Edital de financiamento interno - UFRN/PROEX N° 007/2019 o projeto de Extensão com o título: “Projeto AME 2020: Atitude, Movimento e Escolhas para uma vida saudável”. De acordo com o Plano Nacional de Extensão (UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE, 2012), a proposta está na área temática da Saúde, pois visa à promoção à saúde e qualidade de vida de adolescentes escolares, estimulando a saúde, o esporte e lazer, atingindo de maneira indireta toda a comunidade escolar incluindo os familiares e amigos. Neste contexto, a universidade através desta proposta assegura o retorno de seus esforços para a sociedade.

Por fim, a presente tese está estruturada de acordo com as recomendações do Programa de Pós Graduação em Saúde Coletiva da UFRN para o formato Coletânea de Artigos.

RESUMO

O aumento na prevalência da obesidade precoce, sobretudo nas primeiras décadas do século XXI, se converteu em importante problema de saúde pública com proporções mundiais, especialmente, em função de que a obesidade entre as crianças e adolescentes tende a persistir na idade adulta e estar fortemente associada ao desenvolvimento de doenças crônicas e aumento no risco de óbito. Ações tornam-se relevantes e necessárias para conter essa progressão e, nesse sentido, o ambiente escolar mostra-se adequado para intervenções educacionais para a prevenção e combate a obesidade. O Programa AME "Atitude, Movimento e Escolhas para uma vida saudável" foi elaborado no Programa de Pós Graduação em Saúde Coletiva da Universidade Federal do Rio Grande do Norte e trata-se de uma intervenção multicomponente, baseada na escola, com a abordagem na educação em saúde voltada para alimentação adequada e saudável e estímulo ao estilo de vida ativo (redução do comportamento sedentário e prática de atividade física). O objetivo da tese de doutorado é desenvolver estratégias de Educação Alimentar e Nutricional (EAN) em um programa de intervenção multicomponente baseada na escola para promoção de alimentação adequada e saudável e estilo de vida ativo entre adolescentes. Trata-se de uma pesquisa de desenvolvimento em que foi utilizada a literatura científica atual e disponível com o intuito de elaborar estratégias do eixo de EAN do Programa AME. O método está organizado em duas seções, a primeira descreveu o método dos estudos de revisões sistemáticas (RS) que contribuíram com o embasamento técnico-científico para o desenvolvimento do protocolo; e a segunda seção descreveu o protocolo do ensaio clínico randomizado (ECR). Na primeira seção, duas RS foram desenvolvidas seguindo as recomendações dos Itens para Relatório Preferenciais para Revisões Sistemáticas e Meta-análises (PRISMA) e foram registradas no *International prospective register of systematic reviews* (PROSPERO - CRD42019116520 e CRD42019100914). Para contextualizar onde está inserido o eixo EAN do Programa AME, a segunda seção apresenta os métodos do ECR. A pesquisa foi aprovada pelo Comitê de Ética em Pesquisa (CEP-HUOL UFRN) e registrada no Registro Brasileiro de Ensaios Clínicos (RBR-86xv46). A tese de doutorado está organizada no formato coletânea de artigos. A primeira RS investiga a efetividade de intervenções de EAN baseado na escola e seus efeitos sobre o consumo alimentar de adolescentes e nela foram incluídos 24 ECR. Em 16 estudos a intervenção conseguiu melhorar o consumo de pelo menos um alimento ou grupo de alimentos recomendados como alimentos saudáveis. Os resultados indicam que as intervenções baseadas na escola estão gerando mudanças favoráveis no consumo alimentar de

adolescentes. A segunda RS investiga as evidências científicas quanto à associação entre o consumo de carne vermelha e doenças cardiovasculares, incluindo o efeito dose-resposta e nela foram incluídos 22 estudos prospectivos de coorte. Os resultados indicam uma possível associação entre o consumo de carne vermelha, especialmente carne processada, e a incidência e mortalidade por doença cardíaca coronária, derrame e/ou insuficiência cardíaca. A tendência de dose resposta linear indica que, quanto maior o consumo de carne vermelha, maior o risco de incidência e mortalidade por doenças cardiovasculares. Assim, baseada nos resultados encontrados nas RS, no contexto do ECR e aliadas às recomendações de documentos oficiais da Organização Mundial da Saúde, Ministério da Saúde do Brasil e instituições internacionais, foi realizada a construção da fundamentação teórica da proposta de intervenção do eixo de EAN do Programa AME. O estudo apresenta a justificativa para o desenvolvimento do eixo; as teorias orientadoras do programa AME; objetivos e metas; e características do eixo EAN do programa AME. Desenvolver estratégias de EAN em um programa de intervenção multicomponente baseada na escola para promoção de estilo de vida ativo e alimentação adequada e saudável entre adolescentes poderá propiciar aos adolescentes a construção de pensamentos críticos e reflexivos, que poderão transformar sua vida, a de sua família, comunidade e até mesmo de seu território.

Palavras-chave: Alimentação. Educação em Saúde. Ensaio Clínico. Escola. Adolescente.

ABSTRACT

The increase in the prevalence of early obesity, especially in the first decades of the 21st century, has become an important public health problem of worldwide proportions. This is due to the fact that obesity among children and adolescents tends to persist in adulthood and is strongly associated with the development of chronic diseases and increased risk of death. Actions become relevant and necessary to contain this progression, in this sense, the school environment is suitable for educational interventions to prevent and combat obesity. The AME Program "Attitude, Movement and Choices for a Healthy Life" was developed in the Postgraduate Program in the Collective Health at the Federal University of Rio Grande do Norte and is a multicomponent, including school-based food and nutrition education, reduction of sedentary behavior, and the practice of physical activity. The objective of the doctoral thesis is to develop strategies in Food and Nutrition Education (FNE) in a school-based multicomponent intervention program to promote adequate and healthy food and active lifestyle among adolescents. This is a developmental research in which the current scientific literature was used and available in order to develop strategies for FNE axis of the AME Program. The method is organized in two sections, the first described the method of studies of systematic reviews (SR) that contributed with the technical-scientific basis for the development of the protocol; and the second section described the protocol of the randomized clinical trial (RCT). In the first section, two SRs were developed following the recommendations of the Preferred Report Items for Systematic Reviews and Meta-analyzes (PRISMA) and were registered in the International prospective register of systematic reviews (PROSPERO - CRD42019116520 and CRD42019100914). To contextualize where the FNE axis of the AME Program is inserted, the second section presents the methods of the RCT. The research was approved by the Research Ethics Committee (CEP-HUOL UFRN) and registered in the Brazilian Registry of Clinical Trials (RBR-86xv46). The doctoral thesis is organized in the collection of articles. The first SR investigates the effectiveness of school-based FNE interventions and their effects on adolescent food consumption and 24 RCTs were included. In 16 studies, the intervention managed to improve the consumption of at least one food or group of foods recommended as healthy foods. The results indicate that school-based interventions are generating favorable changes in adolescent food consumption. The second SR investigates the scientific evidence regarding the association between red meat consumption and cardiovascular diseases, including the dose-response effect and 22 prospective cohort studies were included. The results indicate a possible association between

the consumption of red meat, especially processed meat, and the incidence and mortality from coronary heart disease, stroke and / or heart failure. The trend of linear dose response indicates that the greater the consumption of red meat, the greater the risk of incidence and mortality from cardiovascular diseases. Thus, based on the results found in the SR, in the context of the RCT and combined with the recommendations of official documents of the World Health Organization, Ministry of Health of Brazil and international institutions, the theoretical foundation of the intervention proposal for the FNE axis of the AME Program was carried out. The study presents the rationale for the development of the axis; the guiding theories of the AME program; goals and objectives; and characteristics of the FNE axis of the AME program. Developing FNE strategies in a school-based multicomponent intervention program to promote an active lifestyle and adequate and healthy nutrition among adolescents may provide adolescents with the construction of critical and reflective thoughts that can transform their lives, that of their families, community and even their territory.

Keywords: Food. Health Education. Clinical Trial. School. Adolescent.

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LISTA DE SIGLAS

AME	Atitude, Movimento e Escolhas para uma vida saudável
DSS	Determinantes Sociais da Saúde
DCV	Doença Cardiovascular
EAN	Educação Alimentar e Nutricional
ECR	Ensaio Clínico Randomizado
IMC	Índice Massa Corporal
PPGSCol	Programa de Pós Graduação em Saúde Coletiva
PRISMA	Relatórios Preferenciais para Revisões Sistemáticas e Meta-Análises
RN	Rio Grande do Norte
UFRN	Universidade Federal do Rio Grande do Norte
PROSPERO	*International prospective register of systematic reviews*

SUMÁRIO

1 INTRODUÇÃO

Nas últimas décadas, o planeta vivenciou uma complexa mudança nos padrões de saúde e doença e nas interações entre esses, bem como em seus determinantes. Trata-se da transição epidemiológica, documentada por Abdel Omran, em seu artigo de 1971, *"The Epidemiologic Transition: A Theory of the Epidemiology of Population Change"* em que o autor anuncia "doenças degenerativas e provocadas pelo homem substituem as pandemias de infecção como as principais causas de morbimortalidade" [tradução livre da autora] (OMRAN, 1971, p.732).

Entretanto, as doenças transmissíveis não foram extintas e seu espectro tem evoluído rapidamente em relação ao conjunto de fortes mudanças sociais e ambientais (ORGANIZAÇÃO PAN-AMERICANA DA SAÚDE, 2010). Especificamente, em 2020, o mundo vivencia a pandemia do novo coronavírus de 2019 (2019-nCoV), que causa uma síndrome respiratória aguda grave (SARS-CoV-2) (GORBALENYA et al., 2020). O vírus originou-se na cidade de Wuhan, na província de Hubei, na China, e encontra-se em rápida disseminação por todos os continentes mundiais (WANG et al., 2020).

Na maioria das pessoas a doença é leve ou assintomática, entretanto, existem alguns fatores que podem contribuir com o agravamento da doença, como o fato da pessoa apresentar comorbidades pré-existentes (doença cardiovascular, hipertensão, diabetes, doença respiratória, entre outras) (SINGHAL, 2020). Nestes casos, o quadro pode evoluir para pneumonia, síndrome do desconforto respiratório agudo, disfunção de múltiplos órgãos e até a morte (SINGHAL, 2020).

Esta nova crise de saúde pública, considerando sua gravidade e o modo como afeta indivíduos com comorbidades, é mais um fator que demonstra o quão importante e urgente o combate ao crescimento do número de doenças crônicas na população, e em especial, do sobrepeso e obesidade. Visto que o sobrepeso e a obesidade estão associados com múltiplas comorbidades, como a síndrome metabólica, doenças cardiovasculares (DCV), hepáticas, ortopédicas, pulmonares e psicológicas, além de prejuízos na capacidade cognitiva (CHAUDHARY; KANG; SANDHU, 2010; CHU et al., 2018; GUO et al., 2011).

Desde 1990, a prevalência de sobrepeso e obesidade tem aumentado em quase todos os países. A aceleração e gravidade com que esta prevalência vem aumentando, somado as consequências que a obesidade gera em nível individual, social e econômico, nos apontam o

quanto a prevenção da obesidade na infância e adolescência é de suma importância (PATTON et al., 2016).

Na adolescência, os fatores de risco modificáveis para a obesidade se alteram rapidamente. Os fatores de risco modificáveis estão relacionados aos hábitos de vida e entre as mudanças na adolescência estão: aumento da autonomia em relação às escolhas alimentares, o que geralmente leva a escolhas alimentares menos saudáveis; maior exposição à influência da mídia para o consumo de alimentos processados; diminuição da atividade física; e aumento do comportamento sedentário comparado à infância (PATTON et al., 2016).

Neste contexto, a educação em saúde para adolescentes deve ser planejada e executada de maneira diferente da abordagem utilizada com crianças, respeitando as particularidades desta fase da vida. As estratégias que são eficazes e adequadas para crianças, podem não apresentar a mesma eficácia para os adolescentes.

A escola se apresenta como um ambiente ideal para o desenvolvimento de práticas promotoras de saúde, que exercem influência na aquisição de valores e estimula o exercício da cidadania. Ela tem sido identificada como um ambiente adequado para influenciar o consumo alimentar adequado e saudável, estimulo a um estilo de vida ativo entre os adolescentes (PRICE. et al., 2017; RACEY et al., 2016; WORLD HEALTH ORGANIZATION, 2014).

Ao revisar sistematicamente as evidências de intervenções escolares direcionadas ao comportamento alimentar e da atividade física em crianças e adolescentes na Europa, os resultados sugerem que a combinação de componentes educacionais e ambientais focados no comportamento alimentar e da atividade física produz efeitos melhores e mais relevantes (DE BOURDEAUDHUIJ et al., 2011).

Mudanças nos comportamentos de alimentação e no estilo de vida ativo (redução do comportamento sedentário e aumento da prática de atividade física) envolvem a capacidade de tomada de decisão para comportamentos saudáveis. Na adolescência, em especial na fase de maturação puberal (15 aos 19 anos), ocorre o desenvolvimento do córtex pré-frontal e do aumento da conectividade entre as redes cerebrais, com o desenvolvimento contínuo de habilidades executivas e de autorregulação, ou seja, aumentando a capacidade de ponderar as consequências das decisões a curto e em longo prazo (DIAMOND, 2013; PATTON et al., 2016).

Considerando este contexto, e os estudos que apontam que a prática de atividade física e a alimentação saudável estão associadas ao funcionamento cognitivo e habilidades

executivas (AZEVEDO et al, 2020; HAWKINS; KEIRNS; HELMS, 2018; HÖTTING et al., 2016; KOMIYAMA et al., 2016; MARTIN et al., 2018), o grupo de pesquisa vinculado ao PPGSCol elaborou o Programa AME – Atitude, Movimento e Escolhas para uma vida saudável.

O Programa AME caracteriza-se por ser um programa de intervenção multicomponente baseada na escola com ações combinadas, ou seja, uma proposta de intervenção com a abordagem na educação para uma alimentação adequada e saudável e para um estilo de vida ativo. O programa tem como o objetivo melhorar as habilidades executivas dos adolescentes permitindo uma melhor tomada de decisão e consequentemente, mudanças de comportamento no consumo alimentar e no estilo de vida ativo.

Assim, o Programa AME foi estruturado para trabalhar em três eixos temáticos: educação alimentar e nutricional, redução do comportamento sedentário e estimulo à prática de atividade física, a fim de promover uma alimentação adequada e saudável e um estilo de vida ativo entre os adolescentes escolares. A presente tese de doutorado tem como enfoque o desenvolvimento de estratégias do eixo de Educação Alimentar e Nutricional (EAN) do Programa AME.

Para tanto, como embasamento técnico-científico foram desenvolvidas duas revisões sistemáticas: uma sobre os efeitos de intervenções baseadas na escola e o consumo alimentar de adolescentes, visto a ausência de estudos que resumam este efeito especificamente com adolescentes; e a outra sobre associação do consumo de carnes vermelha e a morbimortalidade por DCV e seu efeito dose resposta, visto estudos apontam associação de seu consumo com o risco de mortalidade por todas as causas (SCHWINGSHACKL et al. 2017, ZHONG et al., 2020); com a doença cardíaca coronária, acidente vascular cerebral e insuficiência cardíaca (BECHTLOD et al. 2017; MICHA, MICHAS e MOZAFFARIAN 2012), bem como com alguns tipos de câncer (Stewart et al. 2015), seria oportuno investigar a associação entre o gradiente do consumo de carnes (teste de dose-resposta) e os diferentes tipos de DCV.

Na sequência do presente documento serão apresentadas as seções: *revisão de literatura* que tratará dos temas mudanças nos padrões de saúde e doença, obesidade infantil, saúde na escola, e educação alimentar e nutricional; *objetivo* geral e objetivos específicos; os *procedimentos metodológicos*; *resultados e discussão*, com anexação dos artigos científicos publicados e ou submetidos à avaliação em periódicos internacionais; e por fim, apresentação das conclusões do trabalho com ponderações sobre o tema, suas perspectivas e limitações.

2 REVISÃO DA LITERATURA

2.1 Mudanças nos padrões de saúde e doença

A forma como se busca explicar a saúde de uma população tem variado historicamente e depende, fundamentalmente, da definição teórica que se tenha de saúde e doença e seu significado a nível individual e coletivo (CORDEIRO, 2014).

No modelo positivista observam-se movimentos políticos que avaliam os efeitos de práticas apoiadas na concepção de saúde como redução dos sintomas da doença, encontrado na definição de saúde como o perfeito bem-estar biopsicossocial. Entretanto, na Reforma sanitária e na constituição do Sistema Único de Saúde surge no país o conceito de saúde que conectou, discursivamente, o conceito de promoção da saúde e prevenção de doenças às ações de redução de sintomas, por meio do principio da integralidade (BAGRICHEVSKY, 2015).

O conceito de doença tem origem na visão ontológica do mal, passando para concepção dinâmica, que trata do equilibro de forças como encontramos na definição de saúde da Organização Mundial da Saúde (OMS)*:*

> A saúde é um estado de equilíbrio relativo da forma e função corporal, que resulta do seu ajuste dinâmico bem-sucedido às forças que a perturbam. Não é uma interação passiva entre a substância corporal e as forças que a afetam, mas uma resposta ativa das forças corporais que trabalham em direção ao reajuste [tradução livre da autora] (AROUCA, 2003, p.158).

A destruição da concepção ontológica da doença levou também a destruição da terapia ontológica. O sujeito da terapia deixa de ser as doenças e passa a ser as condições de vida, chegando a definição de que a doença como fisiologia alterada: *"A doença não é nada mais que a vida em condições alteradas"* (FABER, 1922 apud GARCIA, 1989, p.165). Neste contexto, Jules Guérin é o primeiro autor a definir este tratamento como medicina social (GARCIA, 1989). Donnagelo propõe que a história natural da doença seja reconsiderada como história social do processo saúde-doença (CORDEIRO, 2014).

Segundo Donnagelo, o que se conhece como epidemiologia é centrado na noção da história natural da doença. O social está inserido de forma marginal no conjunto de elementos que são tomados como centrais para a articulação capaz ou não de provocar a doença. O social está presente de forma naturalizada, ele é um pedaço do que se chama de meio (agente, hospedeiro e meio) (DONNANGELO, 2014).

O desenvolvimento da sociedade e do modo de vida trouxeran mudanças para os padrões de saúde e doença, levando a chamada transição epidemiológica, com diminuição das doenças transmissíveis e aumento das doenças não transmissíveis. Segundo, Onram (2005, p. 732), "a teoria da transição epidemiológica enfoca a complexa mudança nos padrões de saúde e doença e as interações entre esses padrões e seus determinantes e consequências demográficas, econômicas e sociológicas".

De acordo com o estudo *Global Burden of Disease* 2017, entre 1990 e 2017, a morte precoce por infecções entéricas (como diarreia, febre tifoide e paratifoide e outras infecções intestinais), infecções respiratórias e tuberculose e os distúrbios maternos e neonatais diminuiu, enquanto o número de mortes por doenças não transmissíveis, como DCV e cânceres aumentou (INSTITUTE FOR HEALTH METRICS AND EVALUATION (IHME), 2018).

Apesar de muitas doenças infecciosas terem sido controladas e extintas, outras novas doenças vão surgindo ao longo da história. Em 30 de janeiro de 2020, o diretor-geral da OMS, Dr. Tedros Adhanom Ghebreyesus, declarou o novo surto de coronavírus (2019-nCoV) uma emergência de saúde pública de interesse internacional (WORLD HEALTH ORGANIZATION, 2020). Esta é a sexta declaração deste tipo, após H1N1 (2009), poliomielite (2014), Ebola na África Ocidental (2014), Zika (2016) e Ebola no República Democrática do Congo (2019) (LAI et al., 2020).

Esta atual pandemia chama a atenção para a importância do combate e prevenção das doenças crônicas, visto que a infecção pelo SARV-CoV 2 (2019-nCoV) tem apresentado o curso da doença com maior severidade e muitas vezes levando ao óbito, quando o paciente apresenta doenças crônicas pré-existentes (SINGHAL, 2020).

No contexto atual em que o COVID-19 alcançou os países que possuem uma elevada prevalência de obesidade, pessoas nesta condição, assim como portadoras de diabetes, hipertensão, doenças respiratórias, doenças cardíacas e câncer, vem sendo classificadas como um grupo em condições de risco para complicações e maior severidade de doença (ALLEN, 2020; BRASIL, 2020).

O Centro Nacional de Pesquisa e Auditoria em Terapia Intensiva publicou um relatório sobre os primeiros 775 pacientes de COVID-19 internados em unidades de terapia intensiva (UTI) no Reino Unido (ICNARC, 2020). Os números são pequenos, mas no encontro da pandemia da obesidade com a pandemia do COVID-19 parece haver um risco

aumentado de morte em pacientes obesos admitidos em uma UTI com infecção por COVID-19 (ICNARC, 2020; SPIEGELHALTER et al., 2020).

Na pandemia da gripe A (H1N1) em 2009, a obesidade também foi associada com complicações desta doença viral. Embora a infecção com a cepa de H1N1 normalmente resulte em sintomas relativamente leves e sem complicações, investigações epidemiológicas identificaram a obesidade como um fator de risco independente para hospitalização e morte por gripe A (H1N1) (HANSLIK; BOELLE; FLAHAULT, 2010; LOUIE et al., 2011; MORGAN et al., 2010; SANTA-OLALLA PERALTA et al., 2010).

Neste contexto, torna-se imprescindível a prevenção da obesidade desde os primeiros anos de vida. Prevenir a obesidade infantil reduz a chance de obesidade na vida adulta e do surgimento consequente de comorbidades. Além disso, prevenir a obesidade indica menor chance de agravamento na presença de infecções graves (WORLD HEALTH ORGANIZATION, 2019).

2.2 Obesidade infantil

A OMS define sobrepeso e obesidade como acúmulo anormal ou excessivo de gordura que apresenta risco à saúde (WORLD HEALTH ORGANIZATION, 2020). Em 2013, a *American Medical Association* declarou a obesidade como uma doença crônica (MELDRUM; MORRIS; GAMBONE, 2017).

A obesidade é definida como uma doença crônica multifatorial que resulta, na maioria das vezes, de uma ingestão energética superior ao gasto energético, ou seja, resulta de um balanço energético positivo crônico (CHOOI; DING; MAGKOS, 2019).

As múltiplas influências nas escolhas alimentares das pessoas foi descrito em uma estrutura ecológica, separando-as nos seguintes fatores: individuais, sociais, ambientais e de "nível macro" (Figura 1) (STORY et al., 2008). De acordo com NORIEA et al. (2018), esses fatores ao atuarem em conjunto moldam a epidemia da obesidade e servem como alvos potenciais para o gerenciamento dessa doença (NORIEA et al., 2018).

O termo obesidade infantil refere-se ao acúmulo anormal ou excessivo de gordura em pessoas com menos de 19 anos de idade, ou seja, crianças e adolescentes. Para os adolescentes, o Índice Massa Corporal (IMC) para idade maior que 1 desvio padrão acima da mediana de referência de crescimento da OMS é classificado como sobrepeso; e mais de 2

desvios padrão acima da mediana de referência de crescimento da OMS é classificado como obesidade (WORLD HEALTH ORGANIZATION, 2020).

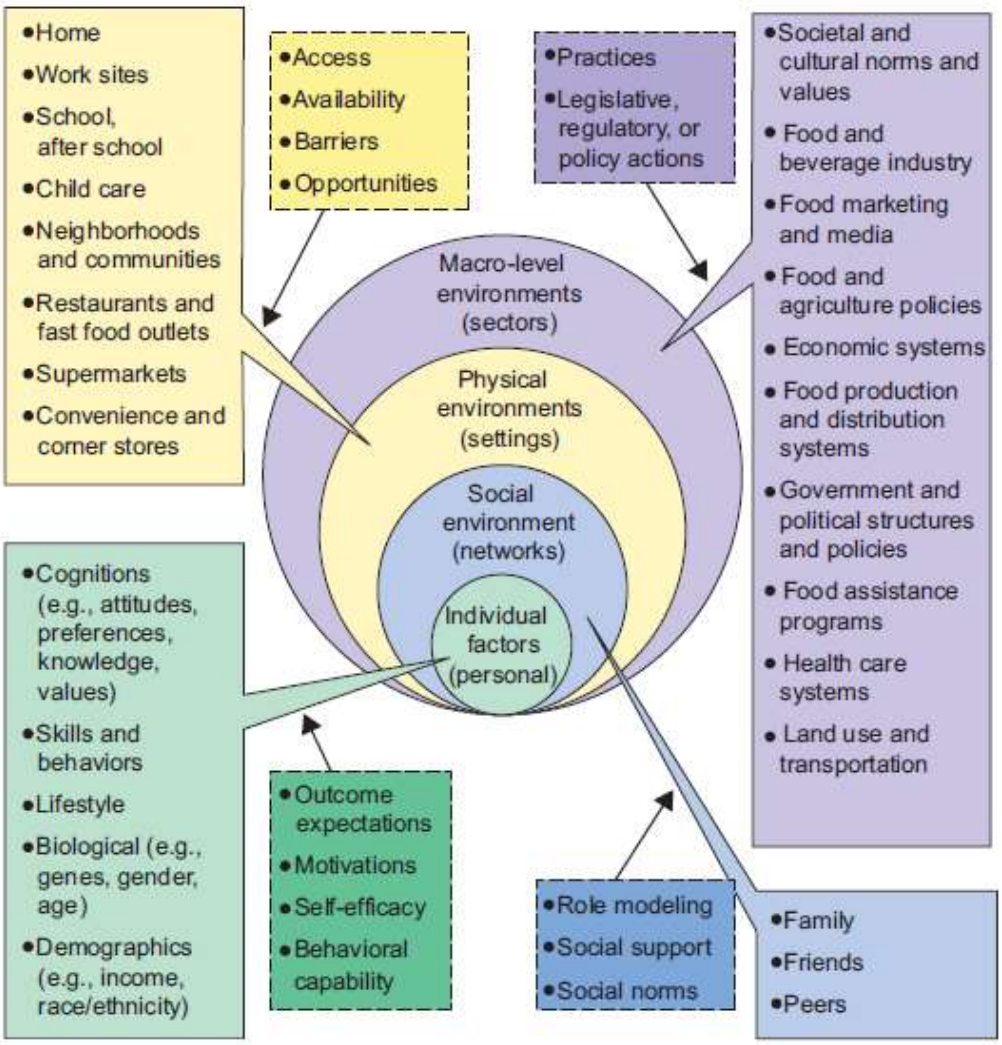
Em pesquisas globais, obesidade e sobrepeso em pessoas com 18 anos ou mais de idade são relatados como dados de adultos. No entanto, a OMS define adolescentes como aqueles indivíduos com idade variando entre 10 e 19 anos (WORLD HEALTH ORGANIZATION, 2017).

Para a classificação dos índices antropométricos na adolescência a OMS recomenda a utilização do IMC para idade, que é um indicador de gordura corporal total; e a utilização do índice de estatura por idade para a avaliação do crescimento linear (ONIS et al., 2007). O IMC é definido como o peso de uma pessoa em quilogramas dividido pelo quadrado da sua altura em metros (kg/m^2). O Quadro 1 apresenta os pontos de corte de IMC-para-idade e Estatura-para-idade para Adolescentes segundo a OMS (2007) (BRASIL, 2011).

Apesar de alguns países apresentarem documentos com as tendências no status de peso de crianças e adolescentes, existem poucas informações comparáveis sobre as tendências mundiais e nenhuma para o IMC médio. Neste contexto, o *Non-communicable Disease Risk Factor Collaboration* reuniram 2416 estudos populacionais com medidas de altura e peso em 128,9 milhões de participantes com 5 anos ou mais, incluindo 31,5 milhões entre 5 e 19 anos, o objetivo de estimar as tendências mundiais no IMC (NCD RISK FACTOR COLLABORATION, 2017).

De acordo com os resultados encontrados no estudo supracitado, o IMC médio padronizado para a idade global de crianças e adolescentes de 5 a 19 anos em 1975, foi de 17,2 kg/m² (IC 95% 16,8–17,6) para meninas e 16,8 kg/m² (IC 95% 16,3–17,2) para meninos. De 1975 a 2016 o aumento global foi de 0,32 kg/m² por década (IC 95% 0,23–0,41), o que resultou em 2016 em IMC médios padronizados por idade para meninas e meninos com valores quase idênticos, sendo 18,6 kg/m² (IC 95% 18,4–18,7) para meninas e 18,5 kg/m² (IC 95% 18,3–18,7). Seguindo o esperado, durante os 42 anos de análise, a prevalência global de obesidade padronizada em crianças e adolescentes aumentou. Em 1975 a prevalência global em meninas era de 0,7% (IC 95% 0,4–1,2) passando para 5,6% (IC 95% 4,8–6,5) em 2016, e em meninos passou de 0,9% (IC 95% 0,5–1,3) em 1975 para 7,8% (IC 95% 6,7–9,1) em 2016.

Figura 1 – An ecological framework depicting the multiple influences on what people eat



Fonte: Story et al., 2008.

Quadro 1 – Pontos de corte de IMC-para-idade e Estatura-para-idade para Adolescentes segundo a OMS (2007)

Valores Críticos	**Índices Antropométricos**	
	IMC-para-idade	**Estatura-para-idade**
< Score-z -3	Magreza acentuada	Muito baixa estatura para idade
≥ Score-z -3 e < Score-z -2	Magreza	Baixa estatura para idade
≥ Score-z -2 e ≤ Score-z +1	Eutrofia	Estatura adequada para idade
> Score-z +1 e ≤ Score-z +2	Sobrepeso	
> Score-z +2 e ≤ Score-z +3	Obesidade	
> Score-z +3	Obesidade grave	

Fonte: WHO (2007), (BRASIL, 2011).

No Brasil, a Pesquisa Nacional de Saúde do Escolar que é realizada com adolescentes das capitais brasileiras mostra que em 2015 a prevalência de excesso de peso entre adolescentes de 13 a 17 anos de idade foi 23,7% da população estudada e 20,5% no nordeste; e a média nacional e no nordeste de obesidade foi 7,8% e 6,4%, respectivamente (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2016).

Especificamente no município de Natal, Rio Grande do Norte (RN), as informações oficiais sobre prevalência de sobrepeso e obesidade encontram-se no VIGITEL 2018, e apresenta a prevalência de excesso de peso entre adultos (≥ 18 anos) de 54% (IC 51,2-57,5); e a prevalência de obesidade de 21,2% (IC 18,6-23,8) (BRASIL, 2019).

O excesso de peso e a obesidade entre os adolescentes os colocam em situação de risco, visto que estudos apresentam associações entre obesidade e DCV, distúrbios cardio-metabólicos, diabetes melitus tipo 2, câncer e distúrbios reprodutivos (CHU et al., 2018), podendo resultar em morte precoce. Em 2015, o IMC elevado foi responsável por 4 milhões de mortes por todas as causas em todo o mundo, nas quais a doença cardiovascular foi a principal causa de morte. Importante ressaltar que quase 40% das mortes ocorreram em pessoas que não eram obesas (THE GBD 2015 OBESITY COLLABORATORS, 2017).

As doenças crônicas são o resultado de uma combinação de fatores genéticos, fisiológicos, ambientais e comportamentais (WORLD HEALTH ORGANIZATION, 2018) Sua prevalência tem aumentado em todo o mundo e nenhum país está livre de seu impacto (EPPING-JORDAN.JE, PRUITT.SD, BENGOA.R, WAGNER.EH, 2002).

Os principais fatores de risco comportamentais tanto das DCV, como de outras doenças crônicas (câncer, diabetes e doenças respiratórias crônicas), são as dietas pouco saudáveis, a inatividade física, o tabagismo, e o uso nocivo de álcool (BENZIGER; ROTH; MORAN, 2016; WORLD HEALTH ORGANIZATION, 2011).

A exposição em longo prazo destes fatores de risco comportamentais leva a alterações metabólicas e fisiológicas: hipertensão, sobrepeso e obesidade, diabetes e dislipidemia que causam danos aos vasos sanguíneos coronários e cerebrais devido à aterosclerose. Este processo da aterosclerose é lento, podendo começar na infância, mas pode ocasionar infartos e acidentes vasculares celebrais apenas após os 35 anos de idade (WORLD HEALTH ORGANIZATION, 2011).

A literatura ressalta que em função da ausência de informações de qualidade especificamente entre os adolescentes, bem como a variedade de metodologia e definições utilizadas, a prevalência de condições crônicas nessa população é difícil de avaliar (SURIS;

MICHAUD; VINER, 2004). No Brasil, entretanto, a Pesquisa Nacional por Amostra de Domicílios (PNAD) apresentou que 11% dos adolescentes entre 14 a 19 anos pesquisados apresentavam doença crônica (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA , 2010).

A obesidade é uma pandemia e precisa ser tratada e, principalmente, prevenida devido a suas comorbidades, mortalidade e custos significativos para a saúde pública (MELDRUM; MORRIS; GAMBONE, 2017).

Nesse sentido, a OMS estabeleceu a Comissão sobre o Fim da Obesidade Infantil com objetivo de combater o crescimento do número de crianças e adolescentes com obesidade. Essa comissão recomenda a implementação de programas abrangentes que promovam saúde por meio de ambientes escolares saudáveis, letramento de saúde e nutrição e atividade física entre crianças e adolescentes em idade escolar (WORLD HEALTH ORGANIZATION, 2017).

2.3 Saúde na escola

2.3.1 Promoção da saúde

Na década de 1960, em várias partes do mundo, se debatia sobre a determinação econômica e social da saúde, abrindo caminho para a busca de uma abordagem positiva que superasse a orientação predominantemente centrada no controle da enfermidade (FERREIRA; BUSS, 2002).

A promoção da saúde é um termo que surgiu na definição das quatro tarefas essenciais da medicina - a promoção da saúde, a prevenção das doenças, a recuperação dos enfermos e a reabilitação (PELEGRINI FILHO; BUSS; ESPERIDIÃO, 2014).

De acordo com a Declaração de Alma-Ata (1978), os cuidados primários de saúde constituem a chave que permitirá que todos os povos do mundo atinjam um nível de saúde que lhes permita levar uma vida social e economicamente produtiva (WORLD HEALTH ORGANIZATION, 1978).

A Declaração de Alma-Ata amplia a visão do cuidado da saúde, envolvendo a própria população e exigindo os esforços coordenados de todos os setores e campos de atividade associadas ao desenvolvimento nacional e comunitário, em particular o agropecuário, a alimentação, a indústria, a educação, a habitação, as obras públicas, as comunicações e outros (FERREIRA; BUSS, 2002).

Em 1981, na Primeira Conferência Nacional de Saúde, no Canadá, foi introduzida a ideia de que contexto social moldava o comportamento individual, logo, a escolha do estilo de

vida dependia da classe social. Assim, o contexto social é apesentado como um poderoso determinante da saúde e a promoção da saúde que era baseada nos estilos de vida passou a ser centrada nos fatores sociais e ambientais (FERREIRA; BUSS, 2002).

Em 21 de novembro de 1986, ocorreu a Primeira Conferência Internacional sobre Promoção da Saúde, com a promulgação da Carta de Ottawa que define que a promoção da saúde "consiste em proporcionar aos povos os meios necessários para melhorar sua saúde e exercer um maior controle sobre a mesma" (BRASIL, 2002, p.1).

Esta nova concepção de saúde valorizava o desenvolvimento humano, ressaltando os fatores necessários para assegurar a qualidade de vida e o direito ao bem-estar social, apontando para os determinantes da saúde, apesar de ainda não se utilizar este termo. Os determinantes da saúde foram incorporados na 34ª Assembleia Mundial da Saúde, na elaboração do Sétimo Programa de Trabalho da OMS (1984 - 1989) (FERREIRA; BUSS, 2002).

Entretanto, o movimento global sobre os determinantes sociais da saúde (DSS) iniciou em 2005, com a criação da Comissão sobre DSS da OMS. Esta comissão desempenhou um extraordinário papel de promoção do tema dos DSS na agenda global, mobilizando governos, especialistas e organizações da sociedade civil (PELLEGRINI FILHO, 2011).

Buss e Pellegrini Filho (2007, p.78) nos apresentam três conceitos de DSS: da Comissão Nacional sobre os Determinantes Sociais da Saúde, que define os DSS como "fatores sociais, econômicos, culturais, étnicos e raciais, psicológicos e comportamentais que influenciam a ocorrência de problemas de saúde e seus fatores de risco na população"; da OMS que define os DSS como "as condições sociais em que as pessoas vivem e trabalham"; e por fim, resumem que existem diversos conceitos de DSS que expressam "o conceito atualmente bastante generalizado de que as condições de vida e trabalho dos indivíduos e de grupos da população estão relacionadas com sua situação de saúde".

A promoção da saúde por meio da educação em saúde trata-se de uma prática social que considera os DSS e parte da realidade das pessoas, estimulando a busca por soluções para prevenção e resolução dos problemas de saúde tanto nos aspectos individuais quanto coletivo (BRASIL, 2007).

A promoção da saúde chegou às escolas por meio de práticas de higiene, de cuidado e de cura que buscam promover a saúde preventiva (ROBERTO; SCHIPHORST, 2016). Historicamente, os médicos higienistas foram adquirindo espaço na sociedade no final do

Século XVIII, por meio de ações intervencionistas de cuidados corporais, de alimentação, roupa, hábitos e costumes das pessoas, estabelecendo-se a chamada "Policia Médica" (BAGRICHEVSKY, 2015).

Seguindo as bases da Carta de Ottawa para a Promoção da Saúde, no final da década de 1980, na Europa e na América do Norte, nasceu o conceito de Escola de Promoção da Saúde da OMS. Nesta proposta é estabelecida uma abordagem holística para promover educação em saúde nas escolas, procurando superar o sucesso limitado da educação em saúde tradicional (LANGFORD et al., 2015).

Como ressaltado por Martínez (2017), a promoção da saúde não se refere apenas a grupos de risco ou pessoas que tenham alguma doença, mas se dirige a todo conjunto da população, sendo uma atividade que combina saúde e social, e não apenas um serviço médico.

Como as crianças e adolescentes passam mais de 10 anos de sua vida frequentando a escola, a promoção da saúde por meio da educação em saúde nas escolas para a prevenção de doenças passa a ser uma possibilidade para reduzir as iniquidades em saúde.

2.3.2 Educação em saúde

De acordo com a OMS a "educação em saúde é qualquer combinação de experiências de aprendizado projetadas para ajudar indivíduos e comunidades a melhorar sua saúde, aumentando seus conhecimentos ou influenciando suas atitudes" [tradução livre da autora] (WORLD HEALTH ORGANIZATION, [s.d.]).

Inicialmente, a educação em saúde era baseada na entrega de informações e fatos, mas, gradativamente, as abordagens educacionais se voltaram mais para o desenvolvimento de habilidades e para abordar todos os aspectos da saúde, incluindo o bem-estar físico, social, emocional e mental (WORLD HEALTH ORGANIZATION, 2003).

A estrutura das Escolas de Promoção da Saúde da OMS é sustentada por essa relação recíproca entre saúde e educação. As três características principais de uma Escola Promotora de Saúde são: tópicos de educação em saúde são promovidos por meio do currículo escolar formal; a saúde e o bem-estar dos alunos são promovidos por meio do currículo informal que engloba os valores e atitudes promovidos na escola e no ambiente físico da escola; e as escolas procuram se envolver com famílias, agências externas e a comunidade em geral, em reconhecimento à importância dessas outras esferas de influência na saúde das crianças (LANGFORD et al., 2015).

A educação em saúde apresenta-se como um conjunto estruturado de práticas pedagógicas articuladas às práticas de saúde (CONVERSANI, 2004), que não se efetiva pelas atividades formais de ensino, mas sim, pelas relações mediante as quais, num processo de trabalho, transformamos a nossa consciência em uma nova consciência. Destarte, a finalidade da educação em saúde é a transformação (NAKAO; GORAYEB, 2015).

Assim, a educação em saúde ultrapassa o conceito de ensino-aprendizagem didatizada e assimétrica, extrapolando o cultivo de hábitos e comportamentos saudáveis, incorporando a concepção de direção e intencionalidade, partindo de situações de saúde de um grupo social (BRASIL, 2007).

No processo de educação em saúde os indivíduos interagem com afetos, percepções, interesses, limites, vivências e leituras da realidade bem distintas e às vezes distantes do que os educadores estão acostumados. Nessa perspectiva torna-se necessário ampliar os meios de percepção e comunicação com o público alvo, possibilitando uma compreensão mais próxima da realidade, tornando essa relação pedagógica mais eficaz, prazerosa, humana e transformadora (CONVERSANI, 2004).

A educação em saúde por meio do aprendizado e ensino no currículo escolar é uma parte essencial da promoção da saúde na escola, apesar desta abranger todos os aspectos da vida escolar. Portanto, ela não deve ser ensinada apenas como uma série de lições separadas, e sim, ser integrada diretamente em todo o currículo. A educação em saúde deve ser baseada nas melhores evidências disponíveis sobre o que funciona, utilizar os melhores e mais adequados recursos e materiais, e ser sistematicamente planejada, estruturada e avaliada (GRAY; YOUNG; BARNEKOW, 2006).

No Brasil, a educação em saúde está prevista de forma transversal na Base Nacional Comum Curricular, que é um documento que define os conhecimentos e as habilidades essenciais que todos os alunos têm direito de aprender em cada ano da vida escolar, em conformidade com o que determina o Plano Nacional de Educação (PNE) (BRASIL, 2017).

A versão final da Base Nacional Comum Curricular utiliza o modelo de habilidades e competências e destaca que, a partir dos conhecimentos científicos, os estudantes poderiam tomar decisões “a respeito da saúde individual e coletiva com base em princípios éticos, democráticos, sustentáveis e solidários” (BRASIL, 2017, p.322).

A educação em saúde na infância e adolescência pode contribuir para a adoção de comportamentos positivos de saúde que irão prevenir riscos e morte prematura, além de poder

desenvolver cidadãos informados, capazes de defender políticas e ambientes que afetam sua saúde (WORLD HEALTH ORGANIZATION, 2003).

Considerando que a alimentação inadequada é um dos principais fatores de risco para o desenvolvimento de doenças crônicas, a (re)educação alimentar e nutricional aliada a outros temas de saúde como redução do comportamento sedentário e a pratica da atividade física, se apresenta como um caminho promissor para manutenção da saúde e prevenção das doenças crônicas.

2.4 Educação Alimentar e Nutricional

No contexto da realização do Direito Humano à Alimentação Adequada e da garantia da Segurança Alimentar e Nutricional, a EAN é definida como: "**...** um campo de conhecimento e de prática contínua e permanente, transdisciplinar, intersetorial e multiprofissional, que visa promover a prática autônoma e voluntária de hábitos alimentares saudáveis" (BRASIL, 2012, p.13).

Em 2009, por meio da sanção da Lei nº 11.947, de 16 de junho, o Programa Nacional de Alimentação Escolar no Brasil incluiu, nas escolas públicas, a EAN no processo de ensino e aprendizagem, como conteúdo transversal do currículo escolar, abordando o tema alimentação e nutrição e o desenvolvimento de práticas saudáveis de vida, na perspectiva da segurança alimentar e nutricional (BRASIL, 2009).

Os currículos da educação infantil, do ensino fundamental e do ensino médio, desde 1996 no país, devem ter base nacional comum, a ser complementada, em cada sistema de ensino e em cada estabelecimento escolar, por uma parte diversificada, exigida pelas características regionais e locais da sociedade, da cultura, da economia e dos educandos, Lei 9.394 de 20 de dezembro de 1996) (BRASIL, 1996). Este documento passa a exigir um currículo em formato de Base Nacional Curricular, que após consulta pública em todo país, discussões em fórum e com especialistas das diversas áreas da Educação em 2018, estrutura-se a Base Nacional Comum Curricular (BRASIL, 2017).

Nesse sentido, apesar da inserção da EAN no currículo escolar das escolas públicas em 2009, apenas em 2018 a Lei de Diretrizes e Bases da Educação Nacional foi alterada com a inclusão da EAN no currículo escolar entre os temas transversais para todas as escolas do país (Incluído pela Lei nº 13.666, de 2018) (BRASIL, 2018).

A EAN caracteriza-se como um campo de ação da Segurança Alimentar e Nutricional e da Promoção da Saúde além de ser também um campo de valorização de

diferentes expressões da cultura alimentar; do fortalecimento de hábitos regionais; da redução do desperdício de alimentos; da promoção do consumo sustentável; e da alimentação saudável (BRASIL, 2012). Assim, promover educação alimentar e nutricional na escola permite a formação de hábitos saudáveis, contribuindo para o crescimento, o desenvolvimento biopsicossocial e a saúde dos escolares (BRASIL, 2013, 2020).

Durante o período de transição da adolescência para a idade adulta jovem, muitas vezes, o contexto leva a uma mudança em direção a comportamentos alimentares não saudáveis, como aumentar a ingestão de lanches, pular café da manhã mais frequente e diminuir a ingestão de frutas e vegetais. Como estas mudanças de comportamento contribuem para o sobrepeso, a obesidade, além de outras doenças crônicas, é necessário que intervenções para prevenção do excesso de peso aconteçam na idade escolar (DEFORCHE et al., 2015). Nessa direção, a educação nutricional de longo prazo oferecida no ambiente escolar pode fornecer às crianças e adolescentes ferramentas para atingir um status de peso saudável (PRICE, et al., 2017).

Estudo de revisão sistemática verificou que, nos estudos metodologicamente mais bem conduzidos, intervenções de educação nutricional escolar demonstraram eficácia tanto para aumentar o consumo de frutas e vegetais quanto para reduzir o sobrepeso e a obesidade em crianças e adolescentes (SILVEIRA et al., 2011).

As intervenções que demonstraram eficácia apresentam duração > 1 ano, introdução às atividades regulares da escola, envolvimento dos pais, introdução da educação nutricional no currículo regular e fornecimento de frutas e legumes pelos serviços de alimentação escolar (SILVEIRA, et al., 2011).

De acordo com Sharma (2011), a introdução da educação através de um currículo parece ser a melhor abordagem e deve ser complementado por outros componentes, como o envolvimento dos pais e da família e abordagens ambientais e políticas, como a construção de apoio social, a modificação de refeições escolares e mudanças nas políticas de nutrição.

Estudo que desenvolveu uma revisão sistemática de revisões sistemáticas avaliou a eficácia das intervenções escolares para prevenir ou controlar o sobrepeso e a obesidade entre escolares e concluiu que intervenções multicomponentes mostram ter superioridade sobre intervenções de um único componente na redução da adiposidade (AMINI et al., 2015).

Em um estudo de intervenção de educação nutricional e atividade física baseada na escola, randomizado, controlado, de curto prazo e com múltiplos componentes apresentou associação a menores níveis de ingestão de frituras, lanches ricos em gordura, açúcar e sal,

refrigerantes e maiores escores de conhecimento, independentemente da idade, sexo, IMC, etnia e valor basal apropriado. Entretanto, não foi associada a mudanças nos comportamentos de atividade física nas análises multivariadas (FRANCIS; NICHOLS; DALRYMPLE, 2010).

Outro estudo de intervenção educacional baseado na escola relacionada à dieta e ao estilo de vida (tempo de tela, atividade física) em acompanhamento de médio prazo (9 meses), concluiu que a intervenção com estudantes da Polônia de 11 a 12 anos pode reduzir a adiposidade central em pré-adolescentes, apesar da diminuição da atividade física e da tendência de aumentar o tempo de tela nesta fase da vida (WADOLOWSKA et al., 2019).

É importante ressaltar que apesar de algumas intervenções escolares não apresentarem um efeito imediato nos resultados da adiposidade, ela produz mudanças de comportamento que trazem muitos benefícios à saúde além da redução da adiposidade (AMINI et al., 2015).

Portanto, intervenções de base escolar de EAN, isoladas ou associadas à intervenções de estilo de vida ou prática de atividade física, são importantes para prevenção e manutenção da saúde, tanto na adolescência como na vida adulta futura.

3 OBJETIVOS

3.1 Objetivo geral

Desenvolver estratégias de Educação Alimentar e Nutricional (EAN) em um programa de intervenção multicomponente baseada na escola para promoção de alimentação adequada e saudável e estilo de vida ativo entre adolescentes.

3.2 Objetivos específicos

a) Investigar a efetividade das intervenções de EAN baseadas na escola e o efeito sobre o consumo alimentar de adolescentes por meio de uma revisão sistemática.
b) Verificar as evidências científicas relativas à associação entre o consumo de carne vermelha e as doenças cardiovasculares e o efeito dose-resposta por meio de uma revisão sistemática.
c) Descrever a justificativa e fundamentação teórica da proposta de intervenção do eixo de EAN em um programa de intervenção multicomponente baseada na escola para adolescentes.

4 MÉTODO

4.1 Tipo de estudo

O presente estudo trata-se de uma pesquisa de desenvolvimento, pois, utilizando sistematicamente a literatura disponível objetiva elaborar estratégias de EAN para um ECR.

Uma pesquisa de desenvolvimento é uma estratégia de pesquisa que utilizando sistematicamente conhecimentos existentes, objetiva elaborar e validar um instrumento (CONTADRIOPOULOS et al., 1999).

Por tratar-se de um estudo complexo, está organizado em duas seções, de modo sintético e de acordo com a sequência desenvolvida para alcançar o objetivo geral (Quadro 2).

Quadro 2 – Estudos descritos em cada seção do método e o produto final da tese

SEÇÕES	ESTUDOS		ARTIGOS	PRODUTO FINAL
I Seção	Revisões Sistemáticas	EAN baseada na escola	– Protocolo da RS (Artigo 1) – Resultados da RS (Artigo 2)	Justificativa e fundamentação teórica da proposta de intervenção do eixo de EAN do Programa AME (Artigo 5)
		Consumo de carne vermelha e DCV	– Protocolo da RS (Artigo 3) – Resultados da RS (Artigo 4)	
II Seção	Ensaio clínico randomizado	Métodos do Programa AME	-	

Fonte: Autoria própria (2020).

A primeira seção descreve o método utilizado nas revisões sistemáticas. As revisões foram desenvolvidas com as seguintes finalidades:

- Revisão Sistemática 1 - Pesquisa científica de revisão sistemática para definição das estratégias educacionais que apresentam evidências de efeito sobre o consumo alimentar de escolares adolescentes.
- Revisão Sistemática 2 - Pesquisa científica de revisão sistemática para que somada a outras evidências e recomendações pudesse contribuir na tomada de decisão quanto às metas de consumo de carne vermelha não processada e carne vermelha processada.

Assim, com o intuito de apresentar o contexto em que está inserido o eixo EAN do Programa AME, a segunda seção apresenta os métodos do ECR, uma intervenção multicomponente baseada na escola para adolescentes.

A construção da fundamentação teórica da proposta de intervenção do eixo de EAN do Programa AME foi baseada nos resultados das revisões sistemáticas apresentadas nesta tese, no contexto do ECR, nos documentos como o *Diet, nutrition and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation* (JOINT WHO/FAO EXPERT CONSULTATION ON DIET, 2003), e no Guia alimentar para população brasileira (BRASIL, 2014).

4.2 I Seção – Revisões sistemáticas

Esta seção apresenta de maneira sucinta os métodos utilizados nas revisões sistemáticas. Maiores detalhes dos métodos estão apresentados nos artigos de protocolo de revisão sistemática (artigos 1 e 3), nos artigos de revisão (artigos 2 e 4), bem como em seus respectivos registros no PROSPERO (ANEXOS 1 e 2).

4.2.1 Características das pesquisas

Foram realizadas duas pesquisas de revisão sistemática: uma para verificar as evidências científicas quanto às intervenções de EAN baseado na escola sobre o consumo alimentar de adolescentes que resultou na produção de dois artigos (Artigos 1 e 2); e outra para verificar as evidências científicas quanto à associação entre o consumo de carne vermelha e as DCV, incluindo o efeito dose-resposta que resultou na produção de dois artigos (Artigos 3 e 4).

Os protocolos de revisão sistemática foram registrados no banco de dados do *International prospective register of systematic reviews* - PROSPERO (CRD42019116520 e CRD42019100914) com base nas diretrizes de declaração de Itens Preferenciais de Relatórios para Revisões Sistemáticas e Protocolos de Meta-Análises (PRISMA-P) (MOHER, 2015). Estes foram estudos baseados em literatura, portanto a aprovação ética é desnecessária.

4.2.2 Critérios de elegibilidade

O Quadro 3 apresenta os critérios de elegibilidade para cada uma das revisões sistemáticas desenvolvidas, utilizando como parâmetro o método PI(E)COS – população, intervenção ou exposição, controle, desfechos (*outcomes*) e desenho do estudo (s*tudy design*).

Quadro 3 – Critérios de elegibilidade dos estudos de revisão sistemática da tese

Critérios	Educação Alimentar e Nutricional baseada na Escola	Consumo de Carne Vermelha e Doenças Cardiovasculares
População	Adolescentes.	Adolescentes, Adultos e Idosos.
Intervenção ou exposição	Intervenção - Educação alimentar e nutricional baseado na escola.	Exposição - Consumo de Carne Vermelha.
Controle	Comparadores não escolares - padrão, sem intervenção ou outra intervenção.	-
Desfechos (*outcomes*)	O tamanho do efeito da intervenção no consumo alimentar.	Desfecho Primário - Associação entre o consumo de carne vermelha ou processada e a incidência ou mortalidade por doença cardiovascular. Desfecho Secundário - Efeito dose-resposta.
Desenho do estudo (*Study Design)*	Ensaio Clínico Randomizado.	Estudo epidemiológico prospectivo (coorte longitudinal).

Fonte: Autoria própria (2020).

4.2.3 Métodos de pesquisa para identificação de estudos

As revisões sistemáticas seguem as seguintes etapas: 1) busca nas bases de dados com aplicação de critérios amplos de inclusão e exclusão por meio da leitura de títulos e resumos; 2) aplicação dos critérios de elegibilidade após a leitura dos textos completos dos artigos selecionados na primeira etapa; 3) avaliação da qualidade metodológica e risco de viés dos artigos incluídos na segunda etapa; 4) síntese qualitativa dos dados dos estudos incluídos (síntese narrativa).

Utilizando os descritores específicos de cada revisão foram realizadas buscas nas bases de dados apresentadas no Quadro 4.

Não houve restrição de tempo e de idiomas nas buscas realizadas. Para garantir a abrangência das pesquisas, foram realizadas buscas manuais nas listas de referência dos estudos recuperados ou das revisões relevantes.

Quadro 4 – Bases de dados utilizadas nos estudos de revisão sistemática da tese

Estudos de Revisão Sistemática	Bases de dados
Educação Alimentar e Nutricional baseada na Escola	MEDLINE/PubMed, Embase, Scopus, Science Direct, Web of Science, Cochrane (CENTRAL), LILACS, ERIC e ADOLEC
Consumo de Carne Vermelha e Doenças Cardiovasculares	MEDLINE/PubMed, Embase, Scopus, Science Direct, Web of Science, Cochrane (CENTRAL), LILACS, SciELO, WHOLIS, PAHO

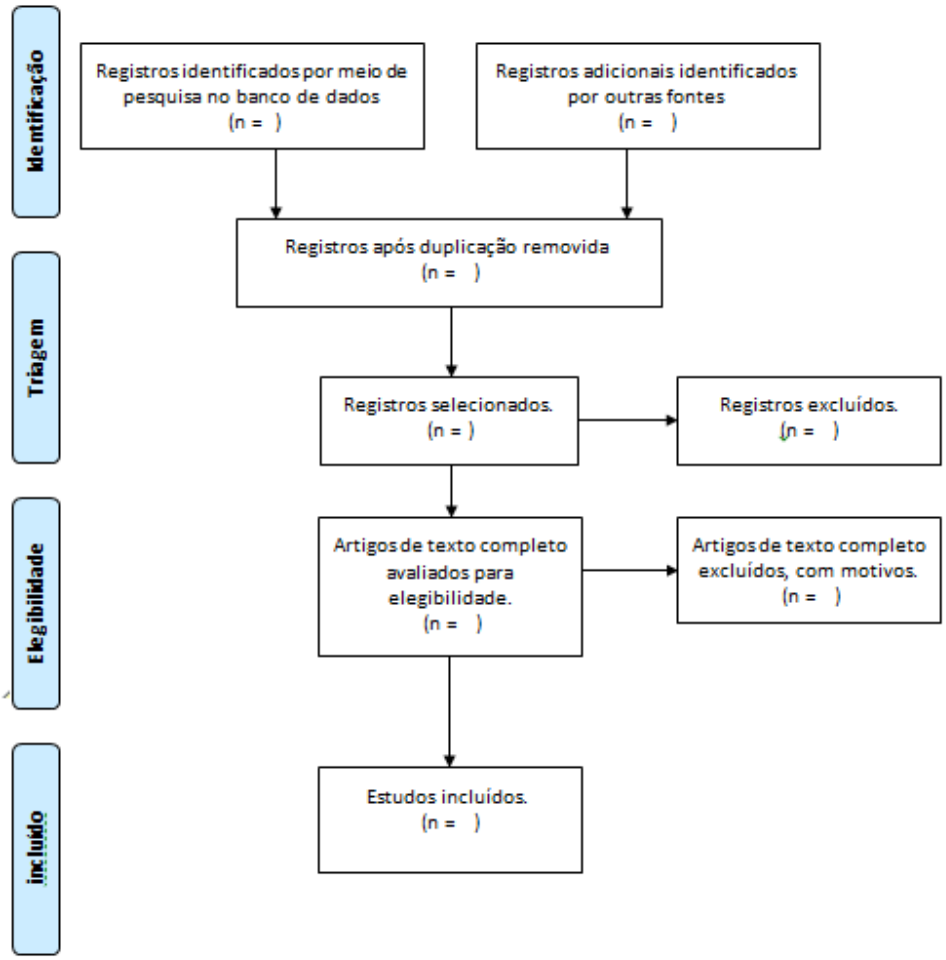
Fonte: Autoria própria (2020).

4.2.4 Seleção de estudo e extração de dados

Para todos os estudos identificados nas revisões sistemáticas, pelo menos dois pesquisadores independentemente e, selecionaram os estudos por títulos e resumos. Os artigos que atenderam aos critérios de elegibilidade foram incluídos para leitura completa. Qualquer discordância foi resolvida por discussão com um terceiro revisor. As fases do processo de seleção estão identificadas na Figura 2, com base nos Itens para Relatórios Preferenciais para Revisões Sistemáticas e Meta-Análises – PRISMA (LIBERATI et al., 2009).

Após a seleção dos estudos relevantes, dois revisores extraíram as informações pertinentes para cada estudo. Qualquer discordância foi resolvida por discussão, reexame do artigo ou um terceiro pesquisador foi consultado.

Figura 2 – Fluxograma de seleção do estudo



Fonte: Adaptado do PRISMA (LIBERATI et al., 2009).

4.2.5 Risco de viés

A qualidade metodológica dos estudos na Revisão de EAN baseada na Escola foi avaliada usando a ferramenta de risco-viés Cochrane Revisada para ensaios randomizados (RoB 2) (HIGGINS et al., 2019). Dois pesquisadores independentes realizaram a avaliação dos artigos, e em caso de dúvidas ou discrepâncias, um terceiro pesquisador foi consultado.

Na revisão de consumo de carne vermelha e doenças cardiovasculares a qualidade metodológica dos estudos foi avaliada usando a escala Newcastle-Ottawa (NOS) (WELLS et al., 2015). A avaliação dos artigos foi realizada por, pelo menos, dois pesquisadores independentes, quando houve dúvidas ou discrepâncias, um terceiro pesquisador foi consultado.

4.2.6 Análise dos dados

Na revisão de EAN baseada na escola foi utilizada uma abordagem narrativa para resumir os resultados da revisão. Os resultados de mudanças no consumo de alimentos decorrentes de intervenções de educação alimentar e nutricional baseadas na escola foram apresentados avaliando os valores basais e à primeira avaliação pós-intervenção. A significância das diferenças nas medidas de desfecho relatadas nos estudos incluídos foi indicada usando *p-valor*.

Na revisão de consumo de carne vermelha e doenças cardiovasculares uma abordagem narrativa foi usada para resumir os resultados das revisões. Os resultados de risco (razões de risco, risco relativo ou taxa de risco; intervalos de confiança de 95%) para a incidência e mortalidade por DCV foram classificados nas categorias de carne vermelha, carne vermelha não processada e consumo de carne processada em mulheres, homens e ambos os sexos. Para cada estudo, verificou-se a categorização do consumo de carne vermelha e o resultado do teste dose-resposta que comparou o maior consumo com o menor consumo.

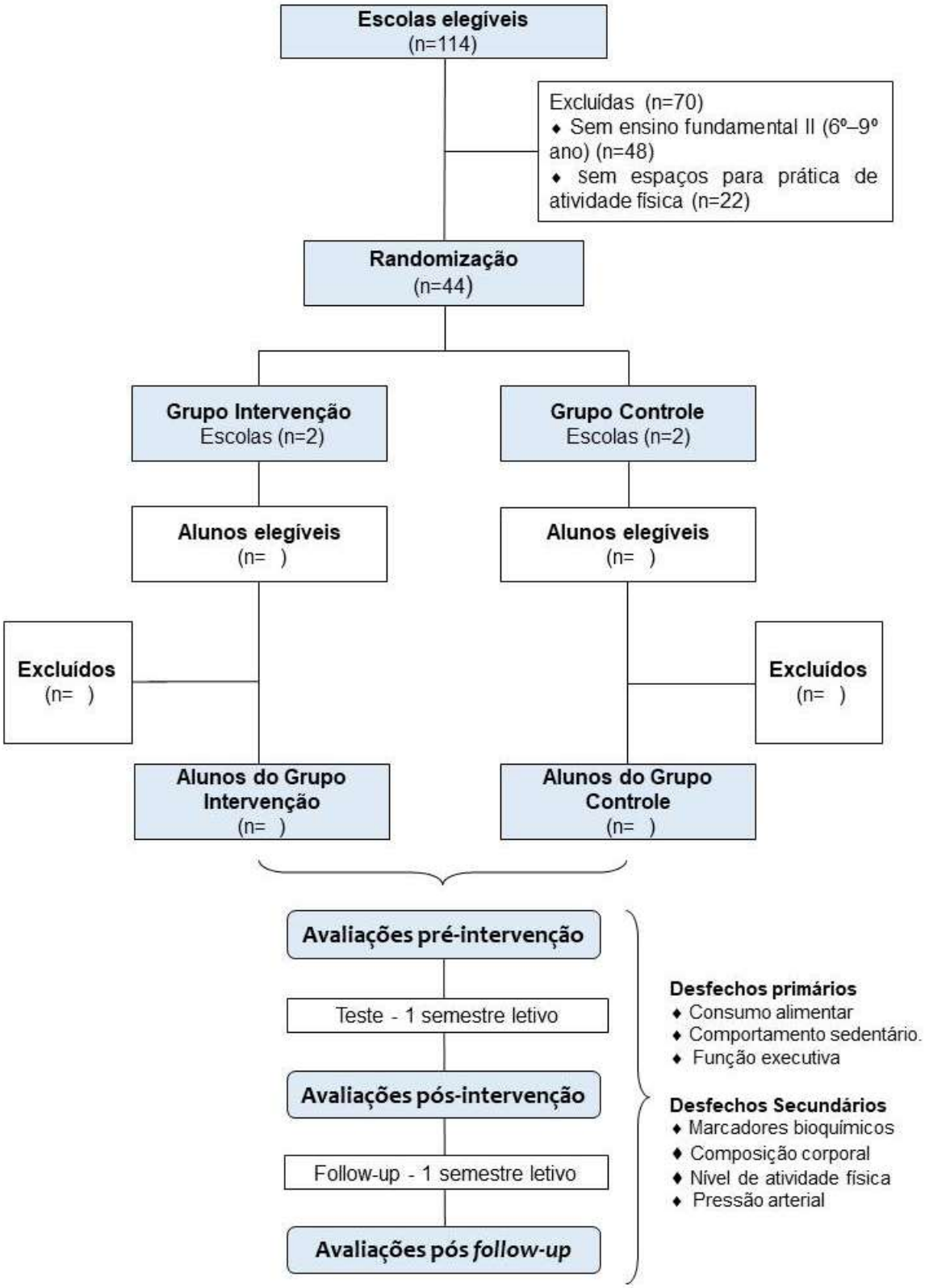
4.3 II Seção – Ensaio clínico randomizado

Esta seção apresenta de maneira sucinta os métodos do Programa AME, uma intervenção multicomponente baseada na escola para adolescentes. Ela está descrita para contextualizar em que conjuntura o eixo de EAN está inserido. Assim, considerando os métodos do ECR foi produzido um artigo descrevendo a justificativa e fundamentação teórica da proposta de intervenção do eixo de EAN (Artigo 5).

4.3.1 Características das pesquisas

O programa foi estruturado como um ECR por cluster, sendo as intervenções aleatorizadas por escolas e não por indivíduos. Os grupos intervenção e controle serão submetidos à avaliação do tamanho do efeito do programa em três diferentes momentos: no *baseline* (pré-intervenção), ao final da intervenção (pós-intervenção) e ao final do semestre letivo seguinte (pós-follow-up) (Figura 3). O grupo controle não receberá nenhum tipo de intervenção.

Figura 3 – Diagrama de fluxo e distribuição dos participantes nos grupos



Fonte: Autoria própria, Natal/RN, 2020.

O período da intervenção foi definido em um semestre letivo, que corresponde a aproximadamente 16 semanas. Um período em que conseguiremos fechar dois ciclos (bimestres) de aulas e baseado em outros estudos de intervenções escolares, trata-se de um tempo médio de duração.

São elegíveis para intervenção todos os alunos matriculados do 7° ao 9° ano do ensino fundamental II das escolas selecionadas, com idades entre 12 e 16 anos. Todos estes alunos serão convidados a participar da intervenção, mas para a análise dos dados serão excluídos da amostra os alunos com deficiência física e/ou intelectual, distúrbios endócrinos, doenças crônicas e gestantes.

Os métodos propostos para o ECR estão registrados no Registro Brasileiro de Ensaios Clínicos - RBR-86xv46 (REBEC, 2019).

4.3.2 Plano amostral

No senso de 2010, o Brasil apresentou uma população de 34.156.038 adolescentes, destes 591.001 em Natal, RN. Em 2018, no ensino fundamental anos finais no RN foram realizadas 467.629 matrículas (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA , 2018).

A população do estudo será constituída por adolescentes escolares da rede pública estadual de ensino da cidade de Natal, no RN, região nordeste do Brasil.

Para o cálculo do tamanho da amostra, foram considerados os dados da literatura do efeito de intervenções baseadas na escola e realizadas com adolescentes, sobre os desfechos primários consumo alimentar (DRAPEAU et al., 2016), comportamentos sedentários (SMITH et al., 2017) e função executiva (COOPER et al., 2016).

Nestes estudos para avaliação do consumo alimentar foram utilizadas as diferenças de médias de porções diárias de frutas e vegetais (DRAPEAU et al., 2016); dos comportamentos sedentários foram utilizadas diferença de média na utilização de múltiplos equipamentos de tela (SMITH et al., 2017); e da função executiva foram utilizadas diferenças de médias de tempo de resposta e acurácia no *Stroop test* (COOPER et al., 2016).

Considerando um poder de 80%, nível de confiança de 95% e a taxa de perdas de 20%, na execução do ECR serão recrutados pelo menos 196 adolescentes para o grupo intervenção e 196 para o grupo controle, totalizando 392 adolescentes.

No estudo sobre o consumo de frutas e verduras foi encontrada uma diferença de média de 1.10 porções para as meninas e 1.20 para os meninos. Assim, com esta amostra de 196 adolescentes em cada grupo, o estudo contemplará essa diferença entre as médias.

4.3.3 Intervenção

Trata-se de uma intervenção multicomponente baseada na escola, com duração de um semestre letivo, para promover alimentação adequada e saudável e um estilo de vida ativo. Considerando que a saúde deve ter seus componentes cognitivos, procedimentais e atitudinais incorporados a toda a gama de áreas acadêmicas (WORLD HEALTH ORGANIZATION, 1999) a intervenção abordará três eixos temáticos: educação alimentar e nutricional, redução do comportamento sedentário e estímulo a prática de atividade física.

Os componentes do programa serão:

(I) Formação dos professores e planejamento de atividades relacionadas aos temas (alimentação adequada e saudável e estilo de vida ativo) para as disciplinas gerais – será realizada sondagem das necessidades dos professores para definição dos temas de formação; em seguida, será realizado o planejamento das ações que serão realizadas de maneira integrada com o currículo escolar e por meio da ação docente no período da intervenção.

(II) Formação e planejamento dos professores de educação física – serão realizadas formações especificas para os professores de educação física com propostas de atividades para as aulas de educação física. Em seguida, será realizado em conjunto com os professores o planejamento das aulas para o período da intervenção.

(III) Oportunidades ativas no ambiente escolar – serão realizadas oficinas sobre os temas de alimentação e estilo de vida ativo; jogos e brincadeiras no pátio da escola; e disponibilização de materiais e estratégias que incentivem adoção de hábitos saudáveis na escola.

(IV) Educação em saúde no ambiente escolar e rede social – serão realizadas ações presenciais e por rede social com os alunos, familiares e professores da escola sobre os temas de alimentação saudável e adequada e estilo de vida ativo.

4.3.4 Coleta de dados

Os dados serão coletados na própria escola no *baseline* (pré-intervenção), ao final da intervenção (pós-intervenção) e ao final do semestre letivo seguinte (pós-follow-up), por meio de questionários (características gerais e socioeconômicas, consumo alimentar, comportamento sedentário, e prática de atividade física), avaliação física (medidas antropométricas e dobras cutâneas), verificação da pressão arterial; teste de aptidão física, coleta de sangue (glicemia e perfil lipídico) e teste cognitivo (*Stroop test*).

Quanto ao consumo alimentar será utilizado o questionário da Pesquisa Nacional de Saúde do Escolar (PENSE 2015) (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2016). Serão avaliados o consumo de feijão, frutas, verduras, doces, bebidas açucaradas e alimentos ultra processados.

Para aplicação dos questionários, do teste cognitivo e o registro dos resultados da avaliação física, teste de aptidão física, pressão arterial e avaliação bioquímica será utilizado o *Web App* desenvolvido especificamente para este programa de intervenção.

4.3.5 Aspectos éticos

Atendendo à Resolução 466⁄2012 do Conselho Nacional de Saúde, o programa de intervenção foi aprovado pelo Comitê de Ética em Pesquisa do Hospital Universitário Onofre Lopes (CEP-HUOL UFRN), sob o CAAE 03316518.2.0000.5292 e parecer de número 3.676.935 (Anexo 3) e tem a anuência da Secretária Estadual de Educação e Cultura do RN (Anexo 4).

Os responsáveis pelos adolescentes receberão explicação sobre o programa de intervenção e deverão consentir a participação do adolescente por meio da leitura e assinatura do Termo de Consentimento Livre e Esclarecido (Apêndice 1). De igual modo, os adolescentes também receberão explicação sobre o programa de intervenção e deverão consentir a participação por meio da leitura e assinatura do Termo de Assentimento Livre e Esclarecido (Apêndice 2).

5 RESULTADOS E DISCUSSÃO

A tese está organizada como coletânea de artigos e serão apresentados na seguinte ordem conforme Quadro 5.

Quadro 5 – Ordem, título e status dos artigos da tese

Ordem	Título do artigo	Status
Artigo 1	Protocol for systematic reviews of school-based food and nutrition education intervention for adolescent health promotion: evidence mapping and syntheses	Publicado: *Medicine*
Artigo 2	Effect of school-based food and nutrition education interventions on the food consumption of adolescents: a systematic review	Produção: *International journal of environmental research and public health*
Artigo 3	Red meat consumption, risk of incidence of cardiovascular disease and cardiovascular mortality, and the dose–response effect: protocol for a systematic review and meta-analysis of longitudinal cohort studies	Publicado: *Medicine*
Artigo 4	Red meat consumption and cardiovascular diseases: a systematic review of cohort studies	Em revisão: *Critical Reviews in Food Science and Nutrition*
Artigo 5	Nutritional intervention of the AME program: rationale and theoretical foundation.	Produção: *Journal of Nutrition Education and Behavior*

Fonte: Autoria própria.

5.1 ARTIGO 1 – PROTOCOL FOR SYSTEMATIC REVIEWS OF SCHOOL-BASED FOOD AND NUTRITION EDUCATION INTERVENTION FOR ADOLESCENT HEALTH PROMOTION: EVIDENCE MAPPING AND SYNTHESES

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Study Protocol Systematic Review

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Protocol for systematic reviews of school-based food and nutrition education intervention for adolescent health promotion

Evidence mapping and syntheses

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Abstract

Background: Nutrition is an important modifiable factor in combating overweight and obesity among adolescents. School has been indicated as an effective environment for influencing eating behavior; however, recent reviews assessing school-based interventions specifically for adolescents are scarce. Therefore, we propose the present systematic review with the aim to comprehensively review the quantitative and qualitative literature on the effects of school-based food and nutrition education interventions on adolescent health promotion through healthy eating habits.

Methods: We will search MEDLINE/PubMed, Embase, Scopus, ERIC, ScienceDirect, Web of Science, Cochrane, LILACS, and ADOLEC. We will include randomized controlled trials (RCT), non-RCT, and controlled before-after studies. Risk of bias will be assessed using the EPOC Risk of Bias Tool for RCT, Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool for non-RCT or controlled before-after, as well as the Critical Appraisal Skills Program (CASP) checklist for qualitative studies. We will analyze the overall strength of the evidence for each outcome using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) tool. Two independent researchers will conduct all evaluations and any disagreements will be consulted with a third reviewer. Data analysis and synthesis will be analyzed by the RevMan 5.3 software. We will conduct the study in accordance with the guideline of the Preferred Reporting Items for Systematic Review and Meta-analyses Protocols.

Result: This review will evaluate the effects of school-based food and nutrition education interventions on adolescent health promotion through healthy eating habits. The primary outcome will be changes in adolescent food consumption. Secondary outcomes will be biological parameters (e.g., body mass index (BMI), waist circumference (WC), body composition, etc); biochemical parameters (e.g., glycemia, triglycerides, total cholesterol, etc); qualitative evidences that support or explain the effect of school-based food and nutrition education interventions on adolescent food consumption.

Conclusion: The findings of this systematic review will summarize the latest evidence of the effects of school-based food and nutrition education interventions on adolescent health promotion. The findings will be an available reference for school-based interventions and other further research.

Registration: PROSPERO CRD42019116520.

Abbreviations: RCT = randomized controlled trials, RoB 2 = risk-of-bias tool for randomized trials, ROBINS-I = Risk of Bias in Non-randomized Studies of Interventions.

Keywords: adolescent, education, intervention, nutrition, protocol, school

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The authors declare that they have no conflict interests.

Supplemental Digital Content is available for this article.

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1. Introduction

The first decades of the 21st century were marked by an increase in the prevalence of overweight and obesity in adolescents. This context becomes worrying from a public health point of view since obesity in the adolescent population can cause breathing difficulties, increased risk of fractures, hypertension, early markers of cardiovascular disease, insulin resistance, and psychological effects. In addition, at this stage of life, obesity is associated with a greater chance of obesity, premature death, and disability in adult life.[1]

In this perspective, an important modifiable factor able to combat the rise in prevalence of overweight and obesity and their consequences in this population is nutrition. Corroborating this, scientific evidence shows that changes in diet have major effects on the individual's current and future health.[2]

It is appropriate to emphasize that this phase of life is an important time to lay the foundations for health in adult life. It is a time of biological and social change[3] in which, often, the food behavior becomes unhealthy.[4] Adolescents now have more autonomy in their food choices, and therefore intervention strategies must be differentiated and targeted to this audience.

Due to the reciprocal relationship between health and education, the school is an effective environment for health promotion, including to influence the eating behavior of adolescents.[5,6] In this school context, a holistic approach to health promotion can be established, involving families and communities to reinforce health messages outside the school environment.[7]

The literature presents systematic reviews and meta-analyses that address school-based food and nutrition education interventions geared mainly for children or for the child-adolescent binomial.[8–11]

However, current systematic reviews that evaluate school-based interventions specifically for adolescents, besides being scarce,[12–15] present specific approaches geared towards technology-based methodologies,[12,13] consider only 1 outcome (fruit and vegetable consumption),[14] or they restrict the scope of the research to developed countries and the time of publication.[15]

Hence, this work aims to comprehensively review the quantitative and qualitative literature on the effects of school-based food and nutrition education interventions on adolescent health promotion. The following review questions will be considered:

1) What are the effects of school-based food and nutrition education interventions on adolescent food consumption?;
2) What are the effects of school-based food and nutrition education interventions on adolescent biochemical parameters?;
3) What are the effects of school-based food and nutrition education interventions on adolescent biological parameters?;
4) What qualitative evidence explains the success of school-based food and nutrition education interventions on adolescent food consumption?

2. Methods

2.1. Study registration

This systematic review protocol has been registered on the PROSPERO database (CRD42019116520), based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) statement guidelines.[16] This is a literature-based study. Ethical approval is unnecessary.

2.2. Eligibility criteria

2.2.1. Types of studies. We will include randomized controlled trials (RCT) (including clustered), non-RCT, or controlled before-after studies that have reported interventions to promote adolescent health through changes in food consumption, biological or biochemical parameters in an intervention group when compared to a control group.

2.2.2. Types of participants. We will include studies that recruited adolescents only. For the purposes of the review, adolescents were defined according to the World Health Organization definition of people aged 10 to 19 years.[17]

2.2.3. Types of interventions. We will include studies that have implemented school-based food and nutrition education interventions. Non-school-based comparators—standard, no intervention or other intervention—will be accepted. Studies without a control group but subjectively measured outcomes (self-report, interviews, questionnaires) will be included.

2.2.4. Outcome measures. The primary outcome measures will be changes in adolescent food consumption. The secondary outcome measures will include the changes of biological parameters (e.g., body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHR), total body fat, etc); biochemical parameters (e.g., glycemia, triglycerides, total cholesterol, HDL cholesterol, LDL cholesterol); qualitative evidences that support or explain the effect of school-based food and nutrition education interventions on adolescent food consumption. Studies will be included if they report at least one of the following outcome measures.

2.2.5. Exclusion criteria. We will not include studies that:

1) the participants were adolescents with physical disabilities, intellectual disabilities, endocrine disorders, chronic diseases (cardiovascular diseases, diabetes), and pregnant;
2) the participants consist of children and adolescents, without analysis of the adolescent subgroup;
3) studies that did not describe the methodology of the food and nutrition education intervention;
4) studies that only evaluated nutrients and not food.

2.3. Search methods for study identification

The review will be divided into 3 thematic areas: food consumption; biological and biochemical parameters associated with food consumption; qualitative evidences. The evidence from the qualitative research will be used to explain the quantitative findings and will provide a deeper understanding of effective school-based strategies to influence adolescent food consumption.

For each thematic area, the revisions will be carried out in the following stages:

1) apply the broad inclusion and exclusion criteria to the searches in the databases by reading the titles and abstracts;
2) apply the eligibility criteria after reading the full texts of the articles selected in the first stage;

3) evaluate the methodological quality and risk of bias of the articles included in the second stage;
4) qualitative synthesis of data from included studies (narrative synthesis or meta-synthesis);
5) quantitative synthesis (meta-analysis).

2.3.1. Electronic search. A comprehensive search will be performed for relevant studies in the following databases, using the search terms detailed in Appendix 1, http://links.lww.com/MD/D202: MEDLINE (via PubMed), Embase (via OVID), Scopus (via Elsevier), Education Resources Information Center (ERIC), Science Direct (via Elsevier), Web of Science-Main Collection (Clarivate Analytics), Cochrane Central Register of Controlled Studies (CENTRAL), LILACS (via Virtual Health Library), and ADOLEC (via Virtual Health Library). There will be no limitation of time and languages.

2.3.2. Additional search. To ensure comprehensiveness of this research, we will supplement searches by hand-searching in the reference lists of retrieved studies or the relevant reviews.

2.4. Study selection and data extraction.

Considering that the studies may be common to the 3 thematic areas of revision, the searches in the databases will be performed together. For all identified studies, at least 2 authors will independently select and review titles and abstracts using the Rayyan web application.[18] Papers which meet the inclusion criteria will be ordered for full review. Any disagreement will be resolved by discussion with a third reviewer.

All information on the phases of the selection process will be identified in Figure 1, based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[19]

Two reviewers will extract the following information from the selected relevant studies: publication identity (ID), participants' characteristics, control group, intervention characteristics, dietary assessment, outcome measurements, and analysis methods. The data to be extracted is available in Table 1. Any disagreement will be resolved by discussion and re-examination of the article. A third researcher will be consulted.

2.5. Data analysis

2.5.1. Risk of bias in the included studies. Two independent researchers will carry out the evaluation, and when there are doubts or discrepancies, a third researcher will be consulted. The methodological quality of the studies will be assessed using the Revised Cochrane risk-of-bias tool for randomized trials (RoB 2).[20] The following criteria will be assessed in intervention studies: random sequence generation, allocation concealment, blinding of participants, and clinicians and outcome assessment. In addition, incomplete outcome data, selective reporting, funding, and potential for conflicts of interest associated with the individual trials will also be considered. The risk of bias will be rated using predetermined criteria as follows: low, high, or unclear.

For non-RCT and controlled before-after studies, risk of bias will be assessed using the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool. The ROBINS-I was developed to assess risk of bias in the results of non-randomized studies that compare health effects of 2 or more interventions.[21]

For qualitative studies, risk of bias will be assessed using the Critical Appraisal Skills Program (CASP) checklist with 10 questions, 9 addressing quality, and 1 addressing "value" (contribution to existing literature).[22] This checklist is recommended by the Cochrane Collaboration for qualitative literature.[23]

We will analyze the overall strength of the evidence for each outcome using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) tool.[24]

2.5.2. Statistical analysis. A narrative approach will be used to summarize the effectiveness of the interventions. Food consumption and educational approach of intervention studies will be looked at separately, and if the studies are sufficiently homogeneous, a quantitative synthesis will be undertaken.

Meta-analysis of the included studies will be handled using statistical software (RevMan 5.3). The heterogeneity between trial results will be evaluated using a standard X^2 test with a significance level 0.05. To assess heterogeneity, we plan to compute the I^2 statistic, which is a quantitative measure of inconsistency across studies. A value of 0% indicates no observed heterogeneity, whereas I^2 values of 50% indicate a substantial level of heterogeneity. If possible, funnel plots will be used to assess the presence of potential reporting biases. A linear regression approach will be used to evaluate funnel plot asymmetry.

If the studies are too heterogeneous, then a narrative synthesis will be undertaken. For studies with qualitative evidence, a meta-synthesis approach will be used for the synthesis of the included studies.

2.5.3. Missing data. In the case of missing data or unclear data (i.e., risk of bias unclear) deemed to possibly be important for this evaluation, we will attempt to contact the corresponding investigators of the article. If we cannot resolve the issues with the data after contacting the authors, we will do an analysis with the available data and discuss the possible impact of the missing data.

2.5.4. Subgroup analyses. If sufficient data are available, we will perform the following subgroup analyses: specific details of the interventions (e.g., methodological strategy, components, and duration), research scenario (family participation, socioeconomic conditions), and risk of bias.

3. Discussion

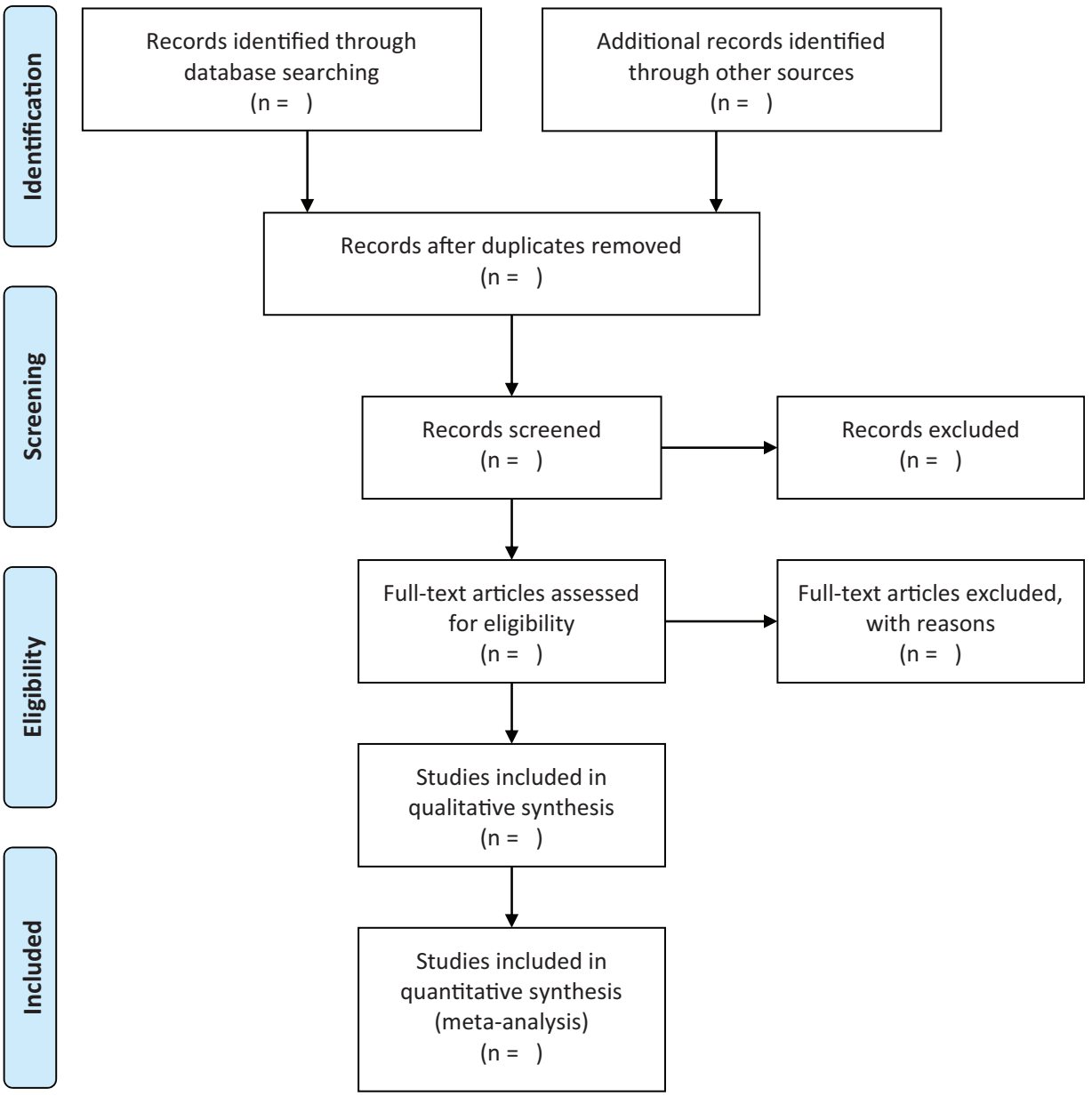
The proposed systematic review and meta-analysis will present studies that evaluated the effects of school-based food and nutrition education interventions on adolescent health promotion.

Systematic reviews and meta-analyses show that interventions at school have positive effects or some potential for changes in school food consumption.[6,8–10,25,26]

However, it is important to emphasize that these studies were performed with child-adolescent binomial or only with the group of children. Recent review studies evaluating school-based interventions specifically for adolescents are scarce.

Two systematic reviews of food and nutritional education interventions for adolescents only evaluated the technology-based methodological strategy (the internet and social media platforms).[12,13]

School-based internet obesity prevention programs have apparently been successful in reaching high-risk students and changing behaviors in the short-term.[12]



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

Figure 1. PRISMA flowchart of study selection.

Regarding the effectiveness of social media interventions in promoting positive changes in nutritional behaviors among adolescents, the current evidence shows that the increase in the intake of desirable food groups was more successful than decreasing unfavorable food habits.[13]

Another study with adolescents specifically investigated the potential role of fruit and vegetable consumption in cardiovascular health and concluded that the associations are inconsistent, probably due to heterogeneity in the methods used to assess and classify consumption and to define cardiovascular risk in adolescents.[14]

Finally, we found a review that points out that multi-strategy interventions can have significant impacts on the nutrition of adolescents when the nutrition education is theoretically based, facilitated by school staff in conjunction with parents and families and includes changes in the food environment from school. However, this review was restricted to studies conducted in developed countries, published from 2000 to 2014.[15]

In this context, we observed that school-based nutrition and nutritional education programs have significant results in children and when assessing the child-adolescent binomial. However, the results are scarce on the effect of different methodological strategies, specifically in the adolescence period. This protocol aims to overcome these limitations by quantitatively and qualitatively analyzing the effect of school-based nutrition education interventions on the promotion of adolescent health.

Table 1

Data extraction table.

Data to be extracted	Item
Publication ID	Title, first author, publication year, country, study name, population.
Study design	Randomized Controlled Trials (RCT).
	Non Randomized Controlled Trials (Non-RCT).
	Controlled before-after.
Participants' characteristics	Sex.
	Age.
	Sample Size.
Control group	No-intervention.
	Other NOT based school Intervention.
Intervention characteristics	Duration of intervention.
	Follow-up period.
	Intervention description.
	Educational approach.
Dietary assessment	24-hour reminder (R24h).
	Food Frequency Questionnaire (FFQ).
	Interview.
Outcomes measurements	Food consumption.
	Biological Parameters.
	Biochemical Parameters.
	Qualitative Evidence.
Analysis methods	Statistical methods used.
	Qualitative synthesis.

Author contributions

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Writing – original draft: Gidyenne Christine Bandeira Silva de Medeiros.

Writing – review & editing: Gidyenne Christine Bandeira Silva de Medeiros, Kesley Pablo Morais de Azevedo, Daniel Ángel Garcia, Victor Hugo de Oliveira Segundo, Ádala Nayana de Sousa Mata, Karla Silveria Dias Pinheiro de Siqueira, Anny Karoliny Pinheiro Fernandes, Raquel Praxedes dos Santos, Débora Danielly Barros de Brito Trindade, Clélia de Oliveira Lyra, Grasiela Piuvezam.

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5.2 ARTIGO 2 – EFFECT OF SCHOOL-BASED FOOD AND NUTRITION EDUCATION INTERVENTIONS ON THE FOOD CONSUMPTION OF ADOLESCENTS: A SYSTEMATIC REVIEW

Artigo em produção para envio a revista *International journal of environmental research and public health* (https://www.mdpi.com/journal/ijerph/instructions)
Qualis Periódicos – Avaliação de Periódicos Quadriênio 2013-2016: A2 – Saúde Coletiva.
Recebemos convite para envio deste artigo para edição especial sobre "Novos desafios e tópicos cruciais para a saúde pública de 2030".

International Journal of Environmental Research and Public Health

MDPI

Review.

Effect of school-based food and nutrition education interventions on the food consumption of adolescents: a systematic review

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Abstract: The school is a favorable environment for the development of interventions to prevent obesity. The objective of this systematic review is to evaluate the effects of school-based food and nutrition education interventions on adolescent food consumption. Literature search was conducted on databases: MEDLINE/PubMed, Embase, Scopus, ERIC, Science Direct, Web of Science, Cochrane, LILACS, and ADOLEC. The research strategies were focused on: population (adolescents), intervention (Food and Nutrition Education), outcome (food consumption) and study design (clinical trial). The Preferred Reporting Items for Systematic reviews and Meta-Analyzes (PRISMA) statement guidelines was follow and all stages of the review were performed by two researchers, when necessary a third researcher resolved the discrepancies. Included studies are randomized clinical trial (RCT). A total of 24 articles were included for review. Most studies performed a multicomponent intervention and were based on theory or model. Of the 24 studies included, in 16 the intervention managed to improve the consumption of at least one food or group of foods recommended as healthy food. The consumption of fruits and vegetables was assessed by most studies (75%). We conclude that the effects of the interventions are generating favorable changes in adolescent food consumption.

Registered on PROSPERO database (CRD42019116520).

Keywords: adolescent; education; nutrition; school; randomized clinical trial.

1. Introduction

The prevalence of obesity has increased worldwide, not only among adults, but among children and adolescents as well. In 2016, 18% of children and adolescents aged 5-19 in the world were overweight or obese [1,2].

The school is a favorable environment for the development of school-based food and nutrition education interventions in order to prevent overweight and obesity among adolescents [2–4].

A systematic review identified that interventions in nutrition education, carried out with children aged 2 to 19 years, who were more likely to succeed were those that had a multicomponent approach, appropriate to age and adequate duration (≥ 6 months), which involved parents and that ensured fidelity and proper alignment between stated objectives [5].

A multicomponent approach is one that has more than one action component associated with the main component of the intervention. In school-based food and nutrition education interventions, for example, the intervention inserted in the school curriculum can be the main component, and associated with it, actions are carried out in other components (environment, family, teacher training, among others), in order to have a more holistic scope of intervention.

There are few systematic reviews that assess interventions specifically for adolescents. A systematic review published in 2016 evaluated randomized control studies published from 2000 to 2014 designed to evaluate multi-strategy interventions that encompassed nutrition education with adolescent populations in developed countries [6].

It is important that food and nutrition education interventions designed specifically for adolescents are evaluated, and that the review is more comprehensive in terms of both publication time and population, including studies from different countries with different socioeconomic conditions.

Therefore, the objective of this systematic review is to evaluate the effects of school-based food and nutrition education interventions on adolescent food consumption.

In general, food and nutrition education interventions are improving adolescent food consumption. It was not possible to arrive at an ideal intervention model, but the results provide us with more specific data on school-based food and nutrition education interventions aimed exclusively at adolescents and their effect on food consumption.

2. Materials and Methods

2.1. Search Strategy

Literature search was conducted in June 2019 on databases: MEDLINE (via PubMed), Embase (via OVID), Scopus (via Elsevier), ERIC - Education Resources Information Center, Science Direct (via Elsevier), Web of Science - Coleção Principal (Clarivate Analytics) , Cochrane Central Register of Controlled Studies (CENTRAL), LILACS (via Biblioteca Virtual em saúde - BVS), and ADOLEC (via Biblioteca Virtual em Saúde - BVS).

The scanning was focused on the following four key elements: population (children, adolescents), intervention (Food and Nutrition Education interventions school-based), outcome (food consumption) and study design (clinical trial). The search strategy depicting the combination of keywords used for the literature search, was published before [7].

This systematic review was conducted following the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement guidelines[8] and details of the methodology was published previously [7].

2.2. Eligibility Criteria

Included studies are original articles reporting randomized clinical trial (RCT). These trials report effect of the school-based food and nutrition education interventions in adolescent food consumption. Studies that reported only the percentage of students who consumed a certain food or not were not included. Also, studies that reported only the consumption of beverages were not included.

It was not necessary to insert other study designs (non-randomized clinical trials, or controlled before-after studies), since the RCTs retrieved in the searches were sufficient to answer the research question.

The included studies involve intervention participants who are adolescent, considering the World Health Organization definition, people aged 10–19 years [9]. The studies that the participants were adolescents with physical disabilities, intellectual disabilities, endocrine disorders, chronic

diseases (cardiovascular diseases, diabetes, obese) and pregnant were excluded. Moreover, gray literature, review articles, and articles that did not include clear information about intervention methodology, assessed children and adolescents as a single group, and evaluated only nutrient and not food were also excluded.

2.3. Data Extration and Summary.

The articles selected in the research bases were inserted in the Rayyan Web application [10]. Then using the application at least 2 independent authors have reviewed the titles and abstracts. The articles that met the inclusion criteria were requested for review by full reading by 2 independent researchers. Any disagreements between the two authors were resolved by discussion with a third reviewer to reach a consensus.

Data extraction was performed by two authors. Extracted data include study design, participants' characteristics, control group, intervention characteristics, dietary assessment, outcome (food consumption), and analysis methods. Studies that have published an intervention protocol article, when necessary, were also consulted in data extraction. Any disagreements in the extracted data between the two authors were resolved by discussion and re-examination of the article to reach a consensus.

The extracted data were presented in a narrative approach to summarize the results of the review. The results of the intervention effect on food consumption were related to baseline values and the first post-intervention assessment. Significance of the differences in the outcome measures reported in the included studies was indicated using p values.

2.4. Methodological Quality of Included Studies.

The methodological quality of the studies was assessed by Cochrane risk-of-bias tool for randomized trials (RoB 2)[11]. This is the most used tool to assess the risk of bias in randomized studies. The RoB 2 has an evaluation in five different domains (randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result). The answers lead to judgments of "low risk of bias," "some concerns," or "high risk of bias" [11]. In the end, the judgments in each domain lead to a general judgment of risk of bias for the result being evaluated, which in this review is food consumption.

Two independent researchers carried out the evaluation and, when necessary, a third researcher was consulted. Thus, the articles were classified as low, high or some concerns, using predetermined criteria.

3. Results

3.1. Literature Search Results

In the search for articles in the databases, 5010 studies were obtained. Fourteen additional articles were detected via the references. After excluding the 738 duplicate studies, the remaining 4286 titles and abstracts were read and evaluated by the researchers. In addition, systematic studies were examined and data found were included in the review process at this stage. After reviewing the title and abstract, 342 studies were selected for full reading. A total of 24 articles were included for review [12–35]. A PRISMA diagram depicting the flow of literature search and article selection is presented in Figure 1.

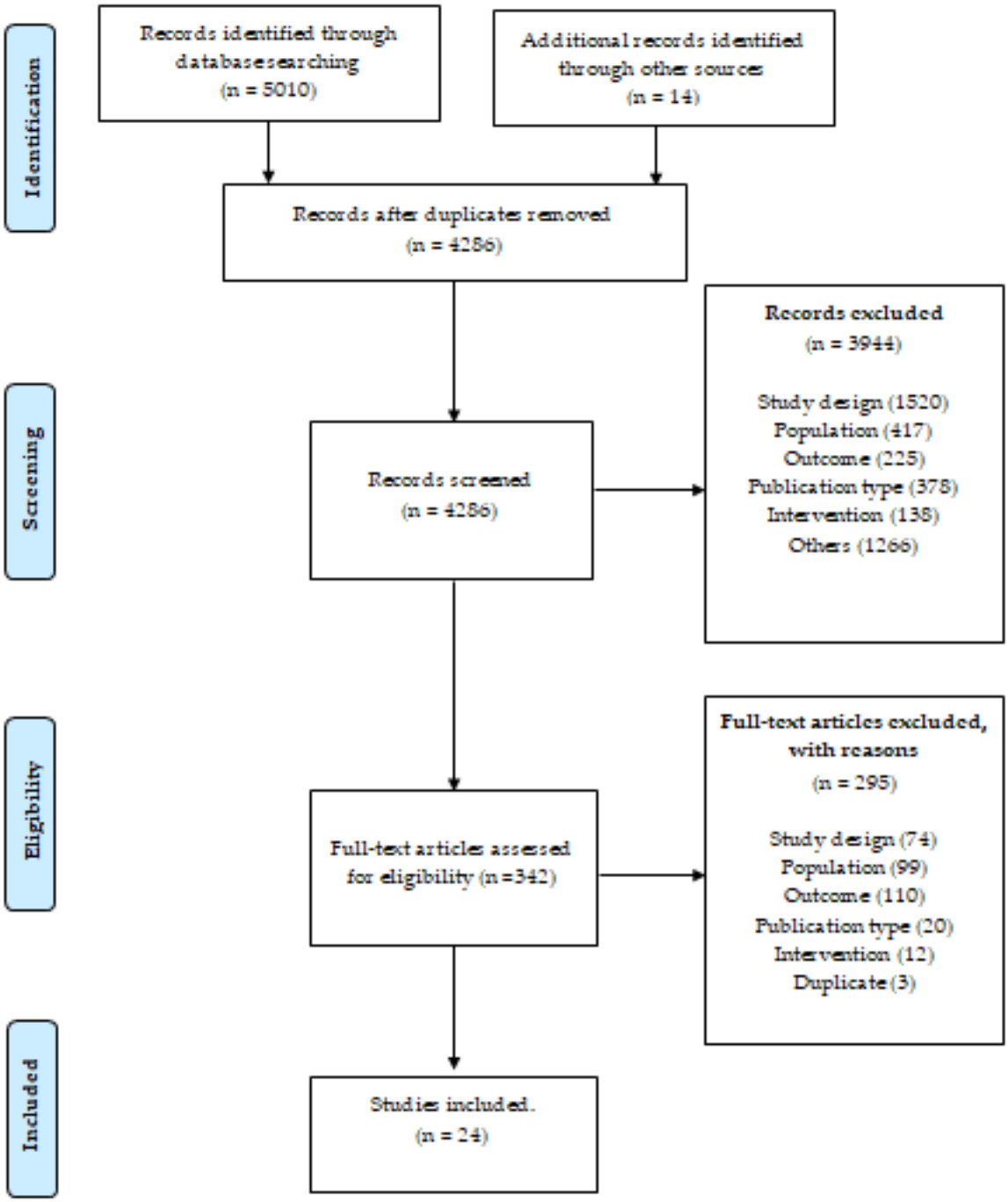

Figure 1. PRISMA Flowchart of study selection.

3.2. Methodological Quality of Included Studies.

In the evaluation of the Overall Bias of ROB 2, four articles were evaluated as 'Low', ten as 'High' risk of bias, and ten as can express 'Some concerns' for the outcome of food consumption (Table 1). The summary of risk of bias by the Cochrane risk of bias tool for randomized studies (RoB 2) is shown in Figure 2.

The 24 studies included in the systematic review are randomized controlled trials; however, half of the studies did not have a detailed description of the processes of generating and hiding the random sequences.

The "Measurement of the outcome" domain was the one with the highest number of studies with "High" risk of bias. School-based EAN interventions do not allow blinding of participants.

Possibly, for this reason, the studies did not provide information on the blinding of participants and researchers.

The results of each domain of the RoB 2 tool, per article included, are in the supplementary material (Figure S1).

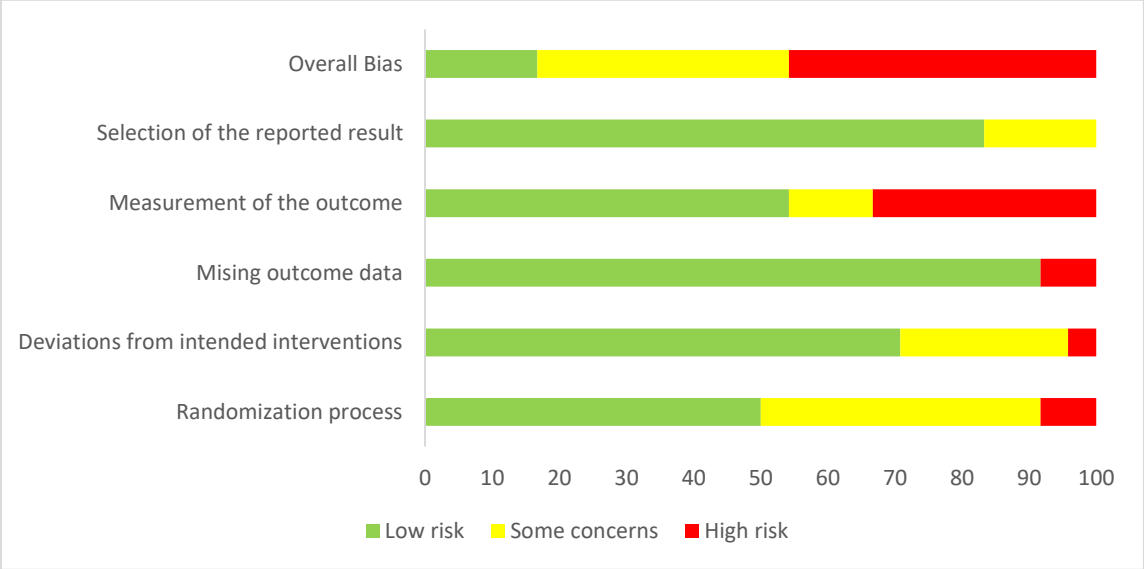

Figure 2. Summary of the risk of bias by Cochrane risk-of-bias tool for randomized trials (RoB 2).

3.3 Study Characteristics.

The RCTs that were included in the review are publications from 1997 to 2019 and from 14 different countries. From the United States of America were nine studies, from Iran, Greece, and Netherlands were two studies from each country, and the others (Italy, Norway, Brazil, Trinidad Tobago, England, Belgium, Finland, Ecuador, United Kingdom and China) were a study of each.

A summary description of the school-based Food and Nutrition Education intervention studies is presented in Table 1.

The interventions were based on different theories and models. The most frequent were: Social Cognitive Theory (SCT) [15,17,19,28–30,35] and Theory of Planned Behavior (TPB) [14,16,24,26]. Nine studies did not claim to have been based on any theory or model [12,13,18,20–23,27,32,33].

Most studies (67%) performed the intervention with more than one component [15–23,25,27,29–32,35]. In nine studies, the intervention had the "school environment" component, with actions such as: change in school meals, educational posters by the school, organization of events, and offering fruits and vegetables [17–19,22,25,29,30,32,35]. The "family" component was present in 8 studies, with actions such as sending messages and leaflets to parents, events at school with the participation of the family, offering fruits and vegetables [17,18,20,21,23,27,30,31]. Another component presented was the "Teacher Professional Development", four studies presented in their actions, a specific component for training and support for the teacher to develop the intervention [15–17,23]. Finally, in another 8 studies, the intervention was centered only on the student, without intervening through other components [12–14,24,26,28,33,34].

In four studies, the practice of physical activity was combined with intervention in nutritional education [18,30,32,34]. The details of the studies included in the systematic review are in the supplementary material (Table S1).

Table 1. Summary of school-based food and nutrition education intervention studies

First author, year	Theory or Model	Component	Duration	Foods*	Instrument	Effect	Risk of Bias
Amani, 2006	*****	Classroom	2 months	Semiquantitative food-frequency scores (five main food groups of the US Food Guide Pyramid)	FFQ	The food-frequency scores were elevated in the education group ($p < 0.05$) but the control group had a non-significant fall in its scores after the campaign ($p < 0.1$)	Some Concerns
Amaro, 2006	*****	Classroom	24 weeks - 15–30 minute-long play sessions once a week	vegetable (serving/day)	FFQ	Significant difference between treated group and control group at post-assessment ($p < 0.01$)	High
Bessems, 2012	Behaviour change theories; Self-Regulation Theory; TPB, Attitude-Social influence-Self Efficacy Model and the action planning literature	Classroom	8 weeks	Fruit (serving/day)	FFQ	Significant mean difference between experimental and control group 0.15 servings at both posttests ($p < 0.001$)	High

Birnbaum, 2002	SCT	Classroom curriculum, school environment, and peer leaders. Parent Packs	1 year period, 10 curriculum sessions.	FV (serving/day)	FFQ	Significant difference in the group of intervention "peer leaders plus classroom curriculum plus school environment interventions" ($p < 0.05$)	Low
Bjelland, 2015**	Social ecological framework incorporating elements from SCT	Class, Home/parents, School wide, and Leisure time activities	20 months	Fruits and vegetables (Times/week)	FFQ	Significant difference between groups post-intervention for fruits ($p < 0.001$), not to vegetables ($p = 0.46$)	Some Concerns
Bukhari, 2011	SCT and the social ecological model	Classroom and Teacher Development	19-week	Healthful eating (score)	FFQ	There was an overall increase in score of 4.9 points, ($P < 0.01$). Improved scores correlated with reporting increases in eating vegetables as snacks ($r = 0.64$, $p < 0.001$), preparing healthful snacks for self ($r = 0.48$, $p < 0.01$), and having sit-down meals with family ($r = 0.55$, $p < 0.004$)	Some Concerns
Cunha, 2013	Pedagogy of the	Classroom	9 months,	Fruits, Beans,	FFQ and	Significant reduction in the	Low

	Oppressed, by Paulo Freire.	curriculum and parents (participation of the family)	monthly 1-h sessions in the classrooms	cookies, sodas and juice (Per day)	24-hour dietary recall	frequency of daily consumption of cookies ($p < 0.001$) and sodas ($p = 0.02$) and an increased frequency of consumption of fruits ($p = 0.04$) in the intervention group, compared with that of the control group	
Dzewaltowski, 2009**	*****	Project level, school level and place level	3 years period	FV, fruit, and vegetables (servings/day)	FFQ	The intervention and control schools did not change differently over time on FV, fruits, or vegetables	High
Forneris, 2010	*****	Classroom.	12-week.	FV (score).	FFQ	No significant change patterns were found at follow-up for fruit and vegetable intake	Some Concerns
Francis, 2010**	Bloom's mastery learning model	Classroom	8 months (10 min/day)	Fried food (servings/day) and HFSS (kJ/day)	FFQ	Average reported daily servings of fried foods were significantly lower in the intervention group than the control group. In multivariate regression equations controlling for age, gender, BMI and baseline value, intervention was associated with lower intake levels of fried foods, HFSS and	High

						sodas ($p < 0.05$)	
Ghaffari, 2019	SCT	Student, family, and school levels	1 year period	FV (score)	FFQ	The difference was significant between the intervention and control groups during 2 months after the intervention ($p < 0.002$). No significant difference between the groups before the intervention	High
Gratton, 2007	TPB	Classroom	3 weeks	FV (score)	7-day food diary	Both interventions (Volitional and Motivational) were found to increase fruit and vegetable consumption significantly ($p <0.001$), although only the volitional intervention demonstrated a significant increase in fruit and vegetable consumption over the control intervention	Some Concerns

Gray, 2015	SCT and self-determination theory	Student/classroom and Teacher Professional Development	8–10 weeks - 24 lessons was taught most school days over	Fruits, Vegetables, Packaged snacks, Fast food and Sweetened beverages	FFQ	Students from the high 'Teacher Implementation' classes significantly consumed fewer packaged snacks ($p < 0.016$) and fast food value/combo meals ($p < 0.047$), and smaller sizes of fast food ($p < 0.001$), compared with control students. There was no significant difference in any eating behavior outcomes between medium 'Teacher Implementation' classes and control group	High
Haerens, 2007	TPB	Student/classroom and Teachers	1 year	Fruits (servings/day)	FFQ	The intervention was not effective in increasing self-reported fruit intake	Some Concerns

Hassapidou, 1997	*****	Student/classroom and parents (leaflets)	10 weeks	Pork, sausages, salami, yellow cheese, butter, olive oil, raw vegetable (salads), apples and pears, citrus fruit, bananas, grapes, kiwi fruit, fruit juice (natural), honey, jam, cake, and cocoa	24-hour dietary recall	The intervention did not result in significant changes in the fruits and vegetables intake. The boys in the intervention group decreased their intake of pork ($p < 0.05$), sausages ($p < 0.05$), salami ($p < 0.01$) and jam ($p < 0.01$) after the intervention. Girls in the intervention group reduced their consumption of cocoa ($p < 0.05$), sausages ($p < 0.05$) and animal butter ($p < 0.01$)	Low

Hoppu, 2010	SCT	Food environment and nutritional education (Pupils, parents and teachers)	1 year	Fruits and vegetables (servings)	FFQ	Energy-adjusted consumption of fruit, including berries (g/MJ) remained constant in IG, whereas it decreased in CG (difference in change, p = 0.04). There was no significant change in the consumption of vegetables	Some Concerns
Ickovics, 2019**	*****	Food environment and nutritional education (Pupils and parents)	3 years	Healthy foods (fruit, vegetables, green salad, potatoes-not fried) and Unhealthy foods (french fries, chips, candy, ice cream, other sweets) (serving/day)	24-hour dietary recall	Students (eighth grade) at schools randomized to the nutrition condition consumed fewer unhealthy foods (p < 0.03)	Some Concerns

Lytle, 2004	SCT	Classroom curriculum, school environment, and peer leaders. Parent Packs	2 years, 10 curriculum sessions per year	Fruits and Vegetables (score)	24-hour dietary recall	No significant differences	High
Martens, 2008	*****	Classroom and parents component (a bag with information and food items for parents)	3 months, eight school classes lasting 50 min each	Fruit (serving/day)	Written questionnaires	Significant difference between groups at T1 = 0.04. $p \leq 0.05$ two-tailed	High
Mihas, 2009	*****	Pupils (Classroom) and parents (seminars)	12 h of classroom material during 12 weeks	Fruits and Vegetables (Servings/day), Ready-to-eat breakfast cereals, Red meat, Poultry and Fish (meals/week)	FFQ	A significant increase in poultry, ready-to-eat breakfast cereals and fruit consumption and a significant decrease of red meat consumption were found in the IG. There was no significant difference in the consumption frequency of any food category in the CG	High

Nicklas, 1998	*****	(1) school-wide media-marketing campaign, (2) school-wide meal and snack modification, (3) classroom workshops and supplementary subject matter activities, and (4) parental involvement	3 years	FV (servings/day)	Knowledge, Attitudes, and Practices questionnaire**	No significant difference between groups	Some Concerns
Ochoa-Avilés, 2017	*****	Matrices for adolescents, parents and school staff	28 months. (30min/day)	FV (servings/day) and Unhealthy snacking (g/d)	24-hour dietary recall	No significant difference between groups	High
Rees, 2010	TPB and the Transtheoretical Model	Classroom	3 months	Fruits, vegetables, Whole grains, Brown bread (servings/day)	24-hour dietary recall	The intervention group consumed approximately 0.35 more servings of brown bread weekly than the control group from baseline. Although this change between groups was statistically significant the magnitude was small. For the other foods there were no significant effects of the	Low

						tailored intervention	
Wang, 2015	Bronfenbrenner's ecological theory	Holistic HPS approach (School environment and ethos, Modified curriculum, and Family/community involvement)	3 months	Consumption score of fruit, vegetables, dairy products, breakfast, dessert, fried food and soft drinks	FFQ	Students in the HPS school had the largest improvement in eating behaviours (from 3.16 to 4.13), followed by those in the HE school (from 2.78 to 3.54)	Some Concerns

* Food presented in the results of food consumption.** Nutrition and physical activity interventions. *** Healthy foods (fruit, vegetables, green salad, potatoes-not fried) and Unhealthy foods (French fries, chips, candy, ice cream, other sweets). FV - fruits and vegetables. SCT - Social Cognitive Theory. TPB - Theory of Planned Behaviour. HFSS - Foods, snack foods that are high in fats, sugar and salt. 24HR - 24-hour dietary recall. [#]self-reported number of servings of fruit and vegetables usually consumed on a daily basis. [##] Five main food groups of the US Food Guide Pyramid. [###]School environment and ethos, Modified curriculum, and Family/community involvement.

3.4 Food Consumption.

Food frequency questionnaires (QFF) and 24-hour recall (R24h) were used to assess food consumption. The consumption of fruits and vegetables was assessed by most studies (75%), in aggregate form F / V (fruits and vegetables) [14,22,23,29,32,33,35], fruits [16,17,19–21,24,26,27,30–32] and / or vegetables [13,17,19,21,26,27,30,32]. Another three studies presented the evaluation of the consumption of a larger group of foods in which fruits and vegetables were also inserted, called Healthful eating (score) [28], Healthy food [18], Semiquantitative food-frequency scores [12], and Consumption score of fruit, vegetables, dairy products, breakfast, dessert, fried food and soft drinks [25].

For F / V consumption, two studies showed significant post-intervention differences[14,29]. In the study by Gratton, Povey and Clark-Carter (2007) [14], two forms of intervention were tested: Volitional intervention in which children were encouraged to write down how, where and when they would eat five portions of fruit and vegetables for the next 7 days; and the Motivational intervention, in which children received 'health education activity sheet', seeking to stimulate the increase in participants 'consumption of fruit and vegetables to five portions a day. The children of the two intervention groups showed a significant increase ($p < 0.001$) in the consumption of F / V, although only the volitional intervention demonstrated a significant increase over the control intervention.

In the evaluation of the Overall Bias of ROB 2 for F / V consumption, this study was assessed as "low" risk of bias in all domains except the domain "randomization process" in which it was assessed as "some concerns" because it does not describe how the process of randomization, leading him to be classified in the Overall bias as "some concerns".

The second study was the Teens Eating for Energy and Nutrition at School (TEENS) study. It showed a significant difference ($p < 0.05$) in the group of intervention "peer leaders plus classroom curriculum plus school environment interventions" [29].

Among the methodologies used in TEENS study were small-group activities and discussions; audiotape; low fat convenience snack distributed for tasting during every session; hands-on fruit and vegetable snack preparations and tasting. "Parent Packs" were sent to parents or guardians, which contained activities and intervention-related messages. In School environment intervention was included taste testing of fruits, vegetables, and lower fat foods, increased the availability of appealing fruits and vegetables on the lunch line, and increased the availability of good tasting lower fat snacks on the a la carte line. A la carte lines and vending machines placed posters comparing fat and sugar in the snack choices. Table tents and posters promoting fruits, vegetables, and lower fat foods were also exhibited; and prize raffles for students taking fruits and vegetables on the lunch line [29].

However, this study was evaluated as "High" risk of bias by Overall Bias of ROB 2 for F / V consumption, because in the domain "Risk of bias in measurement of the outcome", because it does not report anything about the study's evaluators. They do not mention who they were, nor if they were aware of the intervention received by the study participants.

Among the studies that evaluated fruit consumption, five studies showed a significant difference after the intervention. Are they: Krachtvoer programme [20,24], HEIA (Health In Adolescent) Study [30], PAPPAS (*Pais, Alunos e Professores para uma Alimentação Saudável*)[31], and VYRONAS (Vyronas Youth Regarding Obesity, Nutrition and Attitudinal Styles) Study [21].

Two versions of the Krachtvoer programme were included, and in both there was a significant difference in fruit consumption. The Krachtvoer programme instead of seeking to increase knowledge, sought to achieve behavior change based on principles of behavior change theories [20,24].

As for vegetable consumption, when evaluated separately from fruit consumption, only one study showed significant increase in consumption among adolescents ($p<0,01$) [13]. This study used a board game called Kalèdo. There were 24 weeks in which adolescents were subjected to game

sessions of 15 to 30 minutes, once a week. The intervention aimed to generate changes in nutritional knowledge and eating behavior [13].

Of the studies in which the consumption of fruits and vegetables were evaluated in a more comprehensive set of foods, it was found that after intervention there was a significant improvement in the consumption of recommended foods [12,25,28], except for one study that did not present a significant difference, however, it showed a significant reduction of food consumption unhealthy foods ($p < 0.03$) [18].

Other foods that evaluated the effect of the intervention on their consumption were: Beans and[31] cookies[31], pork, sausages, salami, yellow cheese, butter, olive oil, honey, jam, cake, and cocoa[27], ready-to-eat breakfast cereals, red meat, poultry and fish [21].

Of these foods, after the intervention, there was a significant reduction in the frequency of daily consumption of cookies ($p < 0.001$) [31]; a significant increase in poultry consumption [21] and a significant decrease in red meat [21] consumption in the intervention.

In the study that evaluated the consumption of pork, sausages, salami, yellow cheese, butter, olive oil, honey, jam, cake, and cocoa [27], the boys in the intervention group decreased their consumption of pork ($p < 0.05$), sausage ($p < 0.05$), salami ($p < 0.01$) and jam ($p < 0.01$) after the intervention. And the girls in the intervention group reduced their consumption of cocoa ($p < 0.05$) and sausages ($p < 0.05$) [27].

4. Discussion

The aim of this review is to assess the effects of school-based food and nutrition education interventions on adolescent food consumption. In general, these interventions have sought to increase the consumption of healthy foods, especially the consumption of fruits and vegetables.

Of the 24 studies included, in 16 the intervention managed to improve the consumption of at least one food or group of foods recommended as healthy food.

The consumption of fruits and vegetables is used as one of the markers of healthy eating and, if consumed daily in sufficient amounts, can help prevent chronic diseases, such as CVD and certain cancers [36].

Of the interventions that assessed both fruit and vegetable consumption ($n = 8$) separately, three showed a significant increase in post-intervention fruit consumption, while there were no significant changes in vegetable consumption [17, 21, 30].

Children and adolescents tend to have a significantly higher preference for sweetness compared to young adults [37]. However, they tend to have an aversion to the bitter taste present in vegetables [38].

Research on insights from basic research on taste preferences in childhood indicates that the innate preference for sweets and bitter rejection in humans are consequences of evolutionary selection, favoring consumption of fruits rich in vitamins and with high energy [38].

Although adolescents have a preference for sweet flavors and often look suspiciously at new foods, they are predisposed to learn from experience, so environmental factors influence food preferences [39].

Studies with young children point out that repeated exposure to the taste of rejected or unknown foods is a promising strategy to increase their acceptance[40, 41]. With 2-year-old children, it took between 5 and 10 exposures to a new food to increase the preference for it [42].

Strategies that enabled adolescents to try healthy foods were used in 10 studies [16,18–20,22,24,28–30,35] included in this review and 7 of them showed significant differences in favor of the consumption of healthy foods in the post-intervention.

As for environmental factors, the younger the child, the more important are those related to parents and the home. When adolescence arrives, these factors can vary from the availability of food in local stores to the extent of advertising to which they are exposed [39].

It becomes clear the importance of multicomponent interventions, which should focus on content, teacher training and curriculum design to contribute to the development of children knowledge, skills and attitudes [43].

In the school-based food and nutrition education interventions assessed in this review, the components most frequently associated with the classroom were: family, teachers and school environment, respectively.

Despite the fact that adolescents have greater independence in terms of their food consumption, the family remains an important but decreasing source of influence as adulthood approaches [44].

A qualitative study with adolescents and their parents on perceptions and attitudes related to adolescent diets in Botswana (Africa) found that the variety of food choices and social pressures to consume unhealthy foods increases as adolescents move from home to school, or the local mall [45].

As for the teacher component, school-based interventions generally need the support and participation of teachers. However, only half of the interventions mentioned training for teachers or delivery of support material for developing the intervention and encouraging students.

In the study included in this review that evaluated the effect of the intervention considering the level of "Teacher Implementation" and "Student Reception", it is clear that when the intervention is better implemented and teachers receive supporting teachers throughout the intervention period (e.g. troubleshooting any barriers to implement the curriculum), students become more involved, which then are likely to improve students' psychosocial and behavioral outcomes [15].

In this context, it becomes evident the importance that interventions are planned not only considering the issue of knowledge about food and nutrition, but that the theories and models that can influence food choices are considered. In the included studies, we see that more and more researchers have based interventions on different theoretical models.

A systematic review that assessed the effect of multi-strategy interventions in developed countries corroborates our findings when it concluded that these interventions can have significant impacts on adolescent nutrition when they are based on theory, facilitated by school officials in conjunction with parents and families, and includes changes in the school's eating environment [6].

As for the duration of interventions and the effect on food consumption, 93% of interventions of shorter duration (<1 year), showed significant results, while 60% of interventions of longer duration (≥ 1 year), had no significant effects. This fact may signal that the effect of this type of intervention is being short-lived, with no change in behavior being maintained.

Focusing on the change process, some researchers have used the Trans-theoretical model in interventions aimed at changing their lifestyle. A study that sought to systematically review the effectiveness of the Trans-theoretical Model in multi-behavioral interventions to change eating habits and levels of physical activity, concluded that the model is a promising strategy for the promotion of healthy lifestyles [46].

New research, considering the stage of behavior change in which adolescents are and seeking to help break down barriers that arise in the middle of the process, could be tested. Of the intervention studies included in the review, only one of them used the Trans-theoretical model [26]. In this study, the intake of whole grain bread, whole grains, fruits and vegetables was evaluated. At the end of the intervention, there was a significant increase in the consumption of whole grain bread, but the magnitude was small. For other foods, there were no significant effects of the intervention [26].

This review provides us with more specific data about school-based food and nutrition education interventions aimed exclusively at adolescents and their effects on food consumption. It did not define an ideal intervention model to obtain positive effects on adolescent food consumption, but it emphasizes out that interventions must be multicomponent, including changes in the environment and the participation of parents, teachers and school staff. Another important aspect is that the intervention should use theoretical model about behavioral changes, in addition to knowledge about food and nutrition. These findings may contribute to the development of future interventions aimed at the food consumption of school adolescents.

Although we used a systematic and transparent review, the method has the limitation of possible omission of studies related to the theme. In order to avoid this bias, all research stages were carried out by two researchers independently, searches were carried out in nine different databases, in addition to manual searches in the references of the selected studies and systematic reviews of closely related topics.

A limitation of the inserted intervention studies is that food consumption was estimated using a food frequency questionnaire or 24-hour dietary recall, thus increasing the potential for measurement error and selective underestimation or overestimation of intake, which may compromise the validity of the questionnaire.

5. Conclusions

The effects of the interventions are being positive, with favorable changes in the adolescents' diet. Even when the differences are not significant, they are important in the long run.

However, we identified a possible problem in maintaining the changes achieved in the interventions of longer duration (≥ 1 year). This indicates to the need for new interventions to also seek to use strategies that pay attention to the factors that contribute to adherence and sustainability of changes in behavior regarding healthy food consumption.

As well as, it´s necessary that schools adopt the intervention proposals as a school program that accompanies the student in all academic years, contributing to the changes in food consumption become eating habits for adulthood.

Supplementary Materials: Figure S1: Results of each domain and the overall bias of the included articles by Cochrane risk-of-bias tool for randomized trials (RoB 2), Table S1: Details of school-based intervention studies.

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, G.C.B.S.M. and G.P.; methodology, G.C.B.S.M., K.P.M.A.; D.A.G. and G.P.; formal analysis, G.C.B.S.M., K.P.M.A.; and V.H.O.S; investigation, G.C.B.S.M., A.K.P.F., R.P.S. and D.D.B.B.T; data curation, G.C.B.S.M.; writing—original draft preparation, G.C.B.S.M.; writing—review and editing, G.C.B.S.M.; D.A.G.; D.G.M. and G.P.; supervision, G.P.; project administration, G.C.B.S.M. and G.P.

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5.3 ARTIGO 3 – RED MEAT CONSUMPTION, RISK OF INCIDENCE OF CARDIOVASCULAR DISEASE AND CARDIOVASCULAR MORTALITY, AND THE DOSE–RESPONSE EFFECT: PROTOCOL FOR A SYSTEMATIC REVIEW AND META-ANALYSIS OF LONGITUDINAL COHORT STUDIES

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Red meat consumption, risk of incidence of cardiovascular disease and cardiovascular mortality, and the dose–response effect

Protocol for a systematic review and meta-analysis of longitudinal cohort studies

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Abstract

Background: Red and (particularly) processed meats are high in cholesterol and saturated and solid fatty acids. Their consumption is considered one of the risk factors for metabolic disorders. Numerous studies demonstrated a possible association between red meat consumption and cardiovascular disease (CVD). In this protocol, we propose a systematic review of the literature to examine the associations of red meat consumption with CVD incidence and mortality, and explore the potential dose–response relationship.

Methods: We will search MEDLINE/PubMed, Scopus, SciELO, LILACS, ScienceDirect, Web of Science, Cochrane (CENTRAL), WHOLIS, PAHO, and Embase. We will include prospective epidemiological studies (longitudinal cohort). Risk of bias will be assessed using the Newcastle-Ottawa scale (NOS). Four independent researchers will conduct all evaluations. Disagreements will be referred to a fifth reviewer. We will summarize our findings using a narrative approach and tables to describe the characteristics of the included studies. The heterogeneity between trial results will be evaluated using a standard chi-squared test with $P < .05$. We will conduct the study in accordance with the guideline of the Preferred Reporting Items for Systematic Review and Meta-analyses Protocols (PRISMA-P).

Results: This review will evaluate the association between red meat consumption and incidence of CVD and mortality (primary outcome measures). The secondary outcome measure will include the dose–response effect.

Conclusion: The findings of this systematic review will summarize the latest evidence of the association between red meat consumption and incidence of CVD and mortality and the dose–response effect through a systematic review and meta-analysis.

Registration: PROSPERO CRD42019100914.

Abbreviations: CVD = cardiovascular disease, NOS = Newcastle-Ottawa scale, PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyzes, PRISMA-P = Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols.

Keywords: cardiovascular disease, cardiovascular mortality, processed meat, protocol, red meat, unprocessed red meat

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Ethics approval and consent to participate: Does not apply.

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1. Introduction

Population eating patterns are changing rapidly in most countries. There is an emphasis on increased consumption of animal products, especially red meat, even in countries with large populations (such as China).[1,2] These changes in food consumption promote reflections on population morbidity and mortality patterns and result in a transition in health conditions related to the frequency, magnitude, and distribution of diseases. There has been a global shift in the leading cause of mortality and morbidity from infectious to noncommunicable diseases.[3] In this scenario, chronic noncommunicable diseases, including cardiovascular disease (CVD), cancer, diabetes, and chronic respiratory diseases, are the leading global cause of death and account for 70% of deaths worldwide.[4] Major causes of chronic noncommunicable diseases include modifiable behavioral risk factors such as smoking, harmful alcohol consumption, physical inactivity, and improper diet.[4] Dietary fat has been studied as a modifiable variable in the prevention and treatment of noncommunicable cardiometabolic disease.[5]

Recent evidence suggests that the Mediterranean dietary pattern, which features a diet rich in unsaturated fatty acids (healthy fats), may reduce cardiovascular events.[5] In contrast, the consumption of cholesterol, saturated fatty acids, and sodium, all of which are present in red meat and, especially processed meat, are suggested as one of the risk factors for metabolic disorders.[6] In this context, studies showed a possible association between red meat consumption and CVD.[7–9] Hence, this systematic review and meta-analysis protocol aims to review the literature about the associations of red meat consumption with CVD incidence and mortality. It will also explore the dose–response relationship between meat consumption and CVD. The following review question will be considered: what is the association between red meat consumption and incidence of CVD and mortality considering the dose–response effect?

2. Methods

2.1. Study registration

We based the systematic review protocol on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) statement guidelines.[10] This systematic review protocol has been registered on the PROSPERO database (CRD42019100914). Ethical approval is unnecessary.

2.2. Eligibility criteria

2.2.1. Types of studies. We will include prospective epidemiological studies (longitudinal cohort) that have reported the associations of the consumption of unprocessed red meat and processed meat with the incidence of cardiovascular disease and mortality.

2.2.2. Types of participants. We will include studies that follow up at red meat consumption in apparently healthy people.

2.2.3. Exposure. We will include studies that evaluated the exposure the red meat (unprocessed red meat or processed meat) consumption and association with cardiovascular disease and mortality.

2.2.4. Outcome measures. The primary outcome measures will be incidence of or mortality by CVD (coronary artery disease, stroke, heart failure, and other). The secondary outcome measures will include the effect of dose–response.

2.2.5. Exclusion criteria. We will not include studies that: it was a study of animals; it was a study that the risk assessment only related to the consumption of nutrients (animal protein, fat, etc); it was a study that the risk assessment only related all meat (white meat, red meat, and processed meat). The results of the study were aggregated as total CVD, without any specific type of CVD (coronary artery disease, stroke, heart failure, or other).

2.3. Search methods for study identification

We will conduct comprehensive searches in 10 databases: MEDLINE/PubMed, Scopus, SciELO, LILACS, ScienceDirect, Web of Science, Cochrane Library, WHOLIS, PAHO, and Embase.

The search equation was defined considering the following items: diet as exposure; red meat consumption (unprocessed red meat and processed meat); cardiovascular diseases as an outcome; and the type of study, prospective epidemiological studies (longitudinal cohort) (Appendix 1, http://links.lww.com/MD/D246). There will be no limitation of time and languages.

2.4. Study selection and data extraction.

Four reviewers will independently select and review titles and abstracts. Articles which meet the inclusion criteria will be included for full review. Any disagreement will be resolved by discussion with a fifth reviewer.

The phases of the selection process will be identified in Fig. 1, based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA).[11]

Two reviewers will extract the following information: title, first author, publication year, country, study name, population, participants characteristics (age, sex, sample size, no. events), duration of follow-up (y), person-years, disease outcome, disease ascertainment, dietary assessment, type of meat, consumption frequency or amount, statistical methods used for the analysis; risk estimates and confidence intervals, *P*-trend of dose–response test, and covariates that were matched or adjusted for in the multivariable analysis. When in doubt or discrepancies, a third researcher will be consulted.

2.5. Data analysis

2.5.1. Risk of bias in the included studies. We will assess the methodological quality of the studies using the Newcastle-Ottawa scale (NOS).[12] This scale evaluates the quality of non-randomized, cohort and case-control studies in relation to their design, content, and ease of use.

Four reviewers will independently carry out the evaluation. The disagreements will be resolved with a fifth reviewer.

2.5.2. Statistical analysis. We will summarize by narrative approach and tables to describe the characteristics of the included studies.

The studies will structure around the type of CVD, characteristics of the target population, and consumption of different types of red meat (unprocessed red meat and processed meat). We will provide summaries the association of the end multivariate model of red meat consumption with CVD for each study according to sex, when the study does not present results by sex, we will present the results of the analysis with aggregated data.

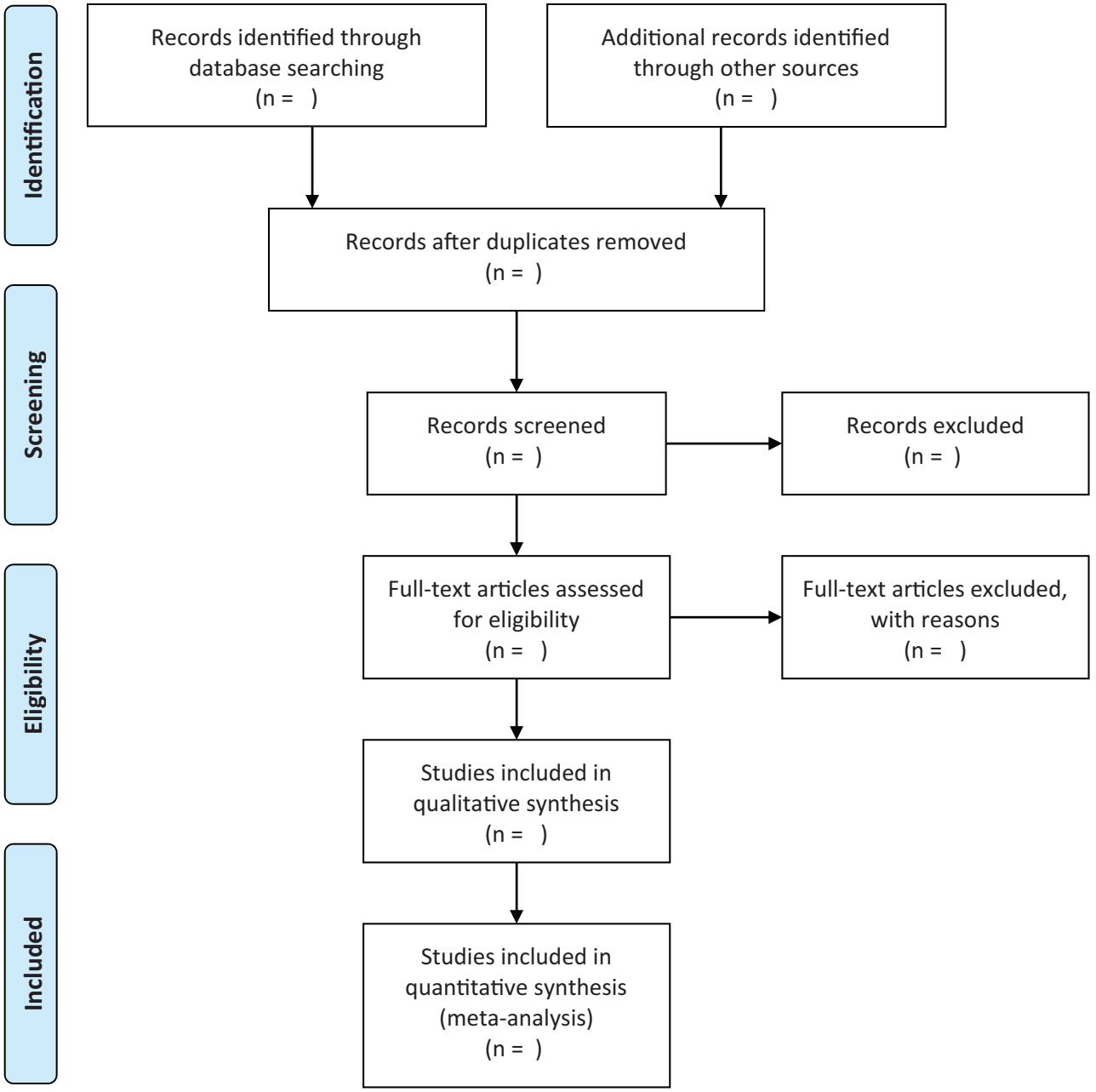

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Figure 1. PRISMA flowchart of study selection. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyzes.

When the study presents the risk analysis by red meat consumption ranges, we will provide a summary of the effects of the association between the highest consumption and the lowest.

The heterogeneity between trial results will be evaluated using a standard chi-square test with a significance level 0.05. We plan to compute the I^2 statistic to assess heterogeneity. The I^2 statistic is a quantitative measure of inconsistency across studies. I^2 values of 50% indicate a substantial level of heterogeneity, whereas a value of 0% indicates no observed heterogeneity. Funnel plots will be used to assess the presence of potential reporting biases, if possible. A linear regression approach will be used to evaluate funnel plot asymmetry.

2.5.3. Subgroup analyses. We will perform the following subgroup analyses by sex, type of red meat consumption, CVD sub types, and effect estimates according to their adjustments of covariates, if applicable.

3. Discussion

The proposed systematic review and meta-analysis will present studies that evaluated the associations of red meat consumption with CVD incidence and mortality, and the dose–response relationship between these factors. Current evidence suggests that increased meat consumption, especially red and processed meat, will negatively affect public health.[2] According to the World Cancer Research Fund, there is strong evidence that consuming red and processed meat increases the risk of colorectal cancer.[13]

Studies demonstrated an association between red meat consumption with type 2 diabetes[14] and CVD, such as coronary artery disease, stroke, and heart failure.[8,14,15] A meta-analysis assessed dietary intake and risk of all-cause mortality and found that each additional daily intake of 100 g red meat is positively associated with the risk of all-cause mortality.[16]

Given the relevance of the evidence that indicates the consumption of red and processed meat as a risk factor for the development of chronic non-communicable disease[8,14,15,17] and for all-cause mortality,[16] it is opportune to investigate the association between this consumption and its gradient, as well as to relate it to CVD incidence and/or mortality, according to sex and disease type.

To estimate the long-term impacts of meat consumption, prospective epidemiological cohort studies are presented as the main approach, because participants are followed for years. Assessing the effect of red meat consumption through controlled clinical trials is extremely difficult to perform; it would require longer follow-up times to measure the long-term health effects. Additionally, experiments with nonhuman animals are difficult to interpret for relevance to human health.[2]

Therefore, the aim of the present study is to evaluate the association between red meat (unprocessed red and processed meat) consumption and CVD and mortality and the dose–response effect through a systematic review and meta-analysis of longitudinal cohort studies.

Author contributions

Conceptualization: Gidyenne Christine Bandeira Silva de Medeiros, Gabriela Xavier Barbalho Mesquita, Grasiela Piuvezam.
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5.4 ARTIGO 4 – RED MEAT CONSUMPTION AND CARDIOVASCULAR DISEASES: A SYSTEMATIC REVIEW OF COHORT STUDIES

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Red Meat Consumption and Cardiovascular Diseases: A Systematic Review of Cohort Studies.

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Red Meat Consumption and Cardiovascular Diseases: a Systematic Review of Cohort Studies.

Objectives: The aim of this study was to examine the associations of unprocessed red meat and processed meat consumption with cardiovascular disease (CVD) incidence and mortality, and the dose-response relationship. **Methods**: Published literature was retrieved through a structured search of 10 electronic databases: MEDLINE/PubMed, Scopus, SciELO, LILACS, ScienceDirect, Web of Science, Cochrane (CENTRAL), WHOLIS, PAHO and Embase, without language or year of publication restrictions. In addition, we searched the references of published studies. We performed an exploratory search and defined the search strategy to include: diet as exposure; consumption of red meat; cardiovascular diseases as outcome; and type of study as prospective epidemiological studies. **Results**: Twenty-two prospective cohort studies were included. The results indicate a positive association between red meat consumption, especially processed meat, and the incidence of and mortality by coronary heart disease, stroke and/or heart failure. The linear trend dose-response indicates that the higher the red meat consumption, the greater the risk of CVD incidence and mortality. **Conclusion**: The current evidence from prospective studies supports that red meat consumption should be reduced, with a greater restriction on processed meat, in order to prevent CVD.
This systematic review protocol was registered on the PROSPERO (CRD42019100914).

Keywords: unprocessed red meat; processed meat; incidence, mortality; cardiovascular disease.

Background

Population feeding patterns are changing and include the replacement of fresh or minimally processed foods with processed and ultra-processed foods (Baker and Friel 2014; Monteiro et al. 2013; Moubarac et al. 2014). Of the products of animal origin,

there has been an increase in the consumption of meat and processed meat products (USDA 2018).

A study by the International Agency for Research on Cancer (IARC), linked to the World Health Organization (WHO), showed that the consumption of processed meat is associated with the incidence of colorectal cancer. The scientific evidence shows a probable association between red meat and cancer, especially for colorectal cancer, pancreatic cancer and prostate cancer (Stewart et al. 2015).

The association between the consumption of red meat and cardiovascular diseases (CVD) has been observed in meta-analysis studies, with an emphasis on coronary heart disease (CHD), stroke and/or heart failure (HF) (Bechtlod et al. 2017; Micha, Michas, and Mozaffarian 2012). A meta-analysis that evaluated the consumption of food groups and the risk of all-cause mortality showed that each additional daily dose of 100 g of red meat was positively associated with the risk of all-cause mortality (Schwingshackl et al. 2017).

A cohort study sought to identify associations of ingestion of processed meat, unprocessed red meat, poultry or fish with incident CVD and all-cause mortality. In the end, the intake of processed meat or unprocessed red meat was significantly associated with incident cardiovascular disease, as well as all-cause mortality (Zhong et al., 2020).

In terms of the relevance of evidence that links the consumption of red and processed meat as a risk factor for the development of chronic, non-communicable diseases (Wiseman, Thompson, Allen 2018) and all-cause mortality (Schwingshackl et al. 2017), it is appropriate to investigate the association between the gradient of the consumption of meat and the different types of CVD, according to sex. Therefore, the aim of this study was to examine the associations of the consumption of unprocessed

red meat and processed meat with the incidence of cardiovascular disease and mortality, and its dose-response relationship.

Methods

This systematic review was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyzes: The PRISMA Statement (Liberati et al. 2009). Further methodological details of the study have been published elsewhere (Medeiros et al. 2019). The study is registered in Prospero under the number CRD42019100914.

Search strategy

Literature published until February 13, 2019 was retrieved through a structured search of 10 electronic databases: MEDLINE/PubMed, Scopus, SciELO, LILACS, ScienceDirect, Web of Science, Cochrane (CENTRAL), WHOLIS, PAHO and Embase, without language or year of publication restrictions. In addition, we also searched the references of published studies.

We performed an exploratory search, then defined the search strategy to include the following items: diet as exposure; consumption of unprocessed red meat or processed meat; cardiovascular diseases as outcome; and type of study as prospective epidemiological studies (longitudinal cohort). A complete and detailed summary of the search strategies used for each database can be found in Supplementary Appendix 1.

Study selection

Four authors (GXBM, DFOS, KPMA, IDSFP) independently screened titles and abstracts to ascertain relevance; disagreements were resolved by consensus after discussion with a fifth researcher (GP).

To be eligible for inclusion, studies needed to (1) be a prospective epidemiological study (longitudinal cohort) with apparently health subjects; (2) have assessed the association between the consumption of red or processed meat and the incidence and/or mortality rates for cardiocascular disesase.

Reviewers excluded records if: (1) it was a study of animals; (2) risk assessment was related to the consumption of nutrients (animal protein, fat); (3) risk assessment only related to the consumption of all meat, including white meat (poultry and fish); 4) the results were aggregated as CVD, without reporting any specific type of CVD.

Data extraction

Two reviewers (KPMA, GXBM) independently conducted data extraction of the methodological characteristics, follow-up and outcomes of the studies, using standardized forms; disagreements were solved by consensus or by a third reviewer (GP). The extracted risk estimates and confidence intervals were the highest consumption versus the lowest consumption (reference) of red meat, and the respective results of the dose-response test (p-trend).

Methodological quality assessment

Four researchers (GXBM, DFOS, IDSFP, and KPMA) evaluated the methodological quality of the studies using the Newcastle-Ottawa scale (NOS) (Wells et al. 2015) (Supplementary Appendix 2). Disagreements were solved by consensus or by a fifth reviewer (GP). The studies included feature scores ranging between six and nine, with a median of eight points. The details of the assessment of each study are described in Supplementary Appendix 3.

Definition of red meat and processed meat

Based on the IARC definitions (Stewart et al. 2015), in this systematic review, we used the following definitions:

- Red meat: the sum of the consumption of unprocessed red meat and processed meat.
- Unprocessed red meat: unprocessed muscle meat from mammals, such as beef, veal, pork, lamb, mutton, horse or goat, including minced and/or frozen meat. It is usually eaten cooked (Stewart et al. 2015).
- Processed meat: meat that has been processed by salting, curing, fermentation, smoking or other processes that enhance the flavor or improve preservation. Most processed meat contains pork or beef, but it can also contain other types of red meat, poultry, organ meat (such as liver) or meat byproducts such as blood. Processed meat includes products such as bacon, sausages, ham, chicken nuggets, poultry deli meats and other deli meats and pâté.

Data synthesis

The risk results (hazard ratios, relative risk or risk ratio; 95% confidence intervals) for the incidence of and mortality by CVD were classified into the categories of red meat, unprocessed red meat and processed meat consumption in women, men and both sexes. For each study, we verified the categorization of red meat consumption and the result of the dose-response test that compared the highest consumption with the lowest consumption.

Results

Article Selection

Out of the 8,353 records that were identified by the systematic literature search and the 5 records identified by a search in published systematic reviews and meta-analyses, 51 full-text articles were assessed in detail as they reported evaluating the association of red meat consumption and the incidence of or mortality by cardiovascular disease. Twenty-two studies were selected and assessed for their methodological quality, using the NOS scale, and subsequently included in the systematic review (Amiano et al. 2015; Ascherio et al. 1994; Ashaye, Gaziano and Djoussé 2011; Bernstein et al. 2010, 2012; Burke et al. 2007; Del Gobbo et al. 2015; Haring et al., 2014; Hu et al. 1999; Kaluza, Åkesson, and Wolk 2014, 2015; Kelemen et al. 2005; Larsson, Virtamo, and Wolk 2011a, 2011b; Nagao et al. 2012; Nettleton et al. 2008; Quintana Pacheco et al. 2018; Sauvaget et al. 2003; Takata et al. 2013; Whiteman et al. 1999; Würtz et al. 2016; Yaemsiri et al. 2012). The final PRISMA diagram is shown in Figure 1.

The 22 studies in the present review include publications from 1994 to 2018, involving cohort studies carried out on three continents: America, Europe and Asia. The studies had on average of 14.5 (± 5.8) years of follow-up, ranging from 4 to 26 years. Considering the baseline, the research subjects in 16 articles were adults and the elderly (Amiano et al. 2015; Ascherio et al. 1994; Bernstein et al. 2012; Haring et al., 2014; Kaluza, Åkesson, and Wolk 2014, 2015; Kelemen et al. 2005; Larsson, Virtamo, and Wolk 2011a, 2011b; Nagao et al. 2012; Nettleton et al. 2008; Quintana Pacheco et al. 2018; Takata et al. 2013; Whiteman et al. 1999; Würtz et al. 2016; Yaemsiri et al. 2012); In four studies, the sample was composed of adults under 60 years of age, but with participants who became older than 60 years of age during the follow-up of the

cohort (Ashaye, Gaziano and Djoussé 2011; Bernstein et al. 2012; Hu et al. 1999; Sauvaget et al 2003); One study was of adolescents, adults and elderly subjects (Burke et al. 2007); One study was with older people as the subjects of the research (Del Gobbo et al. 2015). By means of multivariate analysis, 65.2% of the studies presented risk measures according to sex (Amiano et al. 2015;Ascherio et al. 1994; Ashaye, Gaziano and Djoussé 2011; Bernstein et al. 2010, 2012; Hu et al. 1999; Kaluza, Åkesson, and Wolk 2014, 2015; Kelemen et al. 2005; Larsson, Virtamo, and Wolk 2011a, 2011b; Nagao et al. 2012; Takata et al. 2013; Würtz et al. 2016; Yaemsiri et al. 2012).

In relation to the incidence of and mortality by CVD, we found the outcomes of stroke, HF and CHD. For the incidence of stroke, we included six studies with 333,084 participants and 10,355 cases (Amiano et al. 2015; Bernstein et al. 2012; Larsson, Virtamo, and Wolk 2011a, 2011b; Quintana Pacheco et al. 2018; Yaemsiri et al. 2012); For HF we included five studies with 112,494 participants and 9,421 cases (Ashaye, Gaziano and Djoussé 2011; Del Gobbo et al. 2015; Kaluza, Åkesson, and Wolk 2014, 2015; Nettleton et al. 2008); For CHD, we included six studies with 279,066 participants and 7,450 cases (Ascherio et al. 1994; Bernstein et al. 2010; Haring et al., 2014; Hu et al. 1999; Quintana Pacheco et al. 2018; Würtz et al. 2016).

With regard to mortality due to stroke, we included two studies with 174,639 participants and 2,496 deaths (Sauvaget et al 2003; Takata et al. 2013); For mortality due to HF, we included only one study with 37,035 participants and 266 cases (Kaluza, Åkesson, and Wolk 2014); and for mortality due to CHD, we included six studies with 322,979 participants and 2,949 cases (Bernstein et al. 2010; Burke et al. 2007; Kelemen et al. 2005; Nagao et al. 2012; Takata et al. 2013; Whiteman et al. 1999).

In 21 studies, data collection on food consumption was performed through a Food Frequency Questionnaire (FFQ), and only one study used a Food History

Questionnaire (Amiano et al. 2015). Three studies did not mention questionnaire validation (Burke et al. 2007; Larsson, Virtamo, and Wolk 2011b; Whiteman et al. 1999); whereas the other studies used validated instruments: four studies used validated questionnaires for food and nutrients (Amiano et al. 2015; Bernstein et al. 2012; Quintana Pacheco et al. 2018; Takata et al. 2013), two used questionnaires validated only for food (Bernstein et al. 2010; Sauvaget et al 2003) and 13 used questionnaires validated for nutrients and not for food (Ascherio et al. 1994; Ashaye, Gaziano and Djoussé 2011; Del Gobbo et al. 2015; Haring et al., 2014; Hu et al. 1999; Kaluza, Åkesson, and Wolk 2014, 2015; Kelemen et al. 2005; Larsson, Virtamo, and Wolk 2011a; Nagao et al. 2012; Nettleton et al. 2008; Würtz et al. 2016; Yaemsiri et al. 2012).

The analysis of the association between CVD and the consumption of red meat and processed meat showed the following results: 16 articles evaluated the association between the consumption of unprocessed red meat (Amiano et al. 2015; Ascherio et al. 1994; Bernstein et al. 2010, 2012; Del Gobbo et al. 2015; Haring et al., 2014; Kaluza, Åkesson, and Wolk 2014, 2015; Larsson, Virtamo, and Wolk 2011a, 2011b; Nagao et al. 2012; Sauvaget et al 2003; Takata et al. 2013; Whiteman et al. 1999; Würtz et al. 2016; Yaemsiri et al. 2012); 15 articles evaluated the association between processed meat consumption (Amiano et al. 2015; Bernstein et al. 2010, 2012; Burke et al. 2007; Del Gobbo et al. 2015; Haring et al., 2014; Kaluza, Åkesson, and Wolk 2014, 2015; Larsson, Virtamo, and Wolk 2011a, 2011b; Nagao et al. 2012; Nettleton et al. 2008; Sauvaget et al 2003; Whiteman et al. 1999; Würtz et al. 2016); and 14 articles evaluated the association between the consumption of red meat (Amiano et al. 2015; Ashaye, Gaziano and Djoussé 2011; Bernstein et al. 2010, 2012; Del Gobbo et al. 2015; Haring et al., 2014; Hu et al. 1999; Kaluza, Åkesson, and Wolk 2014, 2015; Kelemen et al. 2005; Larsson, Virtamo, and Wolk 2011a, 2011b; Quintana Pacheco et al. 2018; Würtz

et al. 2016; Yaemsiri et al. 2012). The characteristics of the included studies are described in the Supplementary Appendix 2.

In 13 studies, the analysis of the meat consumption gradient was based on the categorization of the sample into quintiles; in the other articles, the categorization of the sample occurred randomly, with four studies categorising by frequency of consumption and six by consumption portion. Consumption measures varied by weight, number of servings and frequency of consumption without quantification (Table 1).

The risk results were found from the measurements of hazard ratios, relative risk or risk ratio (95% confidence intervals) of the incidence of and mortality by CVD according to the categories of red meat, unprocessed red meat, and processed meat consumption in women, men and both sexes, as presented in Tables 2 and 3, respectively.

Among the studies that evaluated the association of the consumption of unprocessed red meat and processed meat (Amiano et al. 2015; Bernstein et al. 2010, 2012; Del Gobbo et al. 2015; Haring et al., 2014; Kaluza, Åkesson, and Wolk 2014, 2015; Larsson, Virtamo, and Wolk 2011a, 2011b; Würtz et al. 2016) with the incidence of CVD, two studies found a positive association with the consumption of unprocessed red meat. One of the studies showed an association with total stroke and ischemic stroke in women, with a significant linear trend dose-response for total stroke only (Bernstein et al. 2012); whereas the second study found an association with CHD in women, but did not perform a dose-response test (Würtz et al. 2016).

In a more detailed analysis of the association between processed meat consumption and the incidence of CVD, we observed that two studies showed an association with total stroke in men, with a significant linear trend dose-response (BERNSTEIN et al., 2012; LARSSON; VIRTAMO; WOLK, 2011a). We also found an

association between the consumption of processed meat and the incidence of HF, with a significant linear trend dose-response in both women (KALUZA; ÅKESSON; WOLK, 2015) and men (Kaluza, Åkesson, and Wolk 2014); we found no association with CHD (BERNSTEIN et al., 2010; HARING et al., 2014; WÜRTZ et al., 2016).

In terms of the stroke subtypes (ischemic or hemorrhagic), we found an association between processed meat consumption and ischemic stroke in both men and women, with a significant linear trend dose-response in men (Larsson, Virtamo, and Wolk 2011a) but not in women (Larsson, Virtamo, and Wolk 2011b). We found no evidence of the association with hemorrhagic stroke (LARSSON; VIRTAMO; WOLK, 2011a, b),

The studies that evaluated a single type of meat, unprocessed red meat (Ascherio et al. 1994; Yaemsiri et al. 2012) or processed meat (Nettleton et al. 2008) found no association with the incidence of CVD, as well as did not perform a dose-response test.

Among the studies that evaluated the association of the consumption of unprocessed red meat and processed meat (Kaluza, Åkesson, and Wolk 2014; Nagao et al. 2012; Sauvaget et al 2003; Whiteman et al. 1999) with CVD mortality, no study found an association with the consumption of unprocessed red meat, but one study found a significant linear trend dose-response in men, but not in women (Nagao et al. 2012). In addition, two studies demonstrated an association with the consumption of processed meat: one presented a risk association for HF mortality in men, with a significant linear trend dose-response (Kaluza, Åkesson, and Wolk 2014), and the other presented consumption as a protective factor for CHD mortality in men, but not in women, with a significant linear trend dose-response (Nagao et al. 2012).

It is important to highlight that a study (Takata et al. 2013), only evaluated the association between the consumption of unprocessed red meat and CVD mortality,

presenting consumption as a protection factor for hemorrhagic stroke in women, with a significant linear trend dose-response . For CHD, there was a risk association for mortality in men, but not in women; furthermore, the linear trend dose-response test was not significant. On the other hand, the one study that only evaluated the consumption of processed meat with CHD mortality (Burke et al. 2007), found a risk association, regardless of gender, but did not perform a dose-response test.

Definition of red meat and processed meat

We observed that, in the included studies, there was no uniformity in the definitions for unprocessed red meat, processed meat and red meat. According to the terms defined by the WHO and adopted by this systematic review, the term “unprocessed red meat” was also found as "fresh red meat" (Larsson, Virtamo, and Wolk 2011a, 2011b) and "red meat" (Del Gobbo et al. 2015; Haring et al., 2014; Nagao et al. 2012; Takata et al. 2013). The term “processed meat” was also found as "processed red meat" (Bernstein et al. 2012; Würtz et al. 2016), and one study used "red meat" as a synonym for “processed meat” (Nettleton et al. 2008). For the term "red meat", it was also identified as "total red meat" (Amiano et al. 2015; Bernstein et al. 2012; Kaluza, Åkesson, and Wolk 2014, 2015; Larsson, Virtamo, and Wolk 2011a; Quintana Pacheco et al. 2018) and "red & processed meat" (Del Gobbo et al. 2015; Haring et al. 2014). The definitions used by each study are described in Supplementary Appendix 4.

Discussion

The results of the systematic review indicate a positive association between red meat consumption, especially processed meat, and the incidence of and mortality by

CHD, stroke and HF. The linear trend dose-response results indicate that the higher the red meat consumption, the greater the risk of CVD incidence and mortality.

From this perspective, these associations can be seen by comparing the compositions of unprocessed red meat and processed meat, in which processed meat has a higher content of sodium and nitrate (Bronzato and Durante 2017). Dietary sodium is touted as one of the factors that promotes increased blood pressure (Smyth et al 2015; WHO 2003), which is one of the risk factors for CVD (Bronzato and Durante 2017; Singh et al 2013). Nitrate and its by-products, such as peroxynitrite, have shown to be experimentally associated with endothelial dysfunction and atherosclerosis development (Bronzato and Durante 2017; Forstermann 2008).

Another possible explanatory hypothesis lies in the fact that the excessive consumption of red meat assumes an excessive consumption of proteins and fats, and therefore, an imbalance in the consumption of carbohydrates. Biochemistry research shows that this imbalance can lead to an excess of Acetyl-CoA molecules available for the citric acid cycle. Thus, the organism will tend to preserve the excess Acetyl-CoA, which starts to divert the molecules to the biosynthesis pathway of fatty acids, grouping themselves in triglycerides and fatty acids and, finally, being stored in adipose tissue (Nelson and Cox 2017). Thus, the excess consumption of red meat, along with other risk factors, such as a lack of physical activity, sedentary behavior and alcohol consumption, can cause elevated cholesterol levels and blood pressure, which are risk factors for the development of CVD.

Another element that started to be investigated was the intestinal microbiome. A research has identified the microbial metabolite of trimethylamine N-oxide as possibly being responsible, through the link between the microbiota and the synthesis of the pro-

atherogenic compound, trimethylamine N-oxide (TMAO) of L-carnitine and choline, present in red meat (Koeth et al 2013).

Therefore, the association between the consumption of unprocessed red meat and processed meat with CVD has different possible routes, in addition to other aspects, such as the consumption of food with saturated fats, cholesterol and simple carbohydrates (Bronzato and Durante 2017; Chowdhury et al 2014; Koeth et al 2013; Lacroix, Cantin, and Nigam 2017; Quintana Pacheco et al. 2018; Souza et al 2015; Zhang et al 2012). In this sense, studies that analyze food standards may be more suitable for determining risky feeding habits than studies that analyze the food alone.

In a recently published meta-analysis study, dietary patterns with low carbohydrate consumption, but with plant-derived sources of protein and fat (vegetables, nuts, peanut butter and wholegrain breads), were associated with lower all-cause mortality, whereas dietary patterns with animal-derived sources of protein and fat (lamb, pork and chicken) were associated with higher mortality (Seidelmann et al 2018). In a follow-up study, Stewart et al (2016) noted that the higher consumption of healthy foods can be more important for the secondary prevention of coronary artery disease than avoiding the unhealthy foods typical of Western diets.

Thus, complete diet analysis may play a more important role in determining the risk of CVD than the isolated analysis of individual nutritional constituents. However, there is evidence that the consumption of processed meats is associated with cancer. There are indications that the consumption of red meat is also associated with cancer (Wiseman, Thompson, and Allen 2018). Since the restriction of the consumption of red meat from dietary patterns of vegetable protein can reduce the intake of high-quality essential nutrients and proteins, it is important to evaluate the dose-response of the consumption of these foods to CVD. This evaluation should consider, among other

variables, the individuals' eating pattern, in order to define recommendations of these foods within a secure and cardioprotective dietary pattern.

While exploring the consumption doses evaluated in the studies included in this systematic review, we observed that there was no standardization among the studies. We also found that the value that was considered to be high consumption had important variability. In addition, some studies present consumption in servings or frequency, and not by weight (in grams).

The studies that showed an association between the consumption of unprocessed red meat and CVD, with a significant linear trend dose-response, presented a mean daily consumption equivalent to more than 100 g in the group, with the highest quintile or category of consumption. This result did not occur for the association between the consumption of processed meat and CVD risk, with a significant linear trend test dose-response . We verified that there is no observed standard or limit value that is associated with the risk of CVD; this is likely related to the type of processing of the processed meats that were consumed by the study population. Processed meats can be classified as minimally processed, processed or ultra-processed (MONTEIRO et al., 2013; SAÚDE, 2014). The more processed the red meat is, the more substances like sugar, sodium, nitrite and nitrate are present, which are risk factors for CVD.

For studies that did not present consumption in weight (grams), we considered the standard used by the World Cancer Research Fund International (WCR; AICR, 2018), which defines a serving of unprocessed red meat as equivalent to 100 g and that of processed meat as 50 g. Furthermore, the findings of this systematic review revealed that there is no consensus between studies in terms of the risk of red meat consumption and CVD. In this sense, it is important to consider that the results that showed no

association may, hypothetically, show an absence of evidence of an association, and not evidence of an absence of effects on the risk of death or incidence of CVD.

It is important to note that some of the review studies that showed no association, also called “negative studies”, presented a significant linear trend dose-response for the association of the consumption of unprocessed red meat (Bernstein et al. 2010; Nagao et al. 2012) or processed meat (Bernstein et al. 2012) and CVD. Therefore, although there is no association, this indicates the importance of reducing the consumption of unprocessed red meat and processed meat, since a dose-response association indicates that any increase in the level of exposure to a modifiable risk factor (e.g. the consumption of unprocessed meat or processed meat) increases the effect of this risk factor on a particular outcome (PATINO; FERREIRA, 2016).

It is not appropriate to state that the consumption of red meat, and in particular the consumption of processed red meat, is the cause *per se* of CVD incidence or mortality. However, the results of this study indicate relationships with the risk factors and the etiology of CVD; therefore, the moderate consumption of red meat, within a cardio-protective dietary pattern and respecting the individual’s characteristics and personal responses, are important measures in the prevention of CVD.

The results of this systematic review provide scientific evidence that supports the reduction of the consumption of unprocessed red meat and processed meats in dietary guidelines, based on foods aimed at the prevention of CVD. Therefore, the results corroborate the governmental and non-governmental health and nutrition agencies, which recommend reducing the consumption of unprocessed red meat and the suppression of processed meat (DGE 2017; USDA 2015; Wiseman, Thompson, and Allen 2018).

Limitation

The studies that composed the present systematic review, being longitudinal observational studies, have limitations of the method itself, bringing less evidence compared to a clinical trial.

It was also verified the limitation that dietary intake was assessed by means of food frequency questionnaires or food history interviews. In food validation studies, correlations between food frequency questionnaire data and food records, considered to be more accurate, rarely exceed 0.7. This limit is probably related to the fact that an individual's diet, with all its inherent complexity, cannot be fully captured by a structured questionnaire, although some of the errors are inevitably attributable to the comparison methods (Willett 2001).

Moreover, we note that the metrics used to measure the consumption of red meat were varied, and the taxonomies used for tred meat, unprocessed red meat and processed meat were varied and may cause confusion. Moreover, some studies did not present assessments by sex, and there are differences according to age and sex.

Conclusion

Current evidence from prospective studies supports that red meat consumption should be reduced, with a greater restriction on processed meat, in order to prevent CVD. Primary CVD prevention should emphasize the modification of multiple lifestyle factors, including the dietary pattern, as they are important measures for the potential reduction of CVD incidence and mortality.

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Table 1. Categorization of the sample by consumption of unprocessed meat, processed meat and red meat of each study selected in the Systematic Review

			Meat Consumption					
			Women		Men		Men and women	
Unprocessed red meat	**Categorization of the sample**	**Unit**	**lowest**	**Highest or consumption amount**	**lowest**	**Highest or consumption amount**	**lowest**	**Highest or consumption amount**
Würtz et al. 2016	serving	g/week	-	150	-	150	-	-
Amiano et al. 2015	quintiles	g/day	< 11.1	≥ 52.4	< 24.3	≥ 86	-	-
Bernstein et al. 2010	quintiles	median svg/day	0.28	1.17	-	-	-	-
Nagao et al. 2012	quintiles	median g/day	4.0	43.9	6.4	57.8	-	-
Sauvaget et al. 2003	frequency	times/week	-	-	-	-	Never	Almost daily
Takata et al. 2013	quintiles	median g/day	15.0	94.8	20.0	114.9	-	-
Bernstein et al. 2012	quintiles	median svg/day	0.28	1.08	0.14	1.11	-	-
Del Gobbo et al. 2015[*]	quintiles	-	-	-	-	-	NS	NS
Haring et al. 2014	quintiles	median svg/day	-	-	-	-	0,1	1.1
Kaluza, Åkesson, and Wolk 2014	serving	median g/day	-	-	17.0	83.2	-	-
Kaluza, Åkesson, and Wolk 2015	serving	median g/day	14	58	-	-	-	-
Yaemsiri et al. 2012	serving	medium svg/day	-	1	-	-	-	-
Larsson, Virtamo, and Wolk 2011a	quintiles	g/day	-	-	< 33.5	> 83.1	-	-
Larsson, Virtamo, and Wolk 2011b	quintiles	g/day	< 16.5	≥ 48.8	-	-	-	-
Ascherio et al. 1994	frequency	times/month[a] times/week[b]	≤ 1[a]	≥ 4[b]	-	-	-	-
Whiteman et al. 1999	frequency	days week	-	-	-	-	< 1	4-7
Processed meat								

Burke et al. 2007	frequency	serves/month	-	-	-	-	≤4	> 4
Würtz et al. 2016	serving	g/week	-	150	-	150	-	-
Amiano et al. 2015	quintiles	g/day	< 12.0	≥ 46.0	< 21.5	≥72.6	-	-
Bernstein et al. 2010	quintiles	median svg/day	0.00	0.43	-	-	-	-
Nagao et al. 2012	quintiles	medium g/day	0.9	10.4	1.2	13.9	-	-
Nettleton et al. 2008	serving	medium svg/day	-	-	-	-	-	1.1 (± 0.02)
Sauvaget et al. 2003	frequency	times/week	-	-	-	-	Never	Almost daily
Bernstein et al. 2012	quintiles	median svg/day	0.05	0.64	0.03	0.71	-	-
Del Gobbo et al. 2015*	quintiles	median	-	-	-	-	DNP	DNP
Haring et al. 2014	quintiles	median svg/day	-	-	-	-	0,00	1.1
Kaluza, Åkesson, and Wolk 2014	serving	median g/day	-	-	15.5	89.7	-	-
Kaluza, Åkesson, and Wolk 2015	serving	median g/day	16	60	-	-	-	-
Larsson, Virtamo, and Wolk 2011a	quintiles	g/day	-	-	< 20.1	≥ 57.1	-	-
Larsson, Virtamo, and Wolk 2011b	quintiles	g/day	< 12.1	≥ 41.3	-	-	-	-
Nettleton et al. 2008**	serving	svg/day	-	-	-	-	-	1.1 (± 0.02)
Whiteman et al. 1999	frequency	days week	-	-	-	-	< 1	4-7
Red meat								
Quintana Pacheco et al. 2018	serving	g/day	-	-	-	-	-	50
Würtz et al. 2016	serving	g/week	-	150	-	150	-	-
Bernstein et al. 2010	quintiles	median svg/day	0.49	2.11	-	-	-	-
Kelemen et al. 2005	quintiles	median svg per 1000 kcal/day	0.28	1.20	-	-	-	-
Ashaye, Gaziano and Djoussé 2011	quintiles	median svg/week	-	-	1.5	9.5	-	-
Bernstein et al. 2012	quintiles	median svg/day	0.44	1.92	0.3	2.29	-	-
Haring et al. 2014	quintiles	median svg/day	-	-	-	-	0,2	1.9

Hu et al. 1999	serving	svg/d	-	1	-	-	-	-
Kaluza, Åkesson, and Wolk 2014	serving	median g/day	-	-	37.2	175	-	-
Kaluza, Åkesson, and Wolk 2015	serving	median g/day	34	117	-	-	-	-
Larsson, Virtamo, and Wolk 2011a	quintiles	g/day	-	-	<62.5	≥136.2	-	-
Larsson, Virtamo, and Wolk 2011b	quintiles	g/day	< 36.5	≥ 86.0	-	-	-	-
Yaemsiri et al. 2012	serving	medium svg/day	-	1	-	-	-	-

svg – servings; DNP – Did not present * reported that it was analyzed in quintile but did not present the consumption values. ** It was considered as processed meat since in the red meat group evaluated, only the liver was not processed meat.

Table 2. Hazard Ratios or Relative Risk (95% Confidence Intervals) of incident cardiovascular disease (CVD) by Categories of Unprocessed Red Meat, Processed meat, and Red Meat consumption in women, men and both, of the studies selected in the Systematic Review

Women			Men			Women and Men		
Study	**HR/RR(95% CI)**	**P for Trend**	**Study**	**HR/RR (95% CI)**	**P for Trend**	**Study**	**HR/RR (95% CI)**	**P for Trend**
Total stroke								
Unprocessed red meat								
Amiano et al. 2015	1.21 (0.79, 1.85)	0.10	Amiano et al. 2015	0.81 (0.54, 1.21)	0.15			
Bernstein et al. 2012	**1.19 (1.02, 1.40)**	**0.04**	Bernstein et al. 2012	1.11 (0.88, 1.39)	0.51			
Larsson, Virtamo, and Wolk 2011b [∞]	1.07 (0.91, 1.23)	0.31	Larsson, Virtamo, and Wolk 2011a	1.07 (0.93, 1.24)	0.77			
Processed meat								
Amiano et al. 2015	0.81 (0.51, 1.27)	0.17	Amiano et al. 2015	0.92 (0.64–1.32)	0.82			
Bernstein et al. 2012	1.10 (0.95, 1.27)	0.13	Bernstein et al. 2012	**1.27 (1.03, 1.55)**	**< 0.01**			
Larsson, Virtamo, and Wolk 2011b	1.18 (1.00, 1.38)	0.25	Larsson, Virtamo, and Wolk 2011a	**1.23 (1.07, 1.40**)	**0.004**			
Red meat								
Bernstein et al. 2012	1.19 (1.00, 1.41)	0.07	Bernstein et al. 2012	**1.28 (1.02,1.61)**	**0.01**	Quintana Pacheco et al. 2018	1.09 (0.97, 1.23)[*]	-
Larsson, Virtamo, and Wolk 2011b	1.12 (0.95, 1.32)	0.12	Larsson, Virtamo, and Wolk 2011a	1.15 (1.00, 1.33)	0.10			
Ischemic Stroke								
Unprocessed red meat								
Amiano et al. 2015	1.24 (0.74, 2.05)	0.13	Amiano et al. 2015	0.80 (0.51, 1.25)	0.51	Bernstein et al. 2012	**1.27 (1.06, 1.53)**	0.05
Larsson, Virtamo, and Wolk 2011b	1.12 (0.93, 1.34)	0.15	Larsson, Virtamo, and Wolk 2011a	1.02 (0.87, 1.20)	0.63			
Yaemsiri et al. 2012	0.97 (0.63-1.48) [*]	-						

Processed meat								
Amiano et al. 2015	0.82 (0.47, 1.42)	0.31	Amiano et al. 2015	0.86 (0.57–1.29)	0.77	Bernstein et al. 2012	1.15 (0.98, 1.35)	**0.03**
Larsson, Virtamo, and Wolk 2011b	**1.24 (1.04, 1.49)**	0.15	Larsson, Virtamo, and Wolk 2011a	**1.18 (1.01, 1.38)**	**0.03**			
Red meat								
Larsson, Virtamo, and Wolk 2011b[**]	**1.22 (1.01, 1.46)**	**0.04**	Larsson, Virtamo, and Wolk 2011a	1.06 (0.90, 1.25)	0.53	Bernstein et al. 2012	1.22 (1.01, 1.47)	0.03
Yaemsiri et al. 2012[*]	1.13 (0.95-1.34)	-						
Hemorrhagic stroke								
Unprocessed red meat								
Larsson, Virtamo, and Wolk 2011b[+]	0.83 (0.48, 1.42)	0.29	Larsson, Virtamo, and Wolk 2011a	1.27 (0.90, 1.80)	0.26	Bernstein et al. 2012	0.83 (0.55, 1.27)	0.57
Larsson, Virtamo, and Wolk 2011b[++]	0.90 (0.42, 1.91)	0.61						
Processed meat								
Larsson, Virtamo, and Wolk 2011b[+]	0.71 (0.42, 1.18)	0.20	Larsson, Virtamo, and Wolk 2011a	1.39 (0.97, 1.99)	0.15	Bernstein et al. 2012	1.13 (0.76, 1.67)	0.25
Larsson, Virtamo, and Wolk 2011b[++]	1.53 (0.73, 3.20)	0.27						
Red meat								
Larsson, Virtamo, and Wolk 2011b+	0.59 (0.34, 1.04)	0.09	Larsson, Virtamo, and Wolk 2011a	**1.57 (1.09, 2.25)**	0.06	Bernstein et al. 2012	1.19 (0.77, 1.86)	0.44
Larsson, Virtamo, and Wolk 2011b[++]	1.02 (0.48, 2.16)	0.48						
Heart failure								
Unprocessed red meat								
Kaluza, Åkesson, and Wolk 2015	1.00 (0.89, 1.13)	0,80	Kaluza, Åkesson, and Wolk 2014	0.99 (0.87, 1.13)	0.75	Del Gobbo et al. 2015	0.94 (0.80, 1.10)	0.44
Processed meat								
Kaluza, Åkesson, and Wolk 2015	**1.30 (1.05, 1.60)**	**0,002**	Kaluza, Åkesson, and Wolk 2014	**1.28 (1.10–1.48)**	**0.01**	Nettleton et al. 2008[*]	1.07 (0.97, 1.17)	-

						Del Gobbo et al. 2015	1.21 (0.92-1.60)	0.19
Red meat								
Kaluza, Åkesson, and Wolk 2015	**1.23 (1.03, 1.48)**	**0.01**	Ashaye, Gaziano and Djoussé 2011	**1.24 (1.03, 1.48)**	**0.007**	Del Gobbo et al. 2015	1.09 (0.91-1.29)	0.46
			Kaluza, Åkesson, and Wolk 2014	**1.20 (1.03, 1.41)**	**0.04**			
Coronary heart disease								
Unprocessed red meat								
Bernstein et al. 2010	1.13 (0.99, 1.30)	**0.02**				Haring et al. 2014	1.13 (0.89, 1.44)	0,13
Würtz et al. 2016*	1.08 (1.02 – 1.14)	-	Würtz et al. 2016*	1.01 (0.98 – 1.03)	-	Ascherio et al. 1994*	1.38 (0.77-2.29)	-
Processed meat								
Bernstein et al. 2010	93.1 (0.93,1.17)	0.11				Haring et al. 2014	1.04 (0.85, 1.29**)**	0.49
Würtz et al. 2016*	1.05 (0.96 – 1.16)	-	Würtz et al. 2016*	1.04 (1-1.08)	-			
Red meat								
Würtz et al. 2016*	**1.06 (1.01 – 1.10)**	-	Würtz et al. 2016*	1.02 (1,00-1.04)	-	Quintana Pacheco et al. 2018*	**1.18 (1.05, 1.33)****	-
						Haring et al. 2014	1.15 (0.89, 1.48)	0.21
Bernstein et al. 2010	**1,29 (1.12, 1.49)**	**<0.001**						
Hu et al. 1999 ∞	1.09 (0.91, 1.30)	0.35						

HR indicates Hazard Ratios. RR indicates Risk Relative. Risk result of End Multivariable Model * It did not perform a dose-response test**.** **To examine more extreme levels of red meat consumption, they categorized participants into deciles of red meat consumption.+ intracerebral hemorrhage; ++ subarachnoid hemorrhage. ∞ The RR (95% CIs) was per 1 serving/d, but the p for trend was evaluated from the categorization of the sample in quintile of consumption, being the unit median svg / day, the lowest quintile 0.42 and the highest 1.78.

Table 3. Hazard Ratios, Relative Risk or Risk Ratio (95% Confidence Intervals) of mortality cardiovascular disease (CVD) by Categories of Total, Processed, and Unprocessed Red Meat Consumption in women, men and women and men, of the studies selected in the Systematic Review

Women			Men			Men and Women		
Study	**HR/RR (95% CI)**	**P for Trend**	**Study**	**HR/RR (95% CI)**	**P for Trend**	**Study**	**HR/RR (95% CI)**	**P for Trend**
Total stroke								
Unprocessed red meat								
						Sauvaget et al. 2003	1.01 (0.73, 1.38)	0.857
Processed meat								
						Sauvaget et al. 2003	0.90 (0.61,1.33)	0.812
Ischemic Stroke								
Unprocessed red meat								
Takata et al. 2013	0.84 (0.55, 1.28)	0.38	Takata et al. 2013	1.22 (0.69, 2.15)	0.73			
Hemorrhagic stroke								
Unprocessed red meat								
Takata et al. 2013	**0.57 (0.37, 0.87)**	**0.01**	Takata et al. 2013	0.71 (0.43, 1.20)	0.32			
Heart failure								
Unprocessed red meat								
			Kaluza, Åkesson, and Wolk 2014	0.77 (0.47, 1.27)	0.40			
Processed meat								
			Kaluza, Åkesson, and Wolk 2014	**2.43 (1.52–3.88)**	**<0.001**			
Red meat								
			Kaluza, Åkesson,	1.30 (0.75–2.27)	0.03			

			and Wolk 2014					
Coronary heart disease								
Unprocessed red meat								
Nagao et al. 2012	1.23 (0.82, 1.85)	0.32	Nagao et al. 2012	0.7 (0.47, 1.04)	**0.04**	Whiteman et al. 1999[*]	0.55 (0.31–0.99)	-
Takata et al. 2013	1.28 (0.84, 1.96)	0.43	Takata et al. 2013	**1.54 (1.02, 2.32)**	**0.07**			
Processed meat								
Nagao et al. 2012	0.98 (0.59 - 1.62)	0.63	Nagao et al. 2012	**0.56 (0.36 -- 0.88)**	**0.002**	Burke et al. 2007[*]	**2.21 (1.05, 4.63)**	-
						Whiteman et al. 1999[*]	1.28 (0.46–3.54)	-
Red meat								
Kelemen et al. 2005[**]	**1.44 (1.06, 1.94)**	**0.02**						

HR indicates Hazard Ratios[**]Risk ratio (95% CI). RR indicates Risk Relative. Risk result of End Multivariable Model. [*] It did not perform a dose-response test.

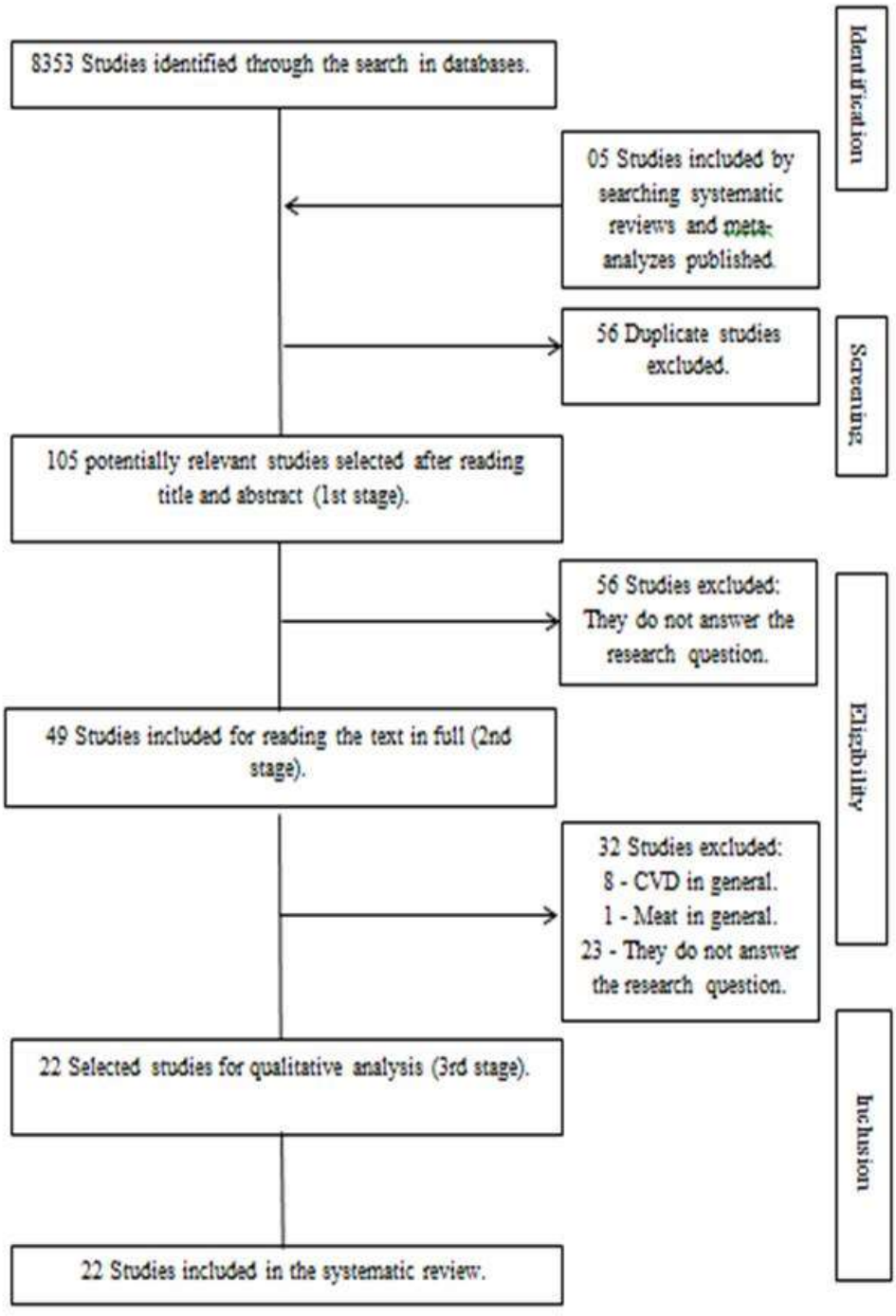

Figure 1. Flow chart of literature search and selection

5.5 ARTIGO 5 – NUTRITIONAL INTERVENTION OF THE AME PROGRAM: RATIONALE AND THEORETICAL FOUNDATION.

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NUTRITIONAL INTERVENTION OF THE AME PROGRAM: RATIONALE AND THEORETICAL FOUNDATION.

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ABSTRACT

The AME Program is a school-based randomized clinical trial that aims to provide behavioral changes in food consumption and in the active lifestyle of adolescents in the public school system in a city in the northeast of Brazil. The AME Program has three thematic axes: food and nutrition education, reduction of sedentary behavior and encouragement of physical activity. This research methods article describes the rationale and theoretical foundation of the Food and Nutrition Education (FNE) axis. It's presenting the rationale for the development of the axis; the guiding theories of the AME Program; objectives and goals; and characteristics of the AME Program's FNE axis. The actions of the AME Program's FNE axis will enable the development of critical and reflective thinking, leading to healthy and sustainable eating habits, transforming their homes and communities, thus enabling the transformation of their territory. Its short term result it may generate better school performance and less spending on public health for adolescents in the public school system. In long-term, may result in adults

with an adequate and healthy diet that will bring health benefits. Brazilian Clinical Trials Registry (REBEC) number RBR-86xv46.

Key words: adolescent, education, intervention, nutrition, protocol, school

INTRODUCTION

The prevalence of overweight and obesity among children and adolescents aged 5 to 19 years has increased worldwide. In 1975 it was 4% and in 2016 it exceeded 18%.[1]

One of the ways to prevent obesity is through an adequate and healthy diet, reduction of sedentary behavior and the practice of physical activity. The school has shown itself to be a conducive environment for interventions aimed at preventing obesity.[2–4]

A review of studies of school interventions in Europe points out that the combination of educational and environmental components focused on eating behavior and physical activity produces better results. [5]

As this type of intervention seeks behavioral changes, it involves the ability to make decisions for healthy behaviors. The development of executive skills that occurs in the pubertal maturation phase (15 to 19 years old) leads to an increase in the ability to assess the consequences of short- and long-term decisions. [6,7] Studies indicate the association of diet and the practice of physical activity with a better development of executive skills. [8–12]

In this context, the AME Program, a randomized, school-based clinical study with public school adolescents in a city in northeastern Brazil, was planned. The objective of the program is to improve the executive skills of adolescents allowing better decision-making and consequently changes in behavior in food consumption, sedentary lifestyle, and physical activity.

Thus, with the objective of promoting an active lifestyle and adequate and healthy diet among school adolescents, the AME Program has three thematic axes: food and nutritional education, reduction of sedentary behavior and stimulation of physical activity.

This article on research methods describes the AME Program's FNE axis, presenting: the justification for the development of the axis; the guiding theories of the AME Program; objectives and goals of the nutritional intervention; and characteristics of the AME Program's FNE axis. The design and methods of the AME Program are reported in Brazilian Clinical Trials Registry (REBEC) number RBR-86xv46.[13]

BACKGROUND AND RATIONALE

Profound social and economic changes have been taking place in high-income countries since the beginning of the 20th century and have reached low- and middle-income countries.[14] These changes have brought greater availability of abundant, cheap and often nutrient-poor foods with the presence of saturated or trans fats, excess salt, and excess sugar,[14] called ultra-processed foods. [15]

A study that evaluated the data from probabilistic samples representative of Brazilian households located in the eleven metropolitan regions in the country, found that the caloric participation of ultra-processed food products increased continuously and significantly from 1987 to 2003.[16]

With the change in eating habits and sedentary lifestyles, obesity epidemic reached low- and middle-income countries, contributing to the development of chronic diseases and premature mortality.[17]

In Brazil, the prevalence of obesity among children and adolescents went from 5% in 2000 to 10.8% in 2016. [18] Unhealthy eating is one of the modifiable risk factors for obesity

and is associated with the development of chronic diseases such as diabetes, cardiovascular diseases and cancer.[19,20]

According to the American Dietetic Association (ADA), low intake of fruits and vegetables; the habit of skipping breakfast; the consumption of fast food, especially among adolescents; and the absence of family meals are risk factors for the development of childhood obesity.[21]

Three dietary patterns were produced among Brazilian adolescents, based on data from the National School Health Survey (PeNSE, 2009): the healthy pattern, characterized by the most frequent consumption of all foods that are indicators of healthy eating (cooked vegetables, fruits, milk, raw vegetables and beans) compared to unhealthy ones; the unhealthy pattern, characterized by the most frequent consumption of all foods that mark unhealthy eating (sweet cookies, savory cookies, sweets, soft drinks, fried snacks, sausages and french fries); and the mixed pattern, characterized by the smallest discrepancy between the frequency of consumption of healthy and unhealthy foods.[22]

In the northeast of Brazil, the proportion of adolescents classified in each of the three eating patterns was 18.6% (17.8-19.5) in the healthy pattern, 46.2% (45.0-47.4) in the mixed pattern , and 35.2% (34.1-36.3) in the unhealthy pattern.[22]

According to the Brazilian Study of Cardiovascular Risks in Adolescents (2013/2014), the diets of Brazilian adolescents were characterized by the consumption of traditional Brazilian food, such as rice and beans, as well as high sugar consumption through sweetened beverages and processed foods.[23]

The review of scientific production based on the three editions of PeNSE (2009, 2012 and 2015) presents a very similar result. It points out the problem of consumption of sweets and sugary drinks among adolescents; and low consumption of fruits and vegetables. Despite having a high consumption of beans, this decreased in 2015.[24]

In this scenario, to prevent obesity and other chronic diseases among adolescents, one of the strategies that has been used is school-based FNE interventions. In a recent systematic review (under elaboration) on the effects of these interventions on adolescent food consumption, it was found that interventions are able to bring changes in food consumption, but there is still a need to find the way for us to have changes in habits, since it was also found that behavioral differences disappear in interventions lasting more than a year.[25]

Studies indicate that multicomponent interventions, with the participation of parents or guardians, training and pedagogical support to the teacher, changes in the environment and school meals have shown changes in the food consumption of students.[25,26]

Another characteristic that has been observed when we think about preventing overweight and obesity is the use of interventions that combine FNE and physical activity[27–30]. The AME Program, in addition to combining FNE and physical activity, also added to the fight against sedentary behavior. With technological development, more and more adolescents are adhering to sedentary behaviors, and the evidence associates television time and other screens exceeding more than 2 hours a day with the risk of developing obesity.[21]

A structured FNE program combined with the encouragement to reduce sedentary behavior and physical activity should have a direct and significant effect on changing adolescent food consumption, reducing the risk of obesity and other chronic diseases. Thus, based on these premises, the FNE component was developed in the intervention of the AME Program.

GUIDING THEORIES OF THE AME PROGRAM

To illustrate how individual, environmental and social factors explain differences in eating behaviors, studies use an ecological model.[31,32] An ecological approach recognizes the complex factors and contexts that influence individual eating patterns.[33]

Socioecological theory considers individuals as participants in social systems, emphasizing that health behaviors are influenced by intrapersonal factors (knowledge, skills and beliefs), interpersonal processes (social support, peers and family) and environmental aspects (environmental characteristics).[34] Therefore, it is not limited to the individual level, but also considers the social, physical and macro environment that surrounds the individual.[35]

Since the 1970s, research in social and behavioral sciences has used socioecological theory as a conceptual model for human development.[33]

The ecological approach is routinely used in nutrition studies in high-income countries and describes the role that the food environment plays in food choices and nutritional transitions.[36,37]

Thus, the AME Program's FNE axis reflects an ecological model, considering the numerous influences on adolescent food consumption. This includes individual food choices, family and peer influences, food provided by the school and sold close to the school.

In addition to the socio-ecological model, the WHO's concept of Health Promotion in Schools (HPS) was also used. This structure adopts an eco-holistic approach to create school environments conducive to health and healthy behaviors.[38]

The AME Program's FNE axis meets the following three elements of the HPS framework: health education included in the school curriculum; health promotion through changes in the school's social and physical environment; and promoting actions that involve

family members in order to reach the environment outside school and recognizing their influence on the health of adolescents.[39]

Finally, it will be assessed what stage of behavior change in the transtheoretical model the adolescent is in for the consumption of fruits and vegetables at the beginning and end of the intervention. According to the trans-theoretical model, the modification of a behavior is a dynamic process with 5 distinct stages: pre-contemplation, contemplation, preparation, action and maintenance. Given the possibility of making changes in the diet, each stage represents a phase with different perceptions and motivations.[40]

Therefore, the socioecological theory, HPS framework and transtheoretical model behavior change stage can provide an excellent comprehensive framework for the intervention to reach individual, organizational and community factors in changing food consumption in order to prevent childhood obesity.

OBJECTIVES AND GOALS OF THE NUTRITIONAL INTERVENTION

The general objective of AME Program's FNE axis is to promote health education for an adequate and healthy diet in order, together with the other axes, to contribute to adherence to an active lifestyle and adequate and healthy food. Consequently, contribute to the prevention of obesity and other chronic diseases.

Adequate food is a basic human right that must guarantee permanent and regular access, in a socially just manner. It is a dietary practice appropriate to the biological and social aspects of the individual. Healthy eating refers to the consumption of foods that have a balanced nutritional composition, with health benefits.[41]

The food guide for the Brazilian population presents guidelines based on dietary standards, does not directly provide recommendations for nutrients or the number of portions

of food. Increased consumption of natural or minimally processed foods is recommended, stimulating the production of meals at home, and decreased consumption of ultra-processed foods and drinks ready for consumption.[42]

The Recommendations for Prevention of Childhood Obesity from the American Dietetic Association (ADA) suggest two items in the usual daily intake of fruits and vegetables, two items in the usual daily intake of sweetened drinks, and one item in the weekly average of meals in fast food establishments.[21]

As for the consumption of fruits and vegetables, the American Cancer Society (ACS) recommends eating five or more servings of a variety of vegetables and fruits a day;[43] the American Heart Association (AHA) eating vegetables and fruits daily, limiting juice intake;[44] the American Institute for Cancer Research (AICR) eating at least five portions (at least 400 g) of a variety of vegetables without starch and fruits every day; [45] the Dietary Guidelines for Americans (DGA) that sufficient amounts of fruits and vegetables are consumed, while remaining within energy requirements; choose a variety of fruits and vegetables every day; [46] and the World Health Organization (WHO) if you have a diet that includes at least 400 g per day of total fruits and vegetables.[47]

The food guide for the Brazilian population also makes no restrictions on the consumption of red meat, only on the consumption of ultra-processed foods, in which processed meats are included. However, analyzing the Family Budget Survey data 2008-2009, the food guide makes an important statement in this regard. It states that for a fifth of the Brazilian population that still has a dietary pattern based on the wide consumption of fresh or minimally processed foods, small changes in the food consumption of these Brazilians, including the increase in the intake of vegetables and the reduction in the consumption of red meats would make the nutritional profile of your diet practically ideal.[42]

A recent systematic review (under review) that evaluated the association between the red meat and processed meat consumption with cardiovascular diseases incidence and mortality pointed out that it is not possible to define that it is the consumption of red meat itself that causes cardiovascular diseases, however, the dose response tests signal that higher consumption results in greater risk for cardiovascular diseases.[48]

There is evidence of an association between the processed meat consumption and the incidence of colorectal cancer and a probable association between red meat and cancer, especially for colorectal cancer, pancreatic cancer and prostate cancer.[49]

The American Institute for Cancer Reseacrh (AICR) recommends that people who eat red meat should not consume more than three servings a week (between 350 to 500 g), very little if any to be processed.[45]

Other institutions also recommend that the consumption of red meat be restricted. The American Cancer Society (ACS) recommends that consumption of processed and red meats be limited[43]; the Dietary Guidelines for Americans (DGA) that when selecting and preparing meat, make choices that are lean, low-fat or fat-free[46]; and WHO that those who are not vegetarians be advised to moderate consumption of preserved meat.[47]

In this context, to define the specific objectives that lead to the achievement of the general objective, the Recommendations for Prevention of Childhood Obesity of the ADA, [21] the recommendations of the Food Guide for the Brazilian population,[42] the aforementioned recommendations for the consumption of fruits and vegetables and red meat; and evidence from systematic reviews on the effect of school-based FNE interventions and adolescent food consumption[25,26] and on the association between red meat consumption and cardiovascular diseases incidence and mortality[48] were considered. Thus, the specific objectives and goals of the axis are presented in figure 1.

Goal setting has shown promise in promoting changes in the behavior of diet and physical activity among adults.[50] Specific and challenging goal setting techniques have been shown to be effective in initiating a change in health behavior and maintaining it over time.[50,51]

Specific objectives	Goals
Stimulate the consumption of fresh foods, especially fruits and vegetables.	Consume five servings a day of fruits and vegetables (vegetables rich in starch such as potatoes, cassava, yams do not count).
Reduce the consumption of ultra-processed foods.	Avoid fast food, consuming at most one fast food item per week.
Stimulate breakfast consumption.	Have breakfast consumption every day.
Encourage adequate consumption of red meats, and reduced consumption of processed meats.	Consume a maximum of three servings of red meat per week, and preferably, no processed.
Encourage family meals in which parents and children have meals together.	Have at least four family meals per week, on different days.

Figure 1 - Specific objectives and goals of the AME Program's FNE axis

The ADA's Recommendations for Prevention of Childhood Obesity suggest that the initial goals should bring about relatively modest changes, as establishing and achieving smaller and more viable goals can lead to increased feelings of self-efficacy, stimulating additional persistence and continuous progress, and may reduce disappointment and perceived failure.[21]

Therefore, setting specific, challenging and achievable goals can lead to better health behavior among adolescents. Thus, in implementing the AME Program's FNE axis, we will start from the reality of adolescent food consumption, proposing modest and individual goals, with monthly reassessments to achieve, at the end of the semester, the proposed goals (Figure 1).

CHARACTERISTICS OF THE AME PROGRAM'S FNE AXIS

The nutritional intervention component will be conducted by nutrition professionals and undergraduate nutrition students referred to this study as a nutrition research team. The nutrition research team members have participated in planning meetings with the State Secretary of Education and Culture of RN, with the coordination and teachers of the schools that will participate in the AME Program, in addition to the technical-scientific meetings of the research team itself. nutrition and other researchers in the field.

In order to get closer to the curricular planning of schools, the nutrition research team will participate in the Pedagogical Journey with the managers and coordinators that precedes the school year. Also, it will participate in the Pedagogical Week of the schools selected for the intervention group.

With the emergence of the COVID-19 pandemic, the beginning of the research had to be postponed to 2021. However, this new scenario strengthens the importance of preventing overweight, obesity and chronic diseases. Since this infectious disease has its condition aggravated, often leading to death, when the individual has obesity or some pre-established chronic disease.[52,53]

The main role of the nutrition research team will be to implement the elements of the nutritional intervention component (Figure 2).

Pre-intervention	Intervention Schools	Control Schools
- elaborate support material for teachers to insert food and nutrition education in the school curriculum in a transversal way; - elaborate support material for teachers to insert food and nutrition education in the school curriculum in a transversal way; - offer training for teachers who will participate in the AME Program through the insertion of food and nutrition education in the school curriculum in a transversal way; - plan the specific workshops on food and nutrition education, and whenever possible work together with the axis of physical activity and reduction of sedentary behavior; - plan actions of food and nutrition education for parents or guardians.	- contribute to the recruitment of school adolescents; - participate in data collection; - perform the specific workshops on food and nutrition education, and whenever possible work together with the axes of physical activity and reduction of sedentary behavior; - provide support to teachers who will implement the intervention of the AME; - perform actions of food and nutrition education for parents or guardians; - send AME program newsletter to parents or guardians; - offer the entire school community feedback on the results found.	- contribute to school recruitment; - participate in data collection; - providing feedback on the data collected as a situational diagnosis; - at the end of the research, offer a workshop so that teachers can implement the AME Program at school; - offer workshopping on adequate and healthy food for the entire school community.

Figure 2 - Role of the AME Program's nutrition research team

The nutritional intervention should be flexible, shaping the students' socioeconomic reality, and the reality of the physical structure and technological resources available in each school, contributing to the program becoming self-sustainable. Thus, it is expected that each school, within its reality, will achieve the objectives of the intervention, making its students more active with a more adequate and healthy diet.

Although we are dealing with the axis of nutritional intervention, all actions will be planned in an integrated manner with the axes of reducing sedentary behavior and the practice of physical activity.

DISCUSSION

Adolescence corresponds to the phase of 10 to 19 years old and constitutes a period of important biological, cognitive, emotional and social changes.[54] In this phase there is an increase in autonomy in relation to food choices, and with greater exposure to the influence of the media for consumption of processed foods, commonly results in less healthy food choices.[7]

The AME Program's FNE axis aims to encourage the adolescents' food consumption to be adequate and healthy considering their habits and socio-cultural context.

As the intervention will be carried out in a city in the northeast of Brazil, for the definition of the goals of the AME Program's FNE axis, the recommendations of the Food Guide for the Brazilian population were considered.

Studies show that although Brazilian adolescents present consumption of traditional Brazilian food, such as rice and beans, bean consumption has been decreasing.[23,44] In addition, adolescents do not consume the recommended amount of fruits and vegetables,

which becomes a risk factor for obesity, cardiovascular diseases and type II diabetes.[44] Therefore, it is essential to develop interventions that consider the recommendations of the Food Guide for the Brazilian Population.

One of the limitations of the nutrition intervention component will be the question of students' socioeconomic conditions, which may limit access to quality food. Therefore, the importance that the school, through its school feeding program, be able to offer an adequate and quality meal to its students.

In Brazil, we have the National School Feeding Program that seeks to contribute to biopsychosocial growth and development, learning, school performance and the formation of healthy eating habits of students, through actions of Food and Nutrition Education (FNE) and the supply of meals that cover their nutritional needs during the school period.[55] Therefore, the AME Program will seek to intervene, as far as possible, in changes in the food or preparations offered by school meals.

Another limitation of the nutrition intervention component is the limited funding that the AME Program has. Therefore, we seek to develop a low-cost and sustainable program, so that it can be replicated later in other schools.

In short, the actions of the AME Program's FNE axis will mean adolescents who will develop critical and reflective thinking leading to healthy and sustainable eating habits, transforming their homes and communities, thus enabling the transformation of their territory.

The physiological consequences of investing in Food and Nutrition Education in schools, which could seem like another public expenditure, will result, in the long run, in adults with adequate and healthy food that will bring health benefits; and in the short term, it will mean better school performance and less spending on public health for adolescents in the public school system.

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6 CONCLUSÕES

Desenvolver estratégias de EAN em um programa de intervenção multicomponente baseada na escola para promoção de estilo de vida ativo e alimentação adequada e saudável entre adolescentes é o objetivo geral desta tese.

Para a construção das estratégias, além da utilização da literatura disponível, foram realizadas duas revisões sistemáticas com a finalidade de embasar algumas tomadas de decisão quanto aos métodos e objetivos.

A primeira RS avaliou intervenções de EAN e o efeito no consumo alimentar de adolescentes escolares. Foi verificado que as intervenções baseadas na escola estão gerando mudanças favoráveis no consumo alimentar de adolescentes. Apesar de não termos definido um modelo de intervenção ideal, os resultados nos fornecem dados mais específicos sobre intervenções escolares de EAN, voltadas exclusivamente para adolescentes e seus efeitos no consumo de alimentos. Dentre as características destaco duas: ser uma intervenção multicomponente, incluindo mudanças no ambiente e a participação de pais, professores e funcionários da escola; e utilizar modelo teórico sobre mudanças comportamentais, além de conhecimentos sobre alimentação e nutrição. Assim, esses achados contribuíram para o desenvolvimento do eixo de EAN do Programa AME.

A segunda RS avaliou a associação do consumo de carne vermelha e doenças cardiovasculares e o efeito dose-resposta. A carne vermelha não pode ser considerada a causa *per si* da incidência e mortalidade por DCV, mas a tendência de dose resposta linear indica que, quanto maior o consumo de carne vermelha, maior o risco de incidência e mortalidade por doenças cardiovasculares. Considerando o Guia alimentar para população brasileira e as recomendações de consumo de carne vermelha da OMS e de instituições internacionais de prevenção ao câncer, associado aos achados desta RS, foi inserido nos objetivos e metas do eixo de EAN do Programa AME a redução do consumo de carne vermelha, em especial, a carne processada.

Assim, a partir das leituras da bibliografia disponível, dos resultados das RS, das trocas de experiências do grupo de pesquisa, acrescido da experiência profissional da doutoranda que é nutricionista e professora do Departamento de Nutrição da UFRN com atuação na área de Alimentação Coletiva e no Centro Colaborador da Alimentação Escolar (CECANE) foram desenvolvidas as estratégias de EAN do Programa AME.

O desenvolvimento do eixo de EAN especificamente para adolescentes se configura como um marco importante para o fortalecimento de ações de saúde coletiva voltadas para este público.

Dentre as características do protocolo podemos destacar a sua sustentabilidade através da possível reprodutibilidade em outas escolas e o baixo custo de execução. Entretanto, sabemos que, dentre as possíveis limitações, existe a questão das condições socioeconômicas dos alunos, que podem limitar o acesso a alimentos de qualidade. O que reforça a importância da política pública de alimentação escolar do Brasil, que através do Programa Nacional de Alimentação Escolar deve oferecer uma refeição adequada e de qualidade aos seus alunos.

Desenvolver estratégias de EAN em um programa de intervenção multicomponente baseada na escola para promoção de estilo de vida ativo e alimentação adequada e saudável entre adolescentes poderá contribuir com a área da saúde coletiva ao propiciar aos adolescentes a construção de pensamentos críticos e reflexivos, que poderão transformar sua vida, a de sua família, comunidade e até mesmo de seu território.

Além dos artigos produzidos e apresentados nesta tese, também foi produzido para o ECR um material de apoio pedagógico a ser entregue aos professores na fase de formação pedagógica. Foram produzidos três e-books, um para cada ano do ensino fundamental do 7° ao 9° ano. O material está em fase de revisão e diagramação pela Secretaria de Educação a Distância – SEDIS/UFRN.

Ainda durante o período do doutorado, diversas outras atividades foram desenvolvidas. Entre elas destaco: coordenação adjunta do evento de extensão "Clube de Leitura de Revisão Sistemática do LEEP – 2019 (EV914-2019); participação como ministrante do "Curso Internacional de Introdução às Revisões Sistemáticas (RS) e Metanálises: Produção e Desenvolvimento de Protocolos de Pesquisa Brasil-Portugal-Espanha - Parte I: RS (2019)"; e a participação como coordenadora adjunta do curso de extensão "Revisões Sistemáticas em Saúde: produção de protocolos para o projeto AME – Laboratório de Estudos Epidemiológicos", sendo todas as atividades coordenadas pela Prof.ª Dr.ª Grasiela Piuvezam.

Neste período também formamos o grupo de pesquisa Systematic Review and Meta-Analysis Laboratory – Lab-Sys coordenado pela Prof.ª Dr.ª Grasiela Piuvezam com a participação de docentes da UFRN e de outras instituições nacionais e internacionais - Universidade Federal de Santa Maria (UFSM), Universidade de Brasília (UnB), Universidade Estadual do Rio Grande do Norte (UERN), Universidade Estadual do Ceará (UECE), Instituto

Federal do Ceará (IFCE), Fundação Oswaldo Cruz (FIOCRUZ), Agencia Nacional de Vigilância Sanitária (ANVISA), e Universidade Católica Santo António de Múrcia (UCAM).

Assim realizamos contatos e parcerias com pesquisadores de outras instituições nacionais e internacionais, o que me trouxe crescimento intelectual e abre possibilidade de novos trabalhos no futuro breve.

Por fim, por meio das atividades complementares desenvolvidas durante o doutorado, pude contribuir com a produção de outros artigos. Deste modo, além dos artigos inseridos na tese, temos mais cinco artigos publicados e um artigo aceito para publicação.

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APÊNDICE 1 – TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO – TCLE

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO – TCLE

Esclarecimentos

Estamos solicitando a você a autorização para que o menor pelo qual você é responsável participe da pesquisa "**Efeitos de uma intervenção de base escolar sobre a função executiva, comportamento sedentário e estado nutricional de adolescentes**", que tem como pesquisadora responsável a Prof[a] Dra. Grasiela Piuvezam.

Esta pesquisa pretende avaliar o efeito de uma intervenção de base escolar sobre variáveis relacionadas ao estado nutricional, comportamento sedentário e função executiva de adolescentes.

O motivo que nos leva a fazer este estudo é que a obesidade tem sido associada a doenças crônicas como câncer e doenças cardiovasculares, e a prejuízos na função cognitiva de crianças e adolescentes. Entretanto, a maioria dos estudos é observacional, destacando a necessidade de estudos experimentais com o monitoramento do impacto de estratégias que envolvam a prática de exercícios físicos, a redução de comportamentos sedentários e de intervenções com foco na educação alimentar e nutricional.

Os menores que os responsáveis autorizarem a participação na pesquisa serão distribuídos em um dos dois grupos: Grupo Intervenção (GI) e Grupo Controle (GC).

Caso você decida autorizar, ele deverá participar de um dos grupos e a intervenção relativa ao grupo será realizada durante 1 semestre letivo através das aulas, de reuniões presenciais na escola, conversas individuais e envio de mensagens. No Grupo Intervenção serão promovidas intervenções com atividades físicas nas aulas de educação física e no contexto escolar, no comportamento sedentário e na educação alimentar e nutricional. No Grupo Controle os participantes não receberão nenhum tipo de intervenção, seguirão com sua rotina normal na escola, mas ao final do estudo participarão de workshop teórico e prático sobre atividades físicas, redução de comportamentos sedentários e alimentação saudável. Durante a intervenção serão realizados registros de imagem (foto e vídeo) e voz, portanto, ele deverá autorizar estes tipos de registros. Ele também deverá permitir a aferição de seu peso, altura, circunferência abdominal (através de fita métrica), medição das dobras cutâneas do braço e nas costas (através de adipômetro) para verificar percentual do gordura, e pressão arterial; deverá assinalar em um formulário qual a figura que melhor representa o seu amadurecimento sexual; deverá responder a um questionário sobre comportamento sedentário relatando o tempo gasto utilizando aparelhos eletrônicos e também sobre o tempo gasto sentado; deverá falar sobre sua alimentação, relatando a frequência de consumo de alguns alimentos (frutas, verduras, alimentos processados etc) nos últimos 7 dias; deverá responder a entrevista sobre as barreiras e os facilitadores para praticar atividades físicas, ter uma vida mais ativa e uma alimentação saudável. Nesta entrevista haverá gravação de voz, portanto, deverá autorizar a gravação. E por fim, para análise da glicose e perfil lipídico deverá permitir a coleta de sangue (30 ml, o equivalente a duas colheres de sopa) após ficar de 12 a 14 h sem comer. O sangue coletado será transportado de maneira adequada até o laboratório de análise

Rubrica do Participante/Responsável legal:	Rubrica do Pesquisador:

na UFRN. Estes procedimentos ocorrerão em três diferentes momentos: 1. Antes da intervenção, 2. Ao final da intervenção, 3. Um semestre letivo após o termino da intervenção.

Durante a intervenção, a aferição das medidas (peso, altura, circunferência abdominal, dobras cutâneas) e da pressão arterial; no momento de assinalar qual a figura que melhor representa o seu amadurecimento sexual; durante a realização dos questionário (comportamento sedentário e consumo alimentar); durante a entrevista; e durante a coleta de sangue a previsão de riscos é mínima, ou seja, o risco que ele(a) corre é semelhante àquele sentido num exame físico ou psicológico de rotina e durante a pratica das aulas de educação física e brincadeiras no intervalo.

Pode acontecer um desconforto na coleta de sangue, gerando um pouco de dor no local da picada da agulha e depois sentir que ficou um pouquinho roxo. Também pode ocorrer constrangimento na aferição das medidas (peso, altura, circunferência abdominal, dobras cutâneas) e da pressão arterial; no momento de assinalar qual a figura que melhor representa o seu amadurecimento sexual; durante a realização dos questionários (comportamento sedentário, consumo alimentar e ambiente obesogênico); durante a entrevista. Estes desconfortos serão minimizados através da utilização da técnica adequada de coleta de sangue por profissional habilitado e capacitado; da utilização de um espaço reservado para responder os questionários e entrevista, realização das avaliações das medidas por profissionais capacitados; da disponibilização dos áudios gravados e da transcrição da entrevista caso o participante queria conferir seus dados registrados; e da não identificação dele (a) na divulgação dos resultados da pesquisa. Para os grupos que terão práticas de atividades físicas podem acontecer quedas ou lesões e/ou dores musculares, no entanto, estes riscos serão minimizados com o acompanhamento de profissionais habilitados e previamente capacitados para atuarem com segurança durante a execução das atividades propostas. Ele (a) terá como benefício uma avaliação de seu estado nutricional e composição corporal com orientações gerais sobre práticas de atividades físicas no ambiente escolar, redução do comportamento sedentário e de uma alimentação saudável, e ainda poderá ser beneficiado com a melhora do programa nacional de alimentação escolar e melhora da articulação destes temas transversais na estrutura curricular advinda dos resultados desta pesquisa

Em caso de algum problema que ele (a) possa ter, comprovadamente relacionado com a pesquisa, ele (a) terá direito a assistência gratuita que será prestada de acordo com o problema apresentado e sob a responsabilidade da Prof[a] Dra. Grasiela Piuvezam.

Durante todo o período da pesquisa você poderá tirar suas dúvidas ligando para Prof[a] Dra. Grasiela Piuvezam, (84) 992296451.

Você tem o direito de recusar sua autorização, em qualquer fase da pesquisa, sem nenhum prejuízo para você e para ele (a).

Os dados que ele (a) irá nos fornecer serão confidenciais e serão divulgados apenas em congressos ou publicações científicas, não havendo divulgação de nenhum dado que possa identificá-lo (a).

Esses dados serão guardados pelo pesquisador responsável por essa pesquisa em local seguro e por um período de 5 anos. Ele tem o direito ao acesso aos resultados após o término do estudo (ou de sua participação no estudo).

Se você tiver algum gasto comprovado pela participação dele (a) nessa pesquisa, ele será assumido pelo pesquisador e reembolsado para você.

Se ele (a) sofrer algum dano comprovadamente decorrente desta pesquisa, ele(a) será indenizado.

Rubrica do Participante/Responsável legal:	**Rubrica do Pesquisador:**

Av. Senador Salgado Filho, 1787, Lagoa Nova, Natal – RN, Programa de Pós-Graduação em Saúde Coletiva. UFRN.
CEP 59.056-000 Natal/RN - Fone: (84) 3342-2338. ppgscol@dod.ufrn.br

Qualquer dúvida sobre a ética dessa pesquisa você deverá entrar em contato com o Comitê de Ética em Pesquisa do Hospital Universitário Onofre Lopes, telefone: 3342-5003, endereço: Av. Nilo Peçanha, 620 – Petrópolis – Espaço João Machado – 1° Andar – Prédio Administrativo - CEP 59.012-300 Nata/Rn, e-mail: cep_huol@yahoo.com.br.

Este documento foi impresso em duas vias. Uma ficará com você e a outra com a pesquisadora responsável Prof[a] Dra. Grasiela Piuvezam.

Consentimento Livre e Esclarecido

Eu, _____, representante legal do menor _____, autorizo sua participação na pesquisa **"Efeitos de uma intervenção de base escolar sobre a função executiva, comportamento sedentário e estado nutricional de adolescentes".**

Esta autorização foi concedida após os esclarecimentos que recebi sobre os objetivos, importância e o modo como os dados serão coletados, por ter entendido os riscos, desconfortos e benefícios que essa pesquisa pode trazer para ele(a) e também por ter compreendido todos os direitos que ele(a) terá como participante e eu como seu representante legal.

Autorizo, ainda, a publicação das informações fornecidas por ele(a) em congressos e/ou publicações científicas, desde que os dados apresentados não possam identificá-lo(a).

Natal, ___ de _____ de _____.

_____

Assinatura do representante legal

Impressão datiloscópica do participante

Declaração do pesquisador responsável

Como pesquisadora responsável pelo estudo **"Efeitos de uma intervenção de base escolar sobre a função executiva, comportamento sedentário e estado nutricional de adolescentes"**, declaro que assumo a inteira responsabilidade de cumprir fielmente os procedimentos metodologicamente e direitos que foram esclarecidos e assegurados ao participante desse estudo, assim como manter sigilo e confidencialidade sobre a identidade do mesmo.

Declaro ainda estar ciente que na inobservância do compromisso ora assumido estarei infringindo as normas e diretrizes propostas pela Resolução 466/12 do Conselho Nacional de Saúde – CNS, que regulamenta as pesquisas envolvendo o ser humano.

Natal, ____de _____de _____.

_____

Prof[a] Dra. Grasiela Piuvezam

APÊNDICE 2 – TERMO DE ASSENTIMENTO LIVRE E ESCLARECIDO – TALE

UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE
CENTRO DE CIÊNCIAS DA SAÚDE
PROGRAMA DE PÓS-GRADUAÇÃO EM SAÚDE COLETIVA - PPGSCOL

TERMO DE ASSENTIMENTO LIVRE E ESCLARECIDO (TALE)

Você está sendo convidado a participar da pesquisa "**Efeitos de uma intervenção de base escolar sobre a função executiva, comportamento sedentário e estado nutricional de adolescentes**", coordenada pela Profª Dra. Grasiela Piuvezam, (84) 992296451. Seus pais ou responsável permitiram que você participe.

Queremos saber o efeito de uma intervenção de base escolar sobre variáveis relacionadas ao estado nutricional, comportamento sedentário e função executiva.

Você só precisa participar da pesquisa se quiser, é um direito seu e não terá nenhum problema se desistir. Os adolescentes que irão participar desta pesquisa têm de 12 a 16 anos de idade.

A pesquisa será feita na sua própria escola, _____ (nome da escola), onde os adolescentes que aceitarem participar serão distribuídos em um dos dois grupos: Grupo Intervenção e Grupo Controle.

Caso aceite participar, você será inserido(a) em um dos grupos e receberá a intervenção relativa ao grupo durante 1 semestre letivo, de reuniões presenciais na escola, conversas individuais e envio de mensagens. No Grupo Intervenção serão intervenções com atividades físicas nas aulas de educação física e no contexto escolar, no comportamento sedentário e na educação alimentar e nutricional. No Grupo Controle os participantes não receberão nenhum tipo de intervenção, seguirão com sua rotina normal na escola, mas ao final do estudo participarão de workshop teórico e prático sobre atividades físicas, redução de comportamentos sedentários e alimentação saudável. Durante a intervenção serão realizados registros de imagem (foto e vídeo) e voz, portanto, você deverá autorizar estes tipos de registros. Também, haverá aferição de seu peso, altura, circunferência abdominal (através de fita métrica), dobras da pele do braço e das costas, e pressão arterial. Você deverá assinalar em um formulário qual a figura que melhor representa o seu amadurecimento sexual; deverá falar sobre sua alimentação, relatando a frequência de consumo de alguns alimentos (frutas, verduras, alimentos processados etc) nos últimos 7 dias, e sobre alguns aspectos do seu ambiente familiar; deverá falar através de entrevista sobre as barreiras e os facilitadores para praticar atividades físicas, ter uma vida mais ativa e uma alimentação saudável. Nesta entrevista haverá gravação de voz, portanto, deverá autorizar a gravação. E por fim, e deverá permitir a coleta de sangue (30 ml, o equivalente a duas colheres de sopa) após ficar de 12 a 14h sem comer. Estes procedimentos ocorrerão em três diferentes momentos: 1. Antes da intervenção; 2. Ao final da intervenção e; 3. Um semestre após o final da intervenção. Para isso, serão usados uma balança digital, estadiômetro portátil (para verificar a altura), fita métrica e esfigmomanômetro digital (para verificar a pressão arterial), desenhos sobre o amadurecimento sexual para você marcar como está o seu amadurecimento; questionário sobre sua alimentação, ambiente obesogênico e sobre as barreiras e os facilitadores para praticar atividades físicas, ter uma vida mais ativa e uma alimentação saudável, e por fim, seringa e material estéril para coleta de sangue. O procedimento é considerado seguro, mas é possível ocorrer risco mínimo de desconforto gerando constrangimento na aferição de seu peso, altura, circunferência abdominal (através de fita métrica) e pressão arterial, no momento de assinalar em um

Rubrica do Participante/Responsável legal:	Rubrica do Pesquisador:

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formulário qual a figura que melhor representa o seu amadurecimento sexual, no momento de falar sobre sua alimentação ou de falar sobre as barreiras e os facilitadores para praticar atividades físicas, ter uma vida mais ativa e uma alimentação saudável, que será minimizado através da utilização de um espaço reservado, e da sua não identificação na divulgação dos resultados da pesquisa. Para retirar o sangue será usada uma seringa fina. Esse jeito de tirar sangue é considerado seguro, mas você poderá sentir dor no local da picada da agulha e depois sentir que ficou um pouquinho roxo. Este risco na coleta de sangue é mínimo e será minimizado através da utilização da técnica adequada de coleta por profissional capacitado. Caso aconteça algo errado, você pode nos procurar pelo telefone que tem no começo do texto. Mas, há coisas boas que podem acontecer como receber avaliação de seu estado nutricional com orientações gerais de uma alimentação saudável, e ainda poderá ser beneficiado com a melhora do programa nacional de alimentação escolar e melhora da articulação destes temas transversais na estrutura curricular advinda dos resultados desta pesquisa.

Ninguém saberá que você está participando da pesquisa; não falaremos a outras pessoas, nem daremos a estranhos as informações que você nos der. Os resultados da pesquisa vão ser publicados em revistas científicas e divulgados para todos os participantes, mas sem identificar os adolescentes que participaram.

==========

CONSENTIMENTO PÓS INFORMADO

Eu _____ aceito participar da pesquisa "**Efeitos de uma intervenção de base escolar sobre a função executiva, comportamento sedentário e estado nutricional de adolescentes".**

Entendi as coisas ruins e as coisas boas que podem acontecer.

Entendi que posso dizer "sim" e participar, mas que, a qualquer momento, posso dizer "não" e desistir e que ninguém vai ficar com raiva de mim.

Os pesquisadores tiraram minhas dúvidas e conversaram com os meus responsáveis.

Recebi uma via deste termo de assentimento e li e concordo em participar da pesquisa.

Natal, ____de _____de _____.

_____

Assinatura do participante

Impressão datiloscópica do participante

_____

Prof[a] Dra. Grasiela Piuvezam
Pesquisadora responsável

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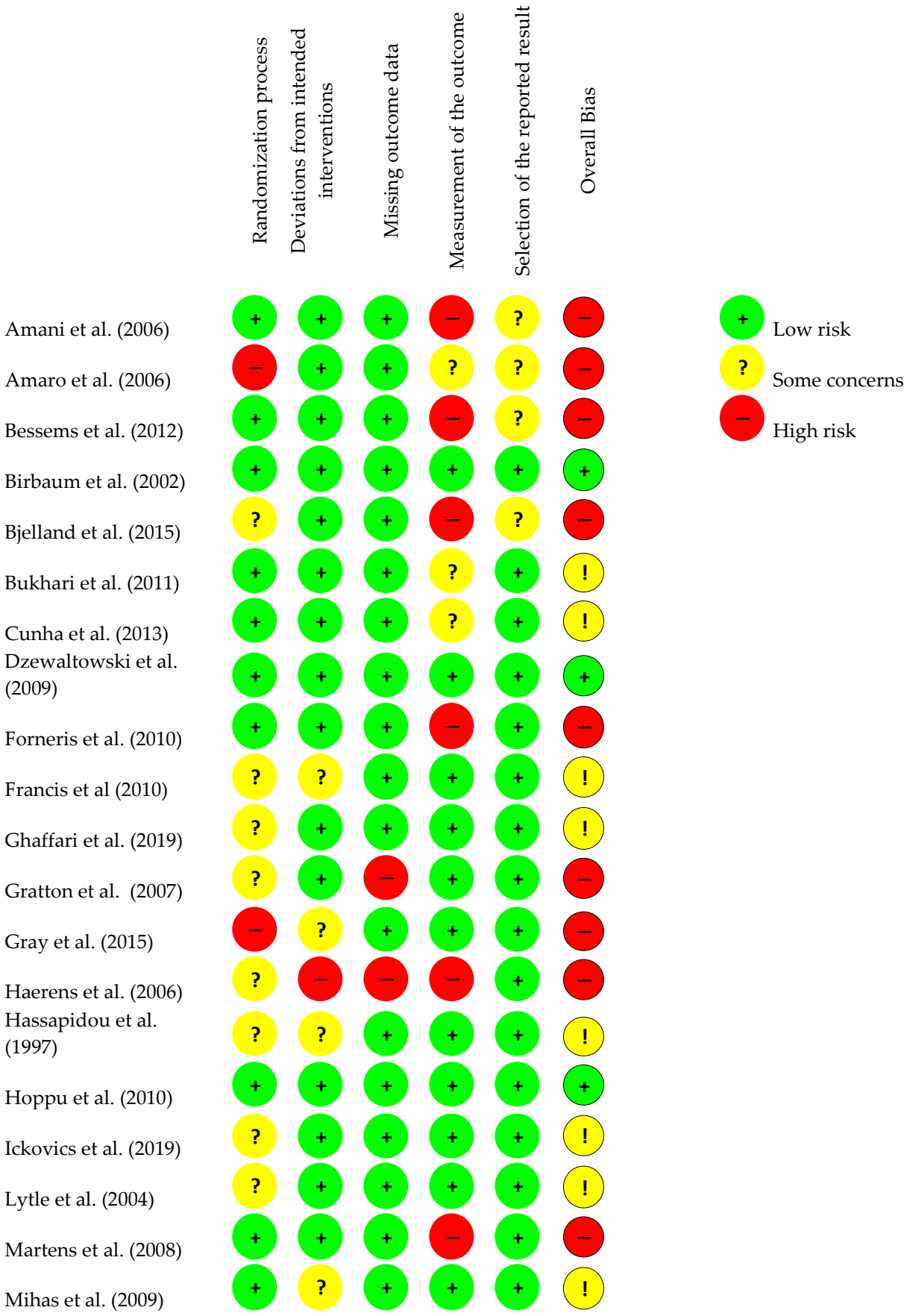
APÊNDICE 3 – SUPLEMENTOS DO ARTIGO – EFFECT OF SCHOOL-BASED FOOD AND NUTRITION EDUCATION INTERVENTIONS ON THE FOOD CONSUMPTION OF ADOLESCENTS: A SYSTEMATIC REVIEW (ARTIGO 2)

Supplement Material



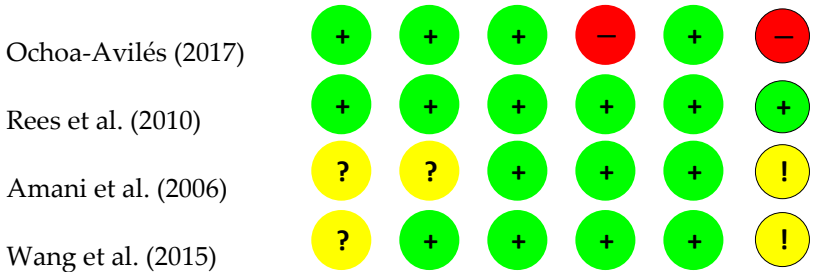


Figure S1. Results of each domain and the overall bias of the included articles by Cochrane risk-of-bias tool for randomized trials (RoB 2).

Table S1. Details of school-based intervention studies.

First author, year, country	Participants	Study name and Intervention description.	Main results	Analyses
Amani, 2006. Iran.	60 adolescent girls (30 subjects from each group). Range aged 12–16 years.	The interventional study was undertaken to explore whether a focused nutrition education campaign could improve the nutritional practices, iron status, and hematologic indices of healthy adolescent girls. The education group received nutritional education on dietary sources of iron, iron availability, and the signs and consequences of iron deficiency and anemia via face-to-face group discussion sessions and simple pamphlets; the CG did not receive any nutritional education during the 2-month study period. The study groups had no contact with each other. Subjects were asked to follow their usual lifestyle patterns and were informed about the purpose of the study prior to the start. Fasting blood samples (5 mL) were taken from each subject pre- and post-intervention.	There were no statistically significant differences in any baseline characteristics between the two groups. Scores for nutritional knowledge and practices of the education group were significantly higher after two months compared with the baseline (31.4 ± 6 vs. 24.3 ±5.9 points, $p < .001$, and 31.2 ± 5 vs. 28.4 ± 5.7 points, $p < 0.05$, respectively). The scores in the CG showed no significant changes from baseline to 2 months. The food-frequency scores were elevated in the education group (28.4 ± 5.7 vs 31.2 ± 5, $p < 0.05$) but the control group had a non-significant fall in its scores after the campaign (31.2 ± 8 vs 29 ± 6.5, $p < 0.10$).	Independent and paired t-tests.

Amaro, 2006. Italy.	IG - 153 children (11–14 year old; 78 male, 75 female). CG: (55 male, 33 female).	**Kalèdo (board-game)** The intervention objective was to test the efficacy of Kalèdo (board-game) on changes in nutrition knowledge and dietary behaviour. During 24 weeks, group treatment a was involved in 15–30 minute-long play sessions once a week. The control group (CG) did not receive any play sessions with Kalèdo.	Children playing Kalèdo showed a significant increase in nutrition knowledge ($p<0.05$) and in weekly vegetable intake ($p<0.01$) with respect to the control. Mixed model ANCOVA showed a significant difference between treated group and CG at post-assessment [$F(1,14)=21.2$; $p<0.01$] for the variable vegetable intake. Adjusted mean number of servings per week was 3.7 (95% CI 3.5 to 4.1) for the treated group and 2.8 (95% CI 2.4 to 3.3) for the CG. A posteriori power analysis showed that, due to the present experimental design and sample size, the detectable difference in number of weekly vegetable servings with type I error rate of 0.05 and 80% power was 0.7.	Mixed model ANCOVA.
Bessems, 2012. Netherlands.	13 experimental schools, 1117 students, and 11 control schools, 758 students. Mean age of 12.9 years.	**Krachtvoer programme** This is an updated version of the program. The Krachtvoer programme to aim at achieving behaviour change based on principles from behaviour change theories. The Krachtvoer programme aims at increasing the consumption of fruit, achieving a daily healthy breakfast, and decreasing the consumption of fats by replacing high-fat snacks by non-fat or low-fat snacks. Teachers from experimental schools implemented the Krachtvoer lessons over a period of eight weeks between September to December 2008. Control schools carried out the usual nutrition education curriculum aimed at increasing knowledge in the same period and postponed Krachtvoer implementation for one year.	Short- and longer-term favourable intervention effects were found for fruit frequency and yesterday's fruit consumption (servings a day). Experimental condition uncorrected mean (SD), T0 = 0.98 (0.80), T1 =1.13 (0.81); Control condition uncorrected mean (SD), T0 = 1.11(0.92), T1 =1.01 (0.85). β short-term effect = 0.048 (0.023-0.053), ($p<0.001$). β longer-term effect = 0.033 (0.017-0.048), ($p<0.001$). Reported intervention effects were corrected for a random intercept of measurement, student, and class, and the fixed factors of gender, year, educational track, SEP, and ethnicity. No intervention effects were found for the breakfast frequency item or the	Mixed linear and mixed logistic regression analyses.

			percentage of students who had consumed breakfast that morning. The outcome variables regarding snack frequency and yesterday's snack consumption did not show any effects. Some favourable effects were revealed regarding the categories of snacks consumed, including short- and longer-term effects on sweets consumption and short-term effects on the consumption of savoury snacks, ice–creams, and fried snacks. The intervention might be more effective among an older age group.	
Birnbaum, 2002, USA.	Students in middle and junior high schools. Env +curr + peer, n = 226. Env + curr, n = 677. Env only, n = 845. Control, n = 1,755.	**Teens Eating for Energy and Nutrition at School (TEENS).** The aim of the intervention was to increase fruit and vegetable intake and decrease the fat intake of low-income young adolescents to reduce their future risk of cancer. The intervention duration was 2-year period, but this reports only on the effects of the seventh-grade intervention (1 year period). The intervention consisted of 10 curriculum sessions, informed by social cognitive theory and developed by using a systematic program planning approach. Four incremental exposures were possible: (1) control group, (2) school environment interventions only, (3) classroom curriculum plus school environment interventions, and (4) peer leaders plus classroom curriculum plus school environment interventions: highest exposure. Peer leaders helped teachers deliver the classroom intervention by leading small-group activities and discussions.	Patterns suggesting dose response were observed, with peer leaders reporting the largest increases in fruit, vegetable, and lower fat food consumption. Students exposed to classroom plus environment interventions also improved, whereas students exposed only to school environment interventions showed trends toward choosing lower fat foods and declining fruit intake and no change in vegetable intake. Changes in self-reported past-year mean daily servings of fruits and vegetables, pre-post seventh-grade intervention, by exposure group - Env only - baseline 4.76(0.04), post-intervention 4.44(0.04), NS; Env + curr - baseline 4.51(0.04), post-intervention 4.95(0.04), $p. < 0.1$; Env +curr + peer - baseline 4.88(0.06), post-intervention 5.80(0.05), $p. < 0.05$.	Multiple logistic regression of dropout (yes/no). Multilevel (mixed) regression analyses

			Control students' choices remained stable. Control group - baseline 4.76(0.03), post-intervention 4.80 (0.03), NS.	
Bjelland, 2015. Norway.	Intervention group - n 498, mean age (SD) 11.2 (0.3); CG – n 898, mean age (SD) 1.2 (0.3).	**HEIA (HEalth In Adolescents) Study.** The aim of intervention was to determine if a multi-component health promotion intervention targeting 11-13 year olds, during 20 months, influenced their consumption of fruit, vegetables and sugar-sweetened beverages. The multi-component approach in the HEIA study included collaboration with school principals and teachers, school-health services and parent committees, while schoolteachers were the key persons to implement the intervention components. The intervention program consisted of a mixture of individual, group and environmental level strategies and activities.	Effects at 20 months assessment of the adolescents in the HEIA study, mean (DS) for Fruit intake, times/week - CG 9.6 (9.1, 10.0); IG 10.9 (10.4, 11.5), p. < 0.00. For Vegetables, times/week - CG 10.5 (10.0, 11.1); IG 10.9 (10.1, 11.6), p. = 0.46.	Mixed-model Poisson regression; mixed-model analysis of variance.

Bukhari, 2011. USA.	IG, n = 49 and CG, n = 49).	**The Diet for a Healthy Planet with Teen Battle Chefs** The program aims to build high school students' skills related to cooking and growing food while presenting opportunities for students to gain insight into food production and marketing, as well as how environmental and personal factors can create barriers to opportunities for good nutrition FamilyCook Productions developed a daily, 19-week, ninth-grade curriculum to address nutrition-related attitudinal and behavior changes. The intervention strategies included: skill development, experiential learning activities (eg, photovoice, 8 video, neighborhood food assessments) and personal nutrition challenges (students' reflective diaries of changes made and how the changes affected their mood). In-class activities were designed to increase students' knowledge, build skills, and raise students' self-efficacy for preparing healthful snacks and meals and identifying good food choices (eg, freshly grown fruits and vegetables, whole grains, and minimally processed foods) over processed and prepackaged food. Students were asked to reflect on how to improve healthful food options in their school and community environment via menu changes and use of community gardens and farmers markets.	Analysis of variance and t tests demonstrated improvements in food intake based on the 15 nutrition items selected from the Youth Risk Behavior Survey for this survey. There was an overall increase in score of 4.9 points, or 20.4% ($p. < 0.01$), in the intervention classes compared with 1.6 points, or 5.7%, in control classes (NS). Improved scores correlated with reporting increases in eating vegetables as snacks ($r = 0.64$, $p. < 0.001$), preparing healthful snacks for self ($r = 0.48$, $p. < 0.01$), and having sit-down meals with family ($r = 0.55$, $p. < 0.004$).	Mixed-model analysis of covariance (ANCOVA).

Cunha, 2013. Brazil.	A sample size of 444 children (222 in each study arm) of fifth graders. Mean age (sd) - Group intervention 11.2 (1.3); group control 11.2 (1.3).	**PAPPAS (Pais, Alunos e Professores para uma Alimentação Saudável).** The aim intervention was to encouraging students to change their eating habits and food consumption over 9 months (from March to November) in the school year of 2010. It focused on positive messages related to the intake of water, fruits, rice, and beans. It also included messages regarding eating fewer cookies, sugar-sweetened beverages, and savory snacks. Trained nutritionists gave monthly 1-h sessions in the classrooms. The activities were designed to discourage students from consuming sugar-sweetened beverages and sugar as well as getting them to replace snacks based on processed food (especially cookies) with fresh fruits or healthy homemade food. To reinforce the message of the activities carried out with children during the class intervention's nutritional sessions, a set of messages were sent to the families in the form of illustrated booklets and recipes. The families also received small gifts such as buttons and magnets. In addition, teachers were encouraged to work with the children on the topics addressed in each intervention session. Thus, a set of exercises and suggestions for class work were provided to them.	Measures of compliance using the frequency of food consumption indicated a statistically significant reduction in the frequency of daily consumption of cookies and sodas and an increased frequency of consumption of fruits in the intervention group, compared with that of the CG. Variation in daily frequency of cookies, sodas, beans and fruits after the nine months intervention, mean (95% IC): Cookies - CG 0.02 (20.04, 0.09); IG 21.35 (20.20, 20.75); β 0.13, p. < 0.001. Sodas - CG 20.08 (20.18, 0.02), IG 20.20 (20.30, 20.11), β 0.13, p. 0.02. Beans - CG 0.00 (20.35, 0.04); IG 0.01 (20.02, 0.05); β 20.01, p. 0.54. Fruits CG 0.10 (20.05, 0.26); IG 0.17 (0.01, 0.34); β 20.16, p. 0.04.	One-way ANCOVA.

Dzewaltowski, 2009. USA.	815 youth attending control schools, mean (SD) age - 12.40 (0.43); and 767 children attending intervention schools, mean (SD) age 12.36 (0.40).	**Healthy Youth Places (HYP).** The multilevel intervention model was designed to target the development of the personal and proxy agency of adult leaders and youth to build middle school environments (healthy places) that promote FV and physical activity (PA). Three tiers (levels) of intervention were used to develop the capacity of adult leaders and youth to build middle school environments (healthy places): project level, school level, place level. At the project level, expert staff delivered continuous group staff training intervention to paid school site coordinators from the eight intervention schools. At the school level, adult site coordinators led the delivery of the change team intervention. This tier mirrored the community hub intervention, with the school site coordinator acting as a facilitator and resource for youth-led school advocacy groups, known as "change teams." The change team was the hub of intervention activities at the school. Students were instructed on the place-based environmental planning and logging system and followed a step-by-step process to implement their environmental change efforts. The school change teams created awareness and visibility within their school regarding the importance of physical activity and good nutrition. A video workgroup at each intervention site, provided with a twice yearly training, a computer, digital video camera, and video editing software, developed site-specific videos that highlighted ways that students could incorporate FV and PA into specific school settings. Place level, places targeted for implementation included the classroom, school lunch and the after school program. The goal of the place level interventions was to reach all children	The majority of sixth graders were not consuming the recommended number of 5 servings of FV per day. Fruits were eaten more often than vegetables. HYP schools did not change in FV but did significantly change in PA compared to control schools. Proxy efficacy to influence school physical activity environments mediated the program effects. Building the skills and efficacy of adults and youth to lead school environmental change may be an effective method to promote youth PA.	Analysis of variance and t tests.

		in the intervention grade cohort, build their skills and efficacy for environmental change, and offer them the opportunity for exposure to implemented school environmental changes. In the classroom, a seventh and eighth grade curriculum ("Students Building and Promoting Healthy Places") that targeted building the knowledge and skills for environmental change was implemented to help facilitate student leadership.		
Forneris, 2010. USA.	Of the students (Sixth graders) at baseline or T1 (n = 2120), 86%, (n = 1830) were present for the first follow-up (T2).	**Goals for Health (GFH)** The intervention was peer-led with high school students teaching health and life skills to sixth-grade students. The purpose of this study was to examine the impact of the GFH school-based program on healthy eating outcomes related to self-efficacy, attitudes, knowledge, and behavior, and to examine the impact of quality of program implementation on the above outcomes. A curriculum, which included a leader manual for each peer leader and a student activity book for each participant, was developed for implementing the program. The peer leaders (N = 144) were high school students chosen by school administrators for their academic performance, leadership qualities, and extracurricular involvement. Leaders received 2 days of training from the GFH staff and a half an hour booster training session each week of the program. Following the 2-day training, the high school students taught the program to middle school students on a weekly basis for 12 consecutive weeks with the exception of a week break for spring vacation. A project staff member was at each school on the day the program was taught to supervise the peer leaders and to provide feedback following the session.	Results included significant change patterns across the 4 assessment points in the predicted direction for healthy eating-related self-efficacy and fat and fiber knowledge. No significant change patterns were found at follow-up for FV intake (score), mean (SD), IG: T1 = 1.32 (0.02), T2 = 1.30 (0.02). CG: T1 = 1.33 (0.02).T2 = 1.32 (0.02).	Mixed models to perform a random effects metaanalysis technique.

Francis, 2010. Trinidad and Tobago	579 students - 280 in the IG and 299 in the CG. Age mean (sd) - IG 10.2 (1.0), CG 10.6 (1.2).The analyzes included 248 in the IG and 224 in the CG.	The objective of the intervention was to improving the knowledge, attitudes and behaviour of primary-school children towards better dietary and activity habits. The study was conducted from 6 September 2006 to 30 April 2007. The curriculum consisted of lessons on nutrition and physical activity based on Bloom's mastery learning model. The modules incorporated three domains of educational activities: cognitive, affective and psychomotor. The content of the curriculum engaged the students in the learning process with activities and experiences geared towards broadening their interest. Students took part in activities where they worked in teams to solve comprehension, vocabulary and mathematics questions based on nutritionally related issues. The physical activity lesson was aimed at increasing energy expenditure both at school and at home.	Average reported daily servings of fried foods were significantly lower in the IG than the CG. Fried food servings/d, mean (SD): Baseline - IG 3.0 (3.1), CG 2.4 (2.5), p. = 0.12. Post-intervention - IG 1.7 (2.1), CG 2.2 (2.5), p. = 0.04 HFSS foods 502 kJ/d, mean (SD): Baseline - IG 4.6 (4.4), CG 4.5 (5.2), NS. Post-intervention - IG 3.2 (4.1), CG 4.2 (5.5), NS. In addition, there was a significant decline in reported fried food intake in the IG at the post-intervention assessment compared with baseline. In multivariate regression equations controlling for age, gender, BMI and baseline value, intervention was associated with lower intake levels of fried foods, snack foods high in fat, sugar and salt (HFSS) and sodas ($P<0.05$).	General linear mixed model regression with SAS PROC MIXED.

Ghaffari, 2019. Iran	308 students (154 subjects in each group), with age range of 13-15 years.	The intervention aim was to improve the pattern of F and V consumption among adolescents by employing Albert Bandura's SCT. The study was implemented during 2017. In student-family-school approach, educational and practical interventions are considered at student, family, and school levels. 1. Student-based interventions (e.g. lectures in classrooms with questioning and answering; presenting educational PPT slides and pamphlets on F&V to students; preparation of salads and snacks with F&V in the classrooms by students). 2. Family-based interventions (e.g. lecturing with emphasis on the role of parents in receiving F&V; face-to-face communication with parents in discussion group). 3. School-based intervention (e.g. educational session for all teachers and managers of schools; installing posters containing health messages related to F&V consumption).	No significant difference in the amount of consumed fruit and vegetable (FV) between the intervention and CGs before the intervention whereas the difference was significant between the groups during 2 and 6 months after the intervention (p. < 0.002, <0.106, respectively). The average amount of FV consumption prior to intervention was 3.7 (1.40) and 2.98 (1.38) in experimental and control groups, respectively. Two months after the intervention were 3.39 (1.56) and 2.83 (1.53) in the intervention and control groups; and 6 months after the intervention, they found to be 3.27 (1.31) and 3.04 (1.11), respectively.	Repeated measures random effects model.
Gratton, 2007. England	198 children with aged between 11 and 16 years old (mean 13.1 years, SD 1.32)	The objectives of the intervention were threefold: (i) assess the effectiveness of a motivational based intervention on children's actual dietary behaviour and intentions to eat five portions of fruit and vegetables a day, (ii) assess the effectiveness of a volitional-based intervention, using the formation of an implementation intention, to try to increase children's actual dietary behaviour and intentions to eat five portions of fruit and vegetables a day and (iii) compare the effectiveness of a motivational vs. a volitional based intervention, in increasing children's actual dietary behaviour and intentions to eat five portions of fruit and vegetables a day. **Experimental group A:** Volitional intervention, participants in experimental group A were asked to form an implementation	Both interventions were found to increase fruit and vegetable consumption significantly, although only the volitional intervention demonstrated a significant increase in fruit and vegetable consumption over the control intervention. A MANOVA revealed no significant differences between the three groups at baseline ($F(10; 382) = 1.76$, $p = 0.07$, $n = 0.04$). Mean score (SD): Volitional - T1 = 2.24 (0.99), T2 = 2.77 (1.25), $p < 0.001$. Motivational - T1 = 2.05 (0.97), T2 = 2.36 (1.18), $p < 0.001$. Control - T1 = 1.95 (1.13), T2 = 1.91 (1.13), NS.	Multivariate linear and logistic regression analyses.

		intention. This involved the children writing down how, where and when they would eat five portions of fruit and vegetables for the next 7 days. Participants were asked to keep hold of their plans and put them into action during the week. This activity was given after the TPB questionnaire and food diary at time 1. **Experimental group B:** The motivational intervention aimed to increase participants' consumption of fruit and vegetables to five portions a day, by using a 'health education activity sheet'. This intervention aimed to change children's beliefs, by using two of the steps suggested by Sutton (2002). **Control group (CG)** The CG formed an implementation intention for how, where and when to complete their homework for the week. The same method was used as for the experimental group except for the emphasis was on writing a plan for completing their schoolwork.		

Gray, 2015. USA	IG (5 schools, 20 classes and 562 students) and CG (5 schools, 21 classes and 574 students).	**Choice, Control and Change.** The intervention was a science and nutrition education curriculum designed to impact the energy balance related behaviors (EBRBs) of high school students: eating more fruits and vegetables, drinking more water, increasing physical activity and decreasing the intake of sweetened beverages and packaged snacks, eating at fast food restaurants and leisure time. Duration of intervention: 2006-2007. The curriculum consisted of 24 classes and was taught by science teachers on most school days over 8 to 10 weeks, between September and December 2006. Control schools received regular science curricula during the same period, and received delayed intervention in the spring of 2007.	The intervention resulted in significant changes in targeted energy balance related behaviors; in particular, students who participated in the curriculum reported fewer sweetened beverages and processed packaged snacks, smaller sizes at fast food restaurants, decreased leisure screen time and increased physical activity com-pared with control students. Behavioral outcomes by the 'Teacher Implementation' in the 'Choice, Control and Change' project: Fruits and vegetables intakes at meals or for snacks there was no significant difference. Packaged snacks (mean times/week, (95%IC)) - CG 3.5 (3.3, 3.7), Medium teacher implementation 3.1 (2.7, 3.4), High teacher implementation 3.1 (2.9, 3.3), p value for Omnibus test = 0.016. Fast food (mean size (1–4), (95%IC)) - CG 2.0 (1.9, 2.1), Medium teacher implementation 1.9 (1.8, 2.1), High teacher implementation 1.8 (1.7, 1.9), p value for Omnibus test = 0.001.	Analysis of variance test.

Haerens, 2007. Belgium.	Intervention with parental support(n = 5, 1226 pupils), intervention alone (n=5, 1006pupils) and a control condition (n=5, 759 pupils). Age range of 11–15 years.	The school-based intervention programme was developed to promote healthy food choices and physical activity. The food intervention focused on three behavioural changes that were supported by environmental changes:(1) increasing fruit consumption to at least 2 pieces a day;(2) reducing soft drinks consumption and increasing water consumption; and (3) reducing fat intake. The healthy food intervention was designed for implementation by the school staff itself. Therefore a working group was composed of the principal, the physical education teacher(s) and other involved teachers. The working group received background information and guidelines on how to address the intervention topics. They received an intervention manual and educational material. Every three months a 1-h meeting with the working group and there search team was held to evaluate the implementation and to plan further actions. Duration of intervention: an academic year - September 2003 to June2004.	The intervention was not effective in increasing self-reported fruit intake and water consumption and no positive intervention effects on soft drinks consumption were found. Pre- and post-intake levels, mean (SD) of fruit intake (pieces week): I + P - pre 5.3 (5.3), post 5.4 (5.3); I - pre 4.6 (5.0), post 4.4 (4.7); C - pre 6.5 (5.0), post 6.0 (4.9); NS.	One-way MANOVA.

Hassapidou, 1997. Greece.	73 students as the IG, and 53 more students as the CG, aged 13-14 years.	The objective is to stimulate the consumption of fruits and vegetables, as a way of preventing diseases, for example cancer. Duration of intervention: from September 1994 until June 1995. The whole programme, which was focused on healthy nutrition, stressed the importance of the Greek diet and encouraged high consumption of fruit and vegetables. The traditional Greek diet includes more fruit and vegetables than the five portions a day recommended in many European countries and the USA. Together with the importance of fruits and vegetables and their role in preventing diseases, emphasis was also given in the programme to the reduction of saturated fat intake.	The intervention resulted in significant reduced intake of pork [CG 0.4 (1), IG -0.2 (0.8), $p < 0.05$], salami [CG 0.3 (1.4), IG -0.9 (2), $p < 0.01$], and sausages [0.2 (1.4), IG -0.6 (1.5), $p < 0.05$] in boys in the IG compared with those in the CG. Moreover, boys increased their olive oil consumption and decreased their seed-oil intake. Although the aim of the programme was to increase fruit and vegetable consumption, a decrease was observed in the consumption of apples, pears and kiwi fruit after the intervention. This can be attributed, however, to the seasonal changes (winter to spring). The decrease observed in the IG was smaller than in the CG. Boys in the IG increased their consumption of bananas, grapes and freshly squeezed juices, and they deceased consumption of jam ($p < 0.01$) and cake. Girls in the IG likewise reduced significant their consumption of sausages [CG 0.2 (1.1), IG -0.3 (1), $p < 0.05$], cocoa [CG 1.7 (3.8), IG -0.02 (3.1), $p < 0.05$] and animal butter [CG 2.6 (6.4), IG -1.1 (5.3), $p < 0.01$] . They increased their intake of raw vegetables, but it was not significant. Girls also decreased their consumption of apples and pears, due to the change of season, but they increased their consumption of natural juices. Girls, furthermore, decreased their consumption of honey, cake and cocoa ($p < 0.05$).	Analysis of covariance (ANCOVA).

Hoppu, 2010. Finland	IG, 147 students and CG, 140 students. Were on average 13,8 years old.	The intervention aim to decrease the intake of sucrose, increase the intake of fiber and the consumption of fruit and vegetables among secondary-school pupils. The intervention actions focused on the development of a healthy food environment as well as on nutritional education. In developing the food environment, the main target groups were headmasters, teachers and school catering personnel who carried out the actions at schools after discussing with the study personnel. Nutritional education was implemented by the teachers during regular lessons. For nutritional education, various materials providing information on sugar, fiber, fruit and vegetables were offered for teachers to use, such as illustrative pictures of typical snacks, posters, informative brochures, games and tests. Teachers were offered ready-planned lessons, but they were also encouraged to use these materials during their normal lessons according to their needs. Duration of intervention: 2007-2008.	The frequency of consumption of rye bread increased (P=0.03) and that of sweets decreased significantly (P=0.006) in the intervention group (IG) compared to control group (CG). Among boys, there were no significant differences between the intervention and CG. The frequency of daily consumption of vegetables decreased among boys and remained the same among girls in both school groups. Along with the intervention, there was some improvement in the quality of snacks. Girls in the IG reported a decrease in their consumption of sweets significantly compared with girls in the CG(P=0.03). Consumption of sugary soft drinks remained constant among boys in the IS, but at the same time increased significantly among boys in the CG (P=0.02). There were no differences in the changes of consumption of bread and fruit as snacks between IG and CG. Energy-adjusted consumption of fruit, including berries (g/MJ) remained constant in IG (change 1 g/MJ), whereas it decreased in CG (change -6 g/MJ, p = 0.04). There was no significant change in the consumption of vegetables.	Linear mixed models.

Ickovics, 2019. USA.	Group: Students (mean age (sd)) IG PA+ Dual: 152 (10.9 (0.70)) IG PA− Nutrition only:152 (10.7 (0.55)) CG PA+: PA only: 178 (10.9 (0.62)) CG PA - Delayed: 113 (10.9 (0.59))	The primary study objective is to assess effectiveness of implementing school-based nutrition and physical activity policies on student BMI trajectories. All schools received $500/year to support a member of the school community (most often teachers) to establish and lead a School Wellness Team. The focus was on different elements of written policy implementation depending on the schools' randomized study condition. Each school was assigned one research staff member who visited the school one to two times per month. Visits typically included meeting with the School Wellness Team, principal, all teachers for the target grade, school cafeteria manager (nutrition condition), and physical education teachers (physical activity condition). Newsletters were distributed triennially to reinforce targeted health messages (e.g., Rethink Your Drink campaign). Additionally, nutrition interventions included cafeteria-based nutrition promotion to encourage healthy food choices, taste-testing new foods, and providing alternatives for use of food during celebrations. Physical activity interventions included promotion of active transport (walk/bike) to school, integrating physical activity into classroom lessons, and fitness challenges.	Given significant effects for students in schools randomized to the nutrition intervention, changes in dietary behaviors over time were examined. Specifically, at the end of the study (eighth grade), students in schools randomized to nutrition interventions reported consuming fewer unhealthy foods (mean=1.83 [SD=0.11] vs mean=2.23 [SD=0.12], β= −0.19, p=0.02), and less frequent consumption of sugar-sweetened beverages (37.95% vs 27.18% drank sugar-sweetened beverages on 2 or fewer days in the past 7 days; OR=1.36, p = 0.025) compared with those in schools with no targeted. Students at schools randomized to receive support for nutrition policy implementation had healthier BMI trajectories over time (F = 3.20, p = 0.02), with a greater magnitude over time and cumulatively significant effects 3 years post-intervention (β= −2.40, p=0.04).	The significance level was set at $p < 0.05$. It did not mention which tests were used in the study.

Lytle, 2004. USA.	IG 1,452; Control Group 1,431.	**Teens Eating for Energy and Nutrition at School (TEENS)** The intervention goal were increasing students' intakes of fruits, vegetables, and lower fat foods. The TEENS intervention was developed using a theory based approach to program planning. Three channels were selected for delivery of the intervention including classroom, family, and schoolwide components. The classroom component included 10 behaviorally based nutrition education lessons in each of the seventh and eighth grades. Most schools chose to deliver the TEENS curriculum in Family and Consumer Science; however, in some schools, it was offered in health or science class. The regular classroom teacher delivered the lessons after full day training for each grade level. The TEENS family component consisted of three newsletters and sets of behavioral coupons in both the seventh and eighth grades delivered in conjunction with the TEENS curriculum. In seventh grade, students had assignments related to the family newsletters that were turned in as homework. The schoolwide channel included working with district food service directors and local school food service managers and staff to help foster a school environment where a healthy food choice was the easier and more normative food choice.	Despite positive interim results for students randomized to intervention schools (Birnbaum et al., 2002), the positive effects of the intervention were not seen for the primary outcomes at the end of the 2nd year. No significant differences ($p > 0.05$) fruits and vegetables intake between intervention and control in baseline. Post intervention (score mean, difference, 95%CI): Fruits only - GI 2.34, GC 2.40, Difference -0.060 (–0.309, 0.190). NS difference. Vegetables only - GI 1.73, GC 1.70, Difference 0.031 (–0.250, 0.312). NS difference. Positive effects were seen only for a food choice score (suggesting that the students usually choose lower versus higher fat foods) and not for measures of food intake.	ANOVA.

Martens, 2008. Netherlands	IG - 879 students, and CG, 734 students. 32% of the students were aged 12 years or younger, 53% were 13 years old and 15% were 14 years or older	**Krachtvoer programme.** The overall aim of the programme was to increase the consumption of fruit and fruit juice, to decrease the consumption of high-fat snacks and to increase breakfast frequency and quality. Before starting the intervention, a mapping was carried out to assist in the realization of each stage in the process of development, implementation and evaluation of theory-based and evidence-based health education programs. The program consisted of eight school classes lasting 50 min each. As recommended by intervention mapping, they systematically used the available theories and evidence to make decisions on programme goals and target group, the behaviour change methods and strategies, the programme design, and implementation strategies. Duration of intervention: September 2002 - December 2002.	Fruit frequency (servings per day) - IG T0 = 0.91 (0.81), T1 = 1.10 (0.86); CG T0 = 0.89 (0.75), T1 = 0.96 (0.81); adjusted for age, gender and baseline (β-value for difference between groups at T1) = 0.043, $p < 0.05$ two-tailed. Fixed regression analyses revealed beneficial effects on the behavioural measures relating to fruit intake (as assessed by a food frequency measure and fruit consumption during the previous day), and most behavioural measures related to high-fat snack intake (food frequency measure, and number of snacks and total fat intake from snacks during the previous day). Mixed regression analysis found comparable regression coefficients for the behavioural outcomes, but the effects related to fruit intake were no longer statistically significant.	Hierarchical linear modeling; generalized linear mixed models Poisson regression.

Mihas, 2009. Greece.	Group: Students, age (sd) IG: 98 students, 13.1(0.8); CG: 93 students, 13.3 (0.9).	**VYRONAS (Vyronas Youth Regarding Obesity, Nutrition and Attitudinal Styles) study.** The intervention aim were evaluate the short-term (15 days) and long-term (12 months) effects of an intervention in school education in health and nutrition in the diet, nutritional intake and BMI. The health and nutrition components of the programme were conducted by the class home economics teacher supervised by a health visitor or a family doctor and incorporated 12 h of classroom material during 12 weeks. The intervention programme considered the interactions among environmental, cognitive and behavioural factors, for which Social Learning Theory provides the theoretical framework. Classroom modules were designed to develop behavioural capability, expectations and self-efficacy for healthful eating and healthy foods selection. Learning activities were designed to influence expectancies that placed an important value on achieving these behaviours.	Fifteen days after the intervention, a significant increase in poultry, ready-to-eat breakfast cereals and fruit consumption and a significant decrease of red meat consumption were found in the IG. Poultry, meals/week mean (SD) - IG baseline 1.6 (1.8), post 2.1 (1.7), p 0.041. Ready-to-eat breakfast cereals, meals/week mean (SD) - IG baseline 0.5 (0.5), post 0.7 (0.5), p 0.005. Fruit, portions/week mean (SD) - IG 4.7 (3.5), post 5.9 (4.3), p 0.036. Red meat, meals/week mean (SD) - IG baseline 3.1 (2.5), post 2.4 (2.1), p 0.028. There was no significant difference in the consumption frequency of any food category in the CG.	General linear mixed model analyses.
Nicklas, 1998. USA.	Identified at baseline (spring 1994) - 2,213 students. At follow-up (spring 1997), 81% of the cohort had	**Gimme 5.** It aims to increase the consumption of fruits and vegetables of high school students, through a media campaign, classroom workshops, modification of school meals and parental support.. It was used to assign 12 schools (six pairs) to intervention or control conditions. Seven other schools served as pilot test sites. The randomization of the 12 schools occurred after the completion of all baseline measurements. The six school pairs were three female, two male and one coed. One school in each pair was randomly assigned to receive Gimme 5 measurements and interventions, while the	The intervention group reported a 14% increase in consumption of servings of fruit and vegetables after two years of intervention, from 2.63 servings at baseline (1994) to 3.00 servings in 1996. This linear increase was not observed in the control group from 1994 to 1996. IG knowledge scores and awareness indicators were significantly higher than those of the CG ($p<0.001$). Gimrne 5 provided a first model to show that dietary habits of high school students can be	ANOVA.

	participated in Gimme 5 measurement for four years, and an additional 15% participated	other schools received only Gimme 5 measurements (controls). The participants of the focus group identified three barriers to increased consumption of fruits and vegetables: 1) lack of availability; 2) lack of variety; and 3) inconsistency in taste. The intervention focused on these barriers. The interventions constituted a school-wide media marketing campaign; classroom activities; modification of school meals ("Fresh Choices"); and parental involvement ("Raisin Teens"). The activities in the classroom and the parents were delivered only to the intervention cohort; however, the entire school benefited from the modification of school meals and the media marketing campaign. Duration of intervention: Changes from baseline (spring 1994) to the end of the intervention period (spring 1997).	influenced by positive media messages relative to that age group, increased exposure to a variety of tasty products, and minimal classroom activity.	

Ochoa-Avilés, 2017. Ecuador	Group, mean age (sd). IG: 618 adolescents, 12.9 (0.8); CG: 612 adolescents, 12.9 (0.8).	**ACTIVITAL trial.** The program aimed at improving the nutritional value of dietary intake, physical activity (primary outcomes), body mass index, waist circumference and blood pressure (secondary outcomes). A needs assessment, including both qualitative and quantitative data, was performed to ensure appropriateness of the program. The data served to define the intervention objectives and strategies using the Intervention Mapping (IM) and the Comprehensive and Participatory Planning and Evaluation (CPPE) approach. This process resulted in the development of the intervention program named ACTIVITAL with the following intervention objectives: adolescents (i) decrease their sugar intake, (ii) increase their daily fruit and vegetable intake, (iii) decrease their unhealthy snack intake, (iv) increase their healthy breakfast intake, and (v) school food kiosks increase the offer of healthy food. Separate matrices of change objectives for adolescents, parents and school staff were generated. In the control schools, no additional activities other than the existing national curriculum followed in health science lectures were included. Duration of intervention: 28 months. (30min/day).	Participants from the IG consumed lower quantities of unhealthy snacks (−23.32 g; 95% CI: −45.25,-1.37) and less added sugar (−5.66 g; 95% CI: −9.63,-1.65) at the end of the trial. Daily fruit and vegetable intake decreased in both the intervention and control groups compared to baseline, albeit this decrease was 23.88 g (95% CI: 7.36, 40.40) lower in the IG. Waist circumference (−0.84 cm; 95% CI: −1.68, 0.28) was lower in the IG at the end of the program; the effect was mainly observed at stage one. Dose and reach were also higher at stage one.	Linear regression models adjusted and linear mixed models.

Rees, 2010. United Kingdom	823 girls, GI 406 and GC 417. Range age 12–16 years.	The intervention aim were to evaluate the effectiveness of a computer generated tailored intervention leaflet compared with a generic leaf. The computer generated tailored intervention leaflet aimed at increasing brown bread, whole grain cereal, fruit and vegetable intakes in adolescent girls. In total there were 6 visits. 1 each week and after 3 months there were three more visits, 1 each week as well. Participants received three 24-hour dietary recall sheets over three different days at baseline, and again in follow-up three months later to record food and beverage intake from the previous day. An example of complete dietary leaf was provided as part of the package so participants could see how to register their food correctly. The recalls were completed during a class with the help of the researchers. Approximately 230 statements were developed to allow tailored responses to an individual's questionnaire data by a team of nutritionists and health psychologists based on qualitative interviews with adolescents. These statements were uploaded to a computer program so that leaflets could be automatically produced according to the questionnaire responses. A standard template for the leaflet was produced using colour graphics which was extensively piloted first with small groups of teenage girls. This allowed the leaflet to be adjusted to enhance visual appeal and relevance to the sample following feedback. The leaflets and process were then piloted with 248 girls from one school to ensure the leaflet was well received and the process workable. The intervention tried to capture not only the issue of food intake, but to identify criteria such as behavioral beliefs (attitudes, cognitive and affective beliefs), normative beliefs (subjective and descriptive norms), control beliefs (perceived behavioral control) and	The IG consumed approximately 0.35 more servings of brown bread weekly than the CG from baseline. Although this change between groups was statistically significant the magnitude was small. For the other foods there were no significant effects of the tailored intervention.	Three different statistical approaches were used: (i) the repeated measurement procedure in the SPSS statistical software package version 15; (ii) the random effect function lme of the package nlme in the R programming language; and (iii) the experimental function gamllsNP in R.

		intention.		

Wang, 2015 China	188 students, age range 12-14 years, mean (sd) 12.8 (0.45) years. HPS school - 62 students; HE school - 65; and control school – 61.	The intervention aim were to demonstrate the effectiveness of health promoting school (HPS) framework to promoting healthy eating behaviours and nutrition knowledge among Chinese middle school students, their parents and school staff. The three schools randomly selected were randomly assigned to either (i) a holistic intervention school using the HPS framework (HPS school), (ii) to a partial intervention school with a modified Health Education curriculum (HE school) or (iii) to a school that does not receive either the HPS or HE intervention (control school). The HPS school implemented a wide range of health promotion activities using the HPS approach. The HE school under took a modified curriculum intervention only; the control school did not receive either the HPS or the HE intervention, but continued with standard school activities and curriculum. The core information component of the interventions in the HPS school and HE school contained the definition and importance of a balanced diet, the functions of the nutrients, nutrient deficiencies and their effects, how to supplement necessary nutrients reasonably, good hygienic practices and food safety. The baseline survey was conducted in July 2012, the intervention activities were implemented in pilot schools. Duration of intervention: September to November 2012.	There was a statistically significant difference in the improvement of eating behaviours of students after interventions across all three schools ($p < 0.001$), with students in the HPS school having the largest improvement in eating behaviours (from 3.16 to 4.13), followed by those in the HE school (from 2.78 to 3.54) and in the control school there was a small increase (from 2.64 to 3.02). There was no statistical difference in the improvement of eating behaviours of parents and school staff after interventions across the three schools.	One-way ANOVA.

APÊNDICE 4 – SUPLEMENTOS DO ARTIGO 4 – RED MEAT CONSUMPTION AND CARDIOVASCULAR DISEASES: A SYSTEMATIC REVIEW OF COHORT STUDIES.

Supplementary Appendix 1.

Search strategy for each database.

Data base	Search strategy
Scopus	(consumption OR intake) AND (meat OR "red meat" OR "processed meat") AND ("cardiovascular disease" OR stroke OR "myocardial infarction" OR "heart failure" OR atherosclerosis OR "cerebrovascular disease" OR "Peripheral vascular disease") AND (cohort study)
PubMed	(consumption OR intake) AND (meat OR “red meat” OR beef OR pork OR lamb OR goat OR “meat products” OR “processed meat” OR ham OR sausage OR hamburger OR bacon OR salami OR pastrami OR “luncheon meats”) AND (“cardiovascular disease” OR “coronary artery disease” OR “heart disease” OR “myocardial infarction” OR stroke OR “carotid artery disease” OR “heart failure” OR “heart attack” OR Atherosclerosis OR “cerebrovascular disease” OR “Peripheral vascular disease”) AND (cohort study)
SciELO	(consumption OR intake) AND (meat OR "red meat" OR "processed meat") AND ("cardiovascular disease" OR stroke OR "myocardial infarction" OR "heart failure" OR atherosclerosis OR "cerebrovascular disease" OR "Peripheral vascular disease") AND (cohort study)
LILACS	(consumption OR intake) AND (meat OR "red meat" OR "processed meat") AND ("cardiovascular disease" OR stroke OR "myocardial infarction" OR "heart failure" OR atherosclerosis OR "cerebrovascular disease" OR "Peripheral vascular disease") AND

	(cohort study)
Web of Science	(consumption OR intake) AND (meat OR "red meat" OR beef OR pork OR lamb OR goat OR "meat products" OR "processed meat" OR ham OR sausage OR hamburger OR bacon OR salami OR pastrami OR "luncheon meats") AND ("cardiovascular disease" OR "coronary artery disease" OR "heart disease" OR "myocardial infarction" OR stroke OR "carotid artery disease" OR "heart failure" OR "heart attack" OR Atherosclerosis OR “cerebrovascular disease” OR “Peripheral vascular disease”) AND (cohort study)
ScienceDirect	(consumption OR intake) AND (meat OR "red meat" OR beef OR "processed meat") and ("cardiovascular disease") AND (cohort study) AND (nutrition OR health sciences)
Cochrane	(consumption OR intake) AND (meat OR "red meat" OR "processed meat") AND ("cardiovascular disease" OR stroke OR "myocardial infarction" OR "heart failure" OR atherosclerosis OR "cerebrovascular disease" OR "Peripheral vascular disease") AND (cohort study)
WHOLIS	(consumption OR intake) AND (meat OR "red meat" OR "processed meat") AND ("cardiovascular disease" OR stroke OR "myocardial infarction" OR "heart failure" OR atherosclerosis OR "cerebrovascular disease" OR "Peripheral vascular disease") AND (cohort study)
PAHO	(consumption OR intake) AND (meat OR "red meat" OR "processed meat") AND ("cardiovascular disease" OR stroke OR "myocardial infarction" OR "heart failure" OR atherosclerosis OR

	"cerebrovascular disease" OR "Peripheral vascular disease") AND (cohort study)
Embase	(consumption OR intake) AND (meat OR red meat) AND (cardiovascular disease OR stroke OR Myocardial infarction OR heart failure OR atherosclerosis OR cerebrovascular disease OR peripheral vascular disease)

First author (year)	Country	Study name	sex	Age (y)	Sample size	Person-years
Burke et al. 2007	Australia	Western Australian Aborigines	Both	15–88	514 (256 women, 258 men)	_
Quintana Pacheco et al. 2018	10 Western European countries (França, Alemanha, Grécia, Itália, Países Baixos, Espanha , Reino Unido, Suécia, Dinamarca e Noruega)	European Prospective Investigation into Cancer and Nutrition (EPIC)-Heidelberg	both	35 - 65	2738	_
Würtz et al. 2016	Denmark	Danish Diet, Cancer and Health study	both	50–64 (median 56 (w), 55 (m))	55171 (29 142 (w) and 26 029 (m))	_

Amiano et al. 2015	Spanish	European Prospective Investigation into Cancer and Nutrition - EPIC	both	29 - 69	41 020 (15 490 men and 25 530 women)	–
Bernstein et al. 2010	USA	Nurses' Health Study - NHS	Women	30-55	84 136	2 050 071

Kelemen et al. 2005	USA	IWHS - Iowa Women's Health Study	Women (postmenopausal)	55 - 69	41 836	475 755
Nagao et al. 2012	Japan	The Japan Collaborative Cohort Study - JACC Study	Both	40-79	51 683 (20 466 men and 31 217 women)	820 076
Nettleton et al. 2008	USA	Atherosclerosis Risk in Communities - ARIC study	Both	45-64	15792 (8710 women and 7082 men)	6 per 1,000 person-years of cases were deaths related to HF.
Sauvaget et al. 2003	Japan	Life Span Study	both	mean age - 58 (W) and 54 (M).	40 349 (24 999 w and 15 350 m)	–

Takata et al. 2013	China	Shanghai Women's Health Study (SWHS) and Shanghai Men's Health Study (SMHS)	both	40-70 (W) 40-74(M)	134 290	803 265 (W) and 334 281 (M)
Yaemsiri et al. 2012	Columbia	Women's Health Initiative Observational Study	Women (postmenopausal)	50–79 (mean age 63.5y, standard deviation 7.3y)	87025	663041
Ashaye, Gaziano and Djoussé 2011	USA	Physicians' Health Study	Men	54.6	21 120	3.30 cases per 1,000 person-years
Bernstein et al. 2012	USA	Nurses' Health Study (NHS)	Women	30–55	84 010	2,041,679

		Health Professionals Follow-Up Study - HFPS	Men	40–75	43 150	833,660
Del Gobbo et al. 2015	USA	Cardiovascular Health Study	women and men	≥65 years	4490	51850
Haring et al. 2014	USA	Atherosclerosis Risk in Communities - ARIC study	both	45–64	12066	_

Hu et al. 1999	USA	Nurses' Health Study	Women	34–59	80082	_
Kaluza, Åkesson, and Wolk 2014	Sweden	Cohort of Swedish Men	men	45-79	37 035	_
Kaluza, Åkesson, and Wolk 2015	Sweden	Swedish Mammography Cohort (SMC)	women	48–83	34 057	447 898
Larsson, Virtamo, and Wolk 2011a	Sweden	Cohort of Swedish Men	men	45–79	40291	_

Larsson, Virtamo, and Wolk 2011b	Sweden	Swedish Mammography Cohort	women	49-83	34 670	_
Ascherio et al. 1994	USA	Health Professionals Follow-up Study	men	40-75	44 933	157 010
Whiteman et al. 1999	United Kingdom	Oxford and Collaborators Health CHECK - OXCHECK study	both	35–64	10 522	_

HR - Hazard Ratios; RR - Relative Risk; CI - confidence intervals; CHD - coronary heart disease; FFQ - food frequency (0 or 1; 1 being better) and summed; quality scores from 0 to 3 were considered lower quality, and 4–5 higher qual

Follow-up (y)	incident/mortality	Outcome	No events.
14	mortality	CHD (myocardial infarction)	24 (13 w, 11 m)
12.7y, 7.5 y among MI cases, 7.5 y among stroke cases.	incident	CHD (myocardial infarction) and Stroke	555 (CHD) 513 (Stroke)
13.6 (w) and 13.5 (m)	incident	CHD (myocardial infarction)	2350 (656 (w) and 1694 (m))

13.8	incident	stroke	674 (531 ischaemic strokes, 79 haemorrhagic strokes, 42 subarachnoid haemorrhages and 22 mixed or unspecified events)
26	incident	CHD (Myocardial infarction)	2210 nonfatal infarctions

15	mortality	CHD	739
18.4	mortality	CHD (ischemic heart diseases)	537
13.3	incident	HF (Atherosclerosis)	1 140
16	mortality	stroke	1462 (655 cerebral infarction, 354 intracerebral haemorrhage, 116 subarachnoid haemorrhage, and 337 other cerebrovascular disease). **

11.2 (SWHS); 5.5 (SMHS)	mortality	CHD (ischemic heart disease), ischemic Stroke and hemorrhagic stroke	306 (W) and 284 (M)- Ischemic heart disease; 320 (W) and 184 (M) Ischemic stroke; and 318 (W) and 212 (M) Hemorrhagic stroke.
7.6	incident	Ischemic Stroke	1049
19.9	incident	Heart failure (HF)	1 204
26	incident	stroke	2,633

22			1,397
21.5	incident	heart failure	1380
22	incident	coronary heart disease (CHD)	1147

14	incident	CHD	939
11.8	incidence and mortality	heart failure	2891 incidences and 266 deaths
13.2	incident	heart failure	2806
10.1	incident	stroke	2409 (1849 cerebral infarctions, 350 hemorrhagic strokes, and 210 unspecified strokes)

10.4	incident	stroke	1680 (1310 cerebral infarction, 154 intracerebral hemorrhage, 79 subarachnoid hemorrhage, and 137 unspecified stroke)
4	incident	coronary disease	844 (249 nonfatal myocardial infarctions, 137 coronary disease fatalities, and 458 bypass operations or angioplasties).
9	mortality	CDH (ischaem	107

questionnaire; MI - myocardial infarction. *Quality asse
lity. ** The percentage distributions of cerebrovascular d

Disease and / or deaths ascertainment
Diagnoses were coded from hospital separation records and death records in the period 1988 to 1999 using the ICD-9-CM (National Coding Centre, 1995) and from 1999–2000 using the ICD-10-AM (National Centre for Classification in Health, 2000). Mapping of ICD-10-AM codes to ICD-9-CM codes was carried out using software developed by the National Centre for Classification in Health. Coronary heart disease (CHD) comprised the codes 410–414, 427 and 428. Diagnosis codes were included if they appeared in any of 21 diagnosis fields
Incident cases of myocardial infarction (MI) and stroke were reported during follow-up by the participants or close family members. Each self-reported case was validated by study physicians based on diagnostic records that were obtained from the treating physicians, who had diagnosed the diseases in the clinic.
The outcome measure was incident non-fatal and fatal MI. Participants registered with a first-time discharge diagnosis of MI or cardiac arrest believed to be caused by an MI (International Classification of Diseases, 8th revision, codes 410– 410.99 and 427.27, and International Classification of Diseases, 10th revision, codes I21.0-I21.9 and I46.0-I46.9) were identified in the Danish National Patient Register and in the Danish Cause of Death Register using the unique ten-digit civil registration number assigned to all Danish citizens by the Central Population Register. From baseline through 2003, the medical records of potential cases were reviewed, and the cases were validated according to MI criteria set by the American Heart Association and the European Society of Cardiology for use in epidemiological studies(22). From 1 January 2004 through 31 December 2009, participants with an MI diagnosis from a hospital ward were accepted as cases without further validation, as the positive predictive value of these register diagnoses from hospital wards was found to be above 92%(23). Other potential cases were validated by review of diagnoses and procedure codes in the National Patient Register and the Cause of Death Register. Information on vital status and emigration was obtained by linkage with the Danish Civil Registration System.

Fatal cases were identified by crossing data with the National Institute of Statistics (INE) using ICD-9 codes 430–438 and ICD-10 codes I60–I69. A validation process was carried out by a team of trained health professionals to confirm and classify all identified stroke events. Stroke cases were classified on the basis of symptoms, presence of cerebrovascular risk factors and specific medical tests (computerised tomography, magnetic resonance imaging, angiography, Doppler imaging and/or lumbar puncture) following the 2006 guidelines of the Spanish Society of Neurology22 as ischaemic, haemorrhagic (cerebral and subarachnoid) or unspecific strokes. Two expert neurologists helped in the classification of the most difficult stroke cases
After report of an infarction, permission to obtain medical records was requested and these were reviewed by study physicians with no knowledge of the subjects' self-reported risk factor status. Myocardial infarction was confirmed using the World Health Organization criteria: symptoms plus either diagnostic electrocardiographic changes or elevated cardiac enzymes 12. Infarctions that required hospital admission and for which confirmatory information was obtained by interview or letter, but for which no medical records were available, were designated as probable (527/2210 cases of nonfatal myocardial infarction, or 24%). We included all confirmed and probable cases in our report because results were similar after probable cases were excluded

Deceased nonrespondents were identified through linkage with the National Death Index.
In each community, investigators conducted a systematic review of death certificates. In Japan, the registration of residence and death is a legal requirement, so it is assumed that this practice is upheld. We used the underlying cause of death coded by the International Statistical Classification of Diseases and Related Health Problems---10th Revision (ICD-10) to identify mortality end points: I20 -- I25 for ischemic heart disease.
Incident HF cases were identified through review of county death certificates and local hospital discharge lists and defined according to the International Classification of Diseases Codes (ICD-9 or ICD-10). Incident HF was defined as first HF hospitalization (428, ICD-9) or any death where the death certificate included an HF code (428, ICD-9 and I50, ICD-10).
linkage to the nationwide family registration system of Japan

Vital status and dates and causes of deaths were ascertained through annual linkage to the Shanghai Vital Statistics Registry and Shanghai Cancer Registry databases and home visits every 2–3 years.
Incident ischemic strokes during the follow-up period were identified through self-report during annual medical history updates through 2005. The annual response rate was 94%.10 The potential outcomes were adjudicated locally by physicians and centrally by trained neurologists using additional details from medical charts, brain imaging, or death certificates. Over 95% of WHI-OS stroke cases were classified based on brain imaging.11 Central adjudicators further classified ischemic strokes by subtypes according to the Trial of ORG 10172 Acute Stroke Trial (TOAST) Classification, based on the presumed underlying stroke etiology.12 Transient ischemic attack, hemorrhagic stroke, stroke not centrally adjudicated, strokes not requiring hospitalization, and strokes not confirmed by central adjudication were not included as a stroke outcome.
A diagnosis of HF was made if there was sufficient evidence in the chart; this included a) a diagnosis of HF on the discharge summary, b) major signs and symptoms from the Framingham criteria for a HF diagnosis, c) chest X-ray evidence for congestive HF, d) minor signs and symptoms with concomitant treatment for HF (use of diuretics, digoxin in the absence of atrial fibrillation, angiotensin converting-enzyme inhibitors, angiotensin receptor blockers, and beta-blockers). Lastly, assessment of left ventricular function via echocardiography or cardiac catheterization (where available) was used to further substantiate the HF diagnosis.
When participants reported a stroke, we obtained permission to review their medical records. Stroke was classified as ischemic (thrombotic, embolic, or unspecified nonhemorrhagic), hemorrhagic, or of unknown type, according to criteria in the National Survey of Stroke . Subarachnoid hemorrhages were distinguished from intraparenchymal hemorrhages. Nonfatal

Subarachnoid hemorrhages were distinguished from intraparenchymal hemorrhages. Nonfatal strokes for which confirmatory information was obtained by interview or letter but no medical records were available and no neuro-imaging was available were designated as probable (223/1098, or 20%, of cases in men and 641/2153, or 30%, of cases in women). Deaths were identified from state vital records, the National Death Index, next-of-kin, or the postal system. Stroke was confirmed as fatal by medical records or autopsy report. Fatal stroke was designated as probable if stroke was reported on the death certificate or reported by next-of-kin, but no medical records were available
Participants were followed by annual study clinic examinations with interim telephone contacts for 10 years and telephone every 6 months thereafter. Incident HF was adjudicated by a centralized events committee using outpatient and inpatient medical records, diagnostic tests, clinical consultations, and interviews. Confirmation of HF required: 1) diagnosis by a treating physician; 2) HF symptoms (shortness of breath, fatigue, orthopnea, or paroxysmal nocturnal dyspnea) plus signs (edema, rales, tachycardia, gallop rhythm, or displaced apical impulse) or supportive findings on echocardiography, contrast ventriculography, or chest radiography; and 3) medical therapy for HF, defined as diuretics plus either digitalis or a vasodilator. Because data on HF subtypes were incomplete for many participants, HF subtypes were not explored in this analysis.
CHD was defined as a definite or probable myocardial infarction or a death from coronary heart disease. CHD events were identified and adjudicated using information from study visits, yearly telephone follow-up calls, review of hospital discharge lists and medical charts, death certificates, next-of-kin interviews, and physician-completed questionnaires

Medical Records were reviewed by study physicians with no knowledge of the subjects' self-reported risk factor status. Myocardial infarction was confirmed by using World Health Organization criteria: symptoms plus either diagnostic electrocardiographic changes or elevated cardiac enzymes. Infarctions that required hospital admission and for which confirmatory information was obtained by interview or letter, but for which no medical records were available, were designated as probable.
Date of the first registered incident HF and date of death from HF were ascertained by linkage of the study cohort with the Swedish Patient Register and the Cause of Death Register at the Swedish National Board of Health and Welfare, which are considered almost 100% complete.12 Events of HF were defined according to the International Classification of Diseases and Related Health Problems, 10th Revision (ICD code I50 and I11.0).
By linkage of the study cohort with the Swedish Patient Register and the Cause of Death Register considered almost 100% complete [14]. Events of HF were defined according to the International Classification of Diseases and Related Health Problems, 10th Revision (ICD code I50 and I11.0).
by linkage of the study cohort with the Swedish Hospital Discharge Registry, which provides virtually complete coverage of the discharges. The International Classification of Diseases 10th revision was used to identify stroke events. Strokes were classified as cerebral infarction (ICD-10 code I63), intracerebral hemorrhage (I61), subarachnoid hemorrhage (I60), and unspecified stroke (I64). Information on dates of death was obtained from the Swedish Death Registry at Statistics Sweden.

by linkage of the study cohort with the Swedish Hospital Discharge Registry, which provides virtually complete coverage of discharges. The International Classification of Diseases 10th revision (ICD-10) was used to identify stroke events. Strokes were classified as cerebral infarction (ICD-10 code I63), intracerebral hemorrhage (I61), subarachnoid hemorrhage (I60), and unspecified stroke (I64). Data on dates of death were obtained from the Swedish Death Registry
Participants who reported an incident myocardial infarction on the 1988 or 1990 questionnaire were sent a letter to confirm the report and to request permission to review medical records. A nonfatal myocardial infarction was confirmed using World Health Organization criteria12: compatible symptoms plus either typical ECG changes or elevation of cardiac enzymes. Deaths were reported by next-of-kin, coworkers, postal authorities, or the National Death Index. Fatal coronary diseases were confirmed using medical records or autopsy reports. Fatal coronary disease was also considered confirmed if it was the underlying cause on the death certificate and a diagnosis of incident coronary disease was confirmed by records or interviews with family members. The cause listed on the death certificate alone was not accepted as confirmation of fatal coronary disease. Sudden death, defined as death within 1 hour of the onset of symptoms in individuals with no previous serious illness or other plausible cause of death (other than coronary disease), was included as fatal coronary disease. For subjects with multiple end points, only the first was included in the analysis. . Physicians reviewing medical records were blinded to the report of dietary intake.
Death certificates were obtained and cause of death determined according to ONS ICD-9 coding practice (codes 410.0–414.9).

ssment was performed by review of study design, including inclusion and exclusion criteria, assessmen
isease deaths were similar between the sexes.

Dietary assessment	Type of Meat	Consumption frequency or amount	Statistical Analysis
FFQ	Processed meat	serves/month	HR (95% CI) - Cox proportional hazards regression analyses
Validated FFQ for nutri	Total red meat.	50 g of daily	HR (95% CI) - Cox proportional hazards regression analyses
Validated FFQ for nutrients	Total red meat, Unprocessed Red Meat, and Processed meat.	150 g/week	HR (95% CI) - Cox proportional hazards regression analyses

validated Dietary History Questionnaire for nutrients and food items.	Unprocessed red meat and processed meat.	Quintiles of intake	HR (95% CI) - Cox proportional hazards regression analyses
validated FFQ for food items	Total red meat, Unprocessed Red Meat, and Processed meat.	Quintiles of intake	Relative Risk (95% CI) -multivariable proportional hazards models.

Validated FFQ for nutrients	Red meats (Total Red Meat)	Quintiles of intake	Risk ratio (95% CI) - Cox regression
Validated FFQ for nutrients	Unprocessed red meat and Procesed meat.	Quintiles of intake	HR (95% CI) - Cox proportional hazards regression analyses
Validated FFQ for nutrients	Processed meat	1 serving/d	HR (95% CI) - Cox proportional hazards regression analyses
Validated FFQ for fo	Unprocessed red meat and Procesed meat.	Frequency - times/week.	HR (95% CI) - Cox proportional hazards regression analyses

Validated FFQ for nutrients and food items	Unprocessed red meat	Quintiles of intake	HR (95% CI) - Cox proportional hazards regression analyses
Validated FFQ for nutrients	unprocessed red meat and total red meat.	1 medium servings/d	HR (95% CI) - Cox proportional hazards regression analyses
Validated FFQ for nu	Total red meat	Quintiles of intake	HR (95% CI) - Cox proportional hazards regression analyses
Validated FFQ for nutrients and food items	unprocessed red meat, processed meat and total red meat	Quintiles of intake	Relative Risk (95% CI) -- Cox proportional hazards regression

	meat.		hazards regression model.
Validated FFQ for nutrients	unprocessed red meat, processed meat, and total red meat.	Quintiles of intake	HR (95% CI) - Cox proportional hazards regression analyses
Validated FFQ for nutrients	unprocessed red meat, processed meat and total red meat.	Quintiles of intake	HR (95% CI) - Cox proportional hazards regression analyses

Validated FFQ for nutrients	Total red meat	Quintiles of intake	Relative Risk (95% CI) - multivariate models using pooled logistic regression
Validated FFQ for nutrients	unprocessed and processed meat	4 Categories (g/day)	HR (95% confidence intervals) - Cox proportional hazards regression models
Validated FFQ for nutrients	unprocessed red meat and processed meat	3 Categories (g/day)	HR (95% confidence intervals) - Cox proportional hazards regression models
Validated FFQ for nutrients	unprocessed red meat, processed meat, and total red meat.	Quintiles of intake	Relative Risk (95% CI) - Cox proportional hazards regression models with age as the time scale to estimate the relative risks

FFQ	unprocessed red meat, processed meat, and total red meat.	Quintiles of intake	Relative Risk (95% CI) - Cox proportional hazards regression models
Validated FFQ for nutrients.	unprocessed red meat	Quintiles of intake	Relative Risks (95% CI)
FFQ	unprocessed red me	tertiles of intake	Relative Risk (95% CI) - Cox proportional hazards regression models.

nt of exposure, assessment of outcome, control of confounding, and evidence of bias

Adjustments	Quality score* (NOS)
sex, age, total cholesterol, mean arterial pressure and waist girth.	9
waist circumference (centimeters), height (centimeters), alcohol consumption (grams per day), fiber intake (grams per day), energy (kilocalories per day), CRP (milligrams per deciliter), LDL (millimoles per liter), smoking (never, former, or current), hypertension (yes or no), education level (primary school, secondary school, or university degree), and menopausal status (premenopausal or postmenopausal)	9
age, total energy, alcohol abstinence, alcohol intake, BMI, waist circumference, smoking status, physical activity, duration of schooling. For women, the status of menopause and the use of hormone replacement therapy were also added to the adjustments.	9

age at baseline (years), centre (Asturias, Granada, Murcia, Navarra and Gipuzkoa) and total energy, body mass index (BMI), waist circumference, smoking status, smoking before 20 years of age, recreational physical activity, educational level, alcohol consumption, use of vitamin supplements (anatomical therapeutic chemical (ATC) code A11), use of antithrombotic or antihaemorrhagic agents (ATC code B01/B02), use of cardiovascular drugs (ATC code C01–C10), use of salicylic acid or derivatives (ATC code N02BA), incident acute myocardial infarction cases, diabetes, self-reported diseases (hypertension, hyperlipidaemia), menopausal status (in women), hormone replacement therapy (in women), oral contraceptives (in women), % of energy from carbohydrates, protein and fats, and intakes of vegetables, fruit, dairy products and fish. fStratified by centre.	8
age (months), time period (13 periods), total energy (fifths of Kcal), cereal fiber (fifths of g/day), alcohol (fifths of g/day), trans-fat (fifths of g/day), body mass index (10 categories), cigarette smoking (never, past, current 1-14 cig/day, current 14-25 cig/day, current 25+ cig/day), menopausal status (pre-menopausal, postmenopausal with no history of hormone replacement, postmenopausal with history of hormone replacement, postmenopausal with current hormone replacement), parental history of early myocardial infarction (before age 65 for mother or age 55 for father), multivitamin use (fifths of yrs), vitamin E supplement use (yes/no), aspirin use at least once per week (yes/no), physical exercise (<3, 3-9, 9-18, 18-27, 27+ metabolic equivalents/week).	8

age, total energy, saturated fat, polyunsaturated fat, monounsaturated fat, trans-fat (expressed as percentage of energy and categorized into quintiles), total fiber, dietary cholesterol, dietary methionine (all quintiles are based on energy-adjusted values), alcohol (≤14 g/day vs. >14 g/day), smoking (never, former, current), activity level (active vs. not active), body mass index (<21.0, 21.0–22.9, 23.0–24.9, 25.0–28.9, ≥29.0), history of hypertension, postmenopausal hormone use, multivitamin use, vitamin E supplement use, education (high school education or less vs. post-high school), family history of cancer, servings of dairy, eggs, fish, poultry, fruits and vegetables excluding potatoes. In addition to all of the above variables the animal protein model is also adjusted for vegetable protein.	8
age, body mass index, ethanol intake, perceived mental stress, walking time, sports participation time, education years, history of hypertension and diabetes, total energy and energy-adjusted food (rice, fish, soy, vegetables and fruits) intakes.	8
energy intake, plus demographics: age, sex, race/center (whites in Minnesota, whites in Maryland, African Americans and whites in North Carolina, African Americans in Mississippi), education level (up to and including grade school, high school without diploma, high school graduate, vocational school, college graduate, graduate school/professional school) lifestyle factors: physical activity level (sport and exercise activity and nonsport activity during leisure), smoking (status and cigarette years), and drinking status (current, former, never), and prevalent disease status: cardiovascular disease, diabetes, and hypertension (present/absent).	8
city, radiation dose, self-reported body mass index, smoking status, alcohol habits, education level, history of diabetes, or hypertension.	8

age at baseline, total caloric intake, income, occupation, education, comorbidity index, physical activity level, total vegetable intake, total fruit intake, fish intake, and red meat or poultry intake where appropriate, smoking history (ever/never smoking for women and pack-years of smoking for men), and alcohol consumption (for men only).	8
age and race (white, black, Hispanic, other), education (<high school, high school diploma or GED, vocational/training school or some college or associate degree, college graduate), family income (<$20K, $20K to <$35K, $35K to <$50K, $50K to <$75K, ≥$75K), years as a regular smoker (never, <10, 10 to <20, 20 to <30, ≥30), hormone replacement therapy use (never, past, current), total METhours per wk, alcohol intake, history of coronary heart disease, history of atrial fibrillation, history of diabetes, aspirin use, use of antihypertensive medication, use of cholesterol lowering medication, BMI, systolic blood pressure, and total energy intake (quntiles), dietary vitamin E (quintiles), fruits and vegetable intake (quintiles), fiber (quintiles).	8
age, aspirin assignment, smoking, (never, past, current), alcohol consumption (<1, 1–4, 5–7, >7 drinks/week), cereal consumption (none, ≤ 1, 2–6, 7+/week), parental history of MI prior to age 60 y, exercise (none, ≤ 1, 2–4, 5+/week) and body mass index (< 25.0, 25.0–29.9, 30+ kg/m2), and prevalent diabetes, coronary heart disease, atrial fibrillation, and hypertension at 12 months post randomization.	7
Multivariable model stratified on age (months) and time period (13 periods in NHS, 11 in HPFS) and includes: body mass index (10 categories), cigarette smoking (never, past, current 1–14 cig/day	7

current 1–14 cig/day, current 14–25 cig/day, current 25+ cig/day), physical exercise (<3, 3–9, 9–18,18–27, 27+ metabolic equivalents/week), parental history of early myocardial infarction (before age 60), menopausal status in women (pre-menopausal, postmenopausal with no history of hormone replacement, postmenopausal with history of hormone replacement, postmenopausal with current hormone replacement), multivitamin use (quintiles of yrs), vitamin E supplement use (yes/no), aspirin use at least once per week (yes/no), total energy (quintiles of Kcal), cereal fiber (quintiles of g/day), alcohol (quintiles of g/day), trans-fat (quintiles of g/day), fruit and vegetables (quintiles of servings/day), and other protein sources (quintiles of servings/day)	
adjusted for age (years), sex (male vs. female), race (Caucasian vs. non-Caucasian), enrollment site (4 clinics), education (< high school, =high school, >high school), annual income (<$25 000, $25 000-$49 999, >$50 000), total kcal expended (quintiles), walking pace (<2 mph, 2-3mph, >3mph), smoking (never, former, current), alcohol intake (none, <1 drink/wk, 1-2 drink/wk, ≥3 drink/wk) + additional adjustment for potential mediators, including body mass index (kg/m2), prevalent treated hypertension (yes vs. no), prevalent diabetes mellitus (yes vs. no), prevalent coronary heart disease (yes vs. no)	7
age, sex, race, study center, total energy intake, smoking, education, systolic blood pressure, use of antihypertensive medication, HDLc, total cholesterol, use of lipid lowering medication, body mass index, waist-to-hip ratio, alcohol intake, sports-related physical activity, leisure-related physical activity, carbohydrate intake, fiber intake, and magnesium intake	7

age (5-y category), time period (7 periods), body mass index (5 categories), cigarette smoking (never, past, and current smoking of 1–14, 15–24, and ³ 25 cigarettes/d), menopausal status (premenopausal, postmenopausal without hormone replacement, postmenopausal with past hormone replacement, and postmenopausal with current hormone replacement), parental history of myocardial infarction before age 60 y; vitamin E supplement use, alcohol consumption (4 categories), history of hypertension, aspirin use (none, 1–6/wk, ³ 7/wk, and dose unknown), vigorous exercise ³ 1/wk (yes or no), and total energy intake. Red meat, white meat, and high-fat and low-fat dairy products were entered into the multivariate models simultaneously.	7
age (continuous), education (less than high school, high school, or university), smoking status, and pack-years of smoking (never; past <20, 20–39, or ≥40 pack-years; or current <20, 20–39, or ≥40 pack-years), body mass index (<20, 20–24.9, 25–29.9, or ≥30 kg/m2), total physical activity (quintiles, measured as metabolic equivalents), aspirin use (yes or no), supplement use (yes or no), family history of myocardial infarction at <60 y (yes or no), and intake of energy (kcal/d, quintiles) and consumption of alcohol, whole grain products, fruit, vegetable, and fish (g/d, quintiles).	7
age (continuous), education (less than high school, high school, or university), smoking status and pack-years of smoking (never; past b20, 20–39, or≥40 pack-years; or current b20, 20–39, or ≥40 pack-years), BMI (b20, 20–24.9, 25–29.9, or ≥30 kg/m2), total physical activity (quintiles,measured asmetabolic equivalents), aspirin use (yes or no), family history of myocardial infarction at b60 years (yes or no) and intake of energy (kcal/day, continuous) and consumption of alcohol, whole grain products, fruit, vegetable and fish (g/day, quintiles).	7
age, smoking status, pack-years of smoking, education, BMI, total physical activity, histories of diabetes and hypertension, aspirin use, family history of myocardial infarction, and intakes of total energy, alcohol, fish, fruit, and vegetables.	7

age, smoking status and pack-years of smoking, education, body mass index, total physical activity, history of diabetes, history of hypertension, aspirin use, family history of myocardial infarction, and intake of total energy, alcohol, coffee, fish, fruits, and vegetables.	7
standard risk factors, saturated fat, and cholesterol intake	6
gender, smoking and age group.	6

;. Each of the five quality criteria was evaluated and scored on an integer scale

Supplementary Appendix 3.

Definitions of unprocessed red meat, processed meat and red meat used in studies included in the systematic review.

	Unprocessed red meat	**Processed meat**	**Red meat**
Burke et al. 2007	-	Processed meats (bacon, canned meat, salami or other sausage) spreads used on bread, including lard, dripping and ghee.	-
Quintana Pacheco et al. 2018	Unprocessed red meat included beef, pork, mutton or lamb, horse, and goat.	Processed meat included all meat products including ham, bacon, sausages, and a small part of minced meat in ready-to-eat products (hamburgers, meatball sandwiches).	Total red meat consumption was defined as the summed intake of unprocessed and processed red meat.
Würtz et al. 2016	Unprocessed red meat included fresh and minced beef, veal, pork and lamb.	Processed red meat included red meat items that had undergone processing such as smoking, salting or curing. This included various kinds of sausage, salami, smoked or cooked ham, other cold cuts, bacon and liver pate.	Red meat, including both unprocessed and processed red meat.
Amiano et al. 2015	Unprocessed red meat included beef,	Processed meat included all meat products such as	Total red meat was the sum of unprocessed

	pork, mutton/lamb, horse and goat.	ham, bacon and sausages, and small portions of minced meat bought as a ready-to-eat product. Processed meat mainly refers to processed red meat but may contain small amounts of processed white meat as well, for example, in sausages.	red meat and processed meat.
Bernstein et al. 2010	-	-	Red meat (hamburger, beef hot dog, processed meat and processed meat sandwich, bacon, beef/pork/lamb as a mixed and main dish).
Kelemen et al. 2005	-	-	Red meats - a composite of beef, pork, and processed meat.
Nagao et al. 2012	Red meat (beef and pork).	Processed meat.	-
Nettleton et al. 2008	-	Red meat (hamburger, meat in sandwiches or mixed dishes, hot dogs, sausage/salami, bacon, liver).	-
Sauvaget et al. 2003	Beef and pork.	Pork products such as ham/sausage.	-
Takata et al. 2013	Red meat (sum of pork and beef/lamb intakes).	-	-

Yaemsiri et al. 2012	Beef, pork, or lamb as a main dish.	-	Red meat.
Ashaye, Gaziano and Djoussé 2011	-	-	Red meat - beef, pork, or lamb as main dish (steak, roast, ham, etc); beef, pork, or lamb as a sandwich or mixed dish; and hot dogs.
Bernstein et al. 2012	Unprocessed red meat (hamburger*, beef, pork, and lamb).	Processed red meat (beef hot dog, processed meats such as bologna and salami, and bacon).	Total red meat.
Del Gobbo et al. 2015	Red meat (unprocessed) was defined as beef steaks/roasts, beef stew, and pork chops/roasts.	Processed meat was defined as hot dogs, ham, lunch meat, bacon, and sausage.	Red & processed meat.
Haring et al. 2014	Red meat.	Processed Meat.	Red Meat & Processed Meat.
Hu et al. 1999	-	-	Red meat (beef, pork, or lamb as a main dish; beef as a sandwich or mixed dish; hamburger; hot dog; processed meat; and bacon).
Kaluza, Åkesson, and Wolk 2014	Unprocessed meat included 3 food items: pork, Beef/veal, and	Processed meat included 4 food items: sausages, cold cuts (ham/salami), blood Pudding/sausages, and liver	Total red meat.

	minced meat. Minced meat dishes (hamburger/ground beef, etc) are generally prepared without food additives such as nitrates or phosphate in Sweden and were considered as unprocessed red meat.	paté.	
Kaluza, Åkesson, and Wolk 2015	Unprocessed meat included three food items: pork, beef/veal and minced meat.	Processed meat included four food items: sausages/hot dogs, cold cuts (ham/salami), blood pudding and liver paté.	Total red meat.
Larsson, Virtamo, and Wolk 2011a	Fresh red meat included all types of fresh and minced pork, beef, and veal.	Processed meats included sausages, hot dogs, salami, ham, processed meat cuts, liver pate´, and blood sausage.	Total red meat was the sum of fresh red meat and processed meat.
Larsson, Virtamo, and Wolk 2011b	Fresh meat included intake of all types of fresh and minced pork, beef, and veal.	Processed meats included sausages, hot dog, salami, ham, processed meat cuts, liver pate´, and blood sausage.	Red meat was the sum of fresh meat and processed meat.
Ascherio et al. 1994	Beef (main dish or sandwich).	-	-
Whiteman et al. 1999	Other fresh or frozen red meat	Processed meat (e.g. pies, burgers, sausages).	-

	(e.g. beef, lamb, pork).

* We identify the hamburger from unprocessed meats, as the authors have classed as unprocessed, we believe that this hamburger is not processed.

ANEXO 1 – REGISTRO NO PROSPERO - SYSTEMATIC REVIEWS OF SCHOOL-BASED FOOD AND NUTRITION EDUCATION INTERVENTION FOR ADOLESCENT HEALTH PROMOTION: EVIDENCE MAPPING AND SYNTHESES

Systematic reviews of school-based food and nutrition education intervention for adolescent health promotion: evidence mapping and syntheses

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Review question

RQ 1- What are the effects of school-based Food and Nutrition Education interventions on adolescent food consumption?

RQ 2 - What are the effects of school-based Food and Nutrition Education interventions on adolescent biochemical parameters?

RQ 3 - What are the effects of school-based Food and Nutrition Education interventions on adolescent biological parameters?

RQ 4 - What qualitative evidence explains the effect of school-based Food and Nutrition Education interventions on adolescent food consumption?

Searches

A comprehensive search of the following databases will be carried out: MEDLINE (via PubMed), Embase (via OVID), Scopus (via Elsevier), ERIC - Education Resources Information Center, ScienceDirect (via Elsevier), Web of Science - Coleção Principal (Clarivate Analytics), the Cochrane Central Register of Controlled Studies (CENTRAL), LILACS (via Biblioteca Virtual em saúde - BVS), and ADOLEC (via Biblioteca Virtual em saúde - BVS).

A combination of free text search terms and Medical Subject Title (MeSH), text words and keywords. The search equation will be defined considering the following items: participant (adolescent, teenager), intervention (education, school, “School Health Services”), outcomes (“Diet, Food, and Nutrition”, fruit, Vegetables, “Dairy products”, candy, “Fast Foods”), study design (clinical trial, intervention).

The search terms for the formations of the search equations will be combine with specific filters of each database.
There will be no limitations on time and languages in the searches to be performed.

Additional search strategy information can be found in the attached PDF document (link provided below).

Types of study to be included

Randomized controlled trials (RCT), Non-RCT or Controlled before-after studies that have reported changes in food consumption. Will be included studies: 1) the Food and Nutrition Education interventions was school-based; 2) food consumption was assessed by a robust dietary assessment method - Objectively (FFQ, 24-hour recalls, diet diaries, food records) and subjectively (self-report, interviews, questionnaires) measured outcomes. 3) Qualitative studies that provide greater in-depth understanding of evidence that supports or

explains the effect of school-based Food and Nutrition Education interventions on adolescent food consumption will also be included.

Condition or domain being studied

Studies conducted among adolescent and reporting school-based intervention results, aimed to change adolescent food consumption will be eligible for inclusion. Food consumption include fruits, vegetables, milk and derivatives, red meat, processed meat, sweets, fried foods, fast food and ready-made dishes.

Participants/population

School adolescents - Studies which targeted 10 to 19 years old school adolescent (OMS, 2018).

Studies in which adolescents with physical disabilities, intellectual disabilities, endocrine disorders, chronic diseases (cardiovascular diseases, diabetes) and pregnant women were the target audience will be excluded.

Intervention(s), exposure(s)

The interventions that will be considered that have reported changes in adolescent food consumption through School-based Food and Nutrition Education.

Comparator(s)/control

Studies with control group (no intervention or other intervention that is not school-based) will be included. Studies without control group but subjectively measured outcomes (self-report, interviews, questionnaires) will be included.

Context

Main outcome(s)

The primary outcome is the change in adolescent food consumption (e.g. in nature or minimally processed products consumption, especially fruits, vegetables and milk and derivatives; sweets; fried foods; fast food; and ready-made dishes.

Timing and effect measures

Not applicable.

Additional outcome(s)

1) Biological parameters (e.g. Body Mass Index (BMI), waist circumference (WC), waist-to-height ratio (WHR), total body fat, etc.).

2) Biochemical parameters (e.g. glycemia, lipid profile etc).

3) Qualitative evidences that supports or explains the effect of school-based Food and Nutrition Education interventions on adolescent food consumption.

Timing and effect measures

Not applicable.

Data extraction (selection and coding)

After the search of the studies two reviewers will independently screen the search results using titles and abstracts. Duplicates and reviews will be removed from the database. Reviewers will then go through the full text to determine whether they meet the inclusion criteria and will extract the following information: title, first author, publication year, country, study name, population, participants characteristics (age, gender, sample size), duration of intervention and follow-up period, intervention description, educational approach, theoretical framework used, dietary assessment, outcome measurements and results (objectively and

subjectively). Discrepancies will be resolved by a third reviewer. The selection of the study is summarized in a PRISMA flow diagram.

Risk of bias (quality) assessment

The methodological quality of the studies will be assessed using a standardized quality assessment tool for RCTs, the EPOC Risk of Bias Tool (Cochrane, 2017), and as a reference the check-list PRISMA (Moher et al, 2009).

The following criteria will be assessed in intervention studies: random sequence generation, allocation concealment, blinding of participants, clinicians and outcome assessment. In addition, incomplete outcome data, selective reporting, funding, and potential for conflicts of interest associated with the individual trials will also be considered. The risk of bias will be rated using predetermined criteria as follows: low, high or unclear.

For non-RCT and controlled before-after studies will be assessed using the ROBINS-I tool. It is a tool developed to assess risk of bias in the results of non-randomized studies that compare health effects of two or more interventions (Sterne et al, 2016).

For qualitative studies, risk of bias will be assessed using the Critical Appraisal Skills Program (CASP) checklist (CASP, 2017). This checklist is recommended by the Cochrane Collaboration for qualitative literature (Hannes, 2011).

We will analyze the overall strength of the evidence for each outcome using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) tool (Guyatt et al, 2008).

Strategy for data synthesis

A narrative approach will be used to summarise the effectiveness of the interventions. Food Consumption and educational approach of intervention studies will be looked at separately and if studies are sufficiently homogeneous a quantitative synthesis will be undertaken.

The heterogeneity between trial results will be evaluated using a standard X^2 test with a significance level 0, 05. To assess heterogeneity, we plan to compute the I^2 statistic, which is a quantitative measure of inconsistency across studies. A value of 0% indicates no observed heterogeneity, whereas I^2 values of 50% indicate a substantial level of heterogeneity. If possible, funnel plots will be used to assess the presence of potential reporting biases. A linear regression approach will be used to evaluate funnel plot asymmetry.

If the studies will be too heterogeneous then a narrative synthesis will be undertaken

educational approach.

For studies with qualitative evidence the approach for the synthesis of the included studies will be by a meta-synthesis.

Analysis of subgroups or subsets

If sufficient data are available, we will perform the following subgroup analyzes: specific details of the interventions (eg, methodological strategy, components and duration), research scenario (family participation, socioeconomic conditions), and risk of bias.

Contact details for further information

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Organisational affiliation of the review

Universidade Federal do Rio Grande do Norte

Review team members and their organisational affiliations

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Ms Karla Silveria Siqueira. Prefeitura Municipal de Monte das Gameleiras/RN
Mrs Anny Karoliny Fernandes. Universidade Federal do Rio Grande do Norte
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Dr Clélia Lyra. Universidade Federal do Rio Grande do Norte
Dr Grasiela Piuvezam. Universidade Federal do Rio Grande do Norte

Type and method of review
Intervention, Meta-analysis, Prevention, Synthesis of qualitative studies, Systematic review

Anticipated or actual start date
15 April 2019

Anticipated completion date
31 October 2019

Funding sources/sponsors
None

Conflicts of interest
None known

Language
English, Portuguese-Brazil

Country
Brazil

Stage of review
Review Ongoing

Subject index terms status
Subject indexing assigned by CRD

Subject index terms
Adolescent; Food; Health Education; Humans; Nutrition Therapy; Schools

Date of registration in PROSPERO
16 April 2019

Date of publication of this version
23 October 2019

Details of any existing review of the same topic by the same authors

Stage of review at time of this submission

Stage	Started	Completed
Preliminary searches	Yes	Yes
Piloting of the study selection process	No	No
Formal screening of search results against eligibility criteria	No	No
Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

Versions

16 April 2019
23 October 2019

ANEXO 2 - REGISTRO NO PROSPERO - RED MEAT CONSUMPTION, RISK OF INCIDENCE OF CARDIOVASCULAR DISEASE AND CARDIOVASCULAR MORTALITY AND EFFECT OF DOSE-RESPONSE: A SYSTEMATIC REVIEW AND META-ANALYSIS OF LONGITUDINAL COHORT STUDIES

Red meat consumption, risk of incidence of cardiovascular disease and cardiovascular mortality and effect of dose-response: a systematic review and meta-analysis of longitudinal cohort studies

Gidyenne Medeiros, Grasiela Piuvezam, Clélia Lyra, Kesley Azevedo, Severina Lima, David Silva, Gabriela Xavier, Isac Davidson Pimenta, Ana Catherine da Silveira Gonçalves

Citation

Gidyenne Medeiros, Grasiela Piuvezam, Clélia Lyra, Kesley Azevedo, Severina Lima, David Silva, Gabriela Xavier, Isac Davidson Pimenta, Ana Catherine da Silveira Gonçalves. Red meat consumption, risk of incidence of cardiovascular disease and cardiovascular mortality and effect of dose-response: a systematic review and meta-analysis of longitudinal cohort studies. PROSPERO 2019 CRD42019100914 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42019100914

Review question

What is the association between red meat consumption and incidence of cardiovascular disease and cardiovascular mortality considering the dose response?

To evaluate the association between red meat consumption and incidence of cardiovascular disease and cardiovascular mortality considering the dose response.

PI(E)COS

P- men and women.

E - red meat consumption.

C- risk of consumption amount and comparisons between Highest and lowest consumption amount

O- incidence of cardiovascular disease and cardiovascular mortality.

S - longitudinal cohort studies.

Searches

A search will performed in ten databases: PubMed, Scopus, SciELO, LILACS, ScienceDirect, Web of Science, Cochrane Library, WHOLIS, PAHO and EMBASE. The search equation was defined considering the following items: Diet as exposure; Red meat consumption (unprocessed red meat and processed meat); cardiovascular diseases as an outcome; and the type of study, prospective epidemiological studies (longitudinal cohort). No restriction will been adopted for the year of publication and language.

Search strategy for each database

For example:

PubMed - (consumption OR intake) AND (meat OR “red meat” OR beef OR

pork OR lamb OR goat OR “meat products” OR “processed meat”

OR ham OR sausage OR hamburger OR bacon OR salami OR

pastrami OR “luncheon meats”) AND (“cardiovascular disease” OR

“coronary artery disease” OR “heart disease” OR “myocardial

infarction” OR stroke OR “carotid artery disease” OR “heart

failure” OR “heart attack” OR Atherosclerosis OR “cerebrovascular

disease” OR “Peripheral vascular disease”) AND (cohort study).

Types of study to be included
Prospective epidemiological studies (longitudinal cohort).

Condition or domain being studied
Studies have shown an association between red meat consumption and cardiovascular diseases (CVD), such as coronary artery disease (CAD), stroke and / or heart failure (Bechthold et al., 2017; Micha et al., 2010, 2012). A meta-analysis assessed dietary intake and risk of all-cause mortality and found that each additional daily intake of 100 g of red meat was positively associated with the risk of all-cause mortality (Schwingshackl et al., 2017)

Given the relevance of the evidence that indicates the consumption of red meat and processed meat as a risk factor for the development of chronic non-communicable disease (World Health Organization, 2017) and for all-cause mortality, it is opportune to investigate the association between this consumption and its gradient, as well as to relate it to cardiovascular disease incidence and / or mortality, according to the sex and type of these diseases. Therefore, the aim of the present study is to evaluate the association between red meat (unprocessed red meat and processed meat) consumption and cardiovascular morbidity and mortality and the dose-response effect through a systematic review and meta-analysis.

Participants/population
The studies will be included in the review if they 1) were prospective epidemiological studies (longitudinal cohort); 2) provided information on the association between red (unprocessed and / or processed) meat consumption and cardiovascular disease morbidity and / or mortality. We will exclude studies that 1) were animal experiments; 2) evaluated the risk only related to the consumption of nutrients (animal protein, fat etc.); 3) who evaluated the risk only related to the consumption of general meat (adding consumption of white meat, red meat and processed meat). 4) studies that aggregate the results as total CVD, and do not report on any CVD (coronary artery disease, stroke, heart failure, or other) separately.

Intervention(s), exposure(s)

Exposure:
A prospective study that will evaluate the association between red meat (unprocessed red meat and / or processed meat) consumption and morbidity and / or mortality of cardiovascular disease.

Comparator(s)/control
Not applicable.

Context

Main outcome(s)
Incident and/ or mortality of cardiovascular disease (coronary artery disease, stroke, heart failure, and other).

Timing and effect measures

Relative risk (hazard ratio, risk ratio) with the 95% confidence intervals and the p-trend of the dose-response test.

Additional outcome(s)
None.

Data extraction (selection and coding)
After the selection of the studies, two reviewers will extract the following information: title, first author,

publication year, country, study name, population, participants characteristics (age, gender, sample size, nº events), duration of follow-up (y), person-years, disease outcome, disease ascertainment, dietary assessment, type of meat, consumption frequency or amount, statistical methods used for the analysis; risk estimates and confidence intervals, p-trend of dose-response test, and covariates that were matched or adjusted for in the multivariable analysis. When in doubt or discrepancies, a third researcher will be consulted.

Risk of bias (quality) assessment

The methodological quality of the studies will be assessed using the Newcastle-Ottawa scale (NOS), which evaluates the quality of non-randomized, cohort and case-control studies in relation to their design, content and ease of use. use. The evaluation will be performed by two independent researchers and when there are doubts or discrepancies a third researcher will be consulted.

Strategy for data synthesis

Data will be presented in summary tables and in narrative form to describe the characteristics of the included studies. They will structured around the type of CVD, characteristics of the target population and consumption of different types of red meat (unprocessed red meat and processed meat). We will provide summaries the association of the end multivariate model of red meat consumption with CVD for each study according to sex, when the study does not present results by sex, we will present the results of the analysis with aggregated data. When the study presents the risk analysis by red meat consumption ranges, we will provide a summary of the effects of the association between the highest consumption and the lowest.

The heterogeneity between trial results will be evaluated using a standard X^2 test with a significance level 0, 05. To assess heterogeneity, we plan to compute the I^2 statistic, which is a quantitative measure of inconsistency across studies. A value of 0% indicates no observed heterogeneity, whereas I^2 values of 50% indicate a substantial level of heterogeneity. If possible, funnel plots will be used to assess the presence of potential reporting biases. A linear regression approach will be used to evaluate funnel plot asymmetry.

Analysis of subgroups or subsets

We will perform sub analysis by sex, type of red meat consumption, CVD sub types and effect estimates according to their adjustments of covariates, if applicable.

Contact details for further information

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Review team members and their organisational affiliations

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Ms Kesley Azevedo. Universidade Federal do Rio Grande do Norte
Dr Severina Lima. Universidade Federal do Rio Grande do Norte
Ms David Silva.
Mrs Gabriela Xavier.
Mr Isac Davidson Pimenta. Universidade Federal do Rio Grande do Norte
Dr Ana Catherine da Silveira Gonçalves. Universidade Federal do Rio Grane do Norte

Type and method of review

Epidemiologic, Meta-analysis, Prevention, Systematic review

Anticipated or actual start date

07 January 2019

Anticipated completion date

30 August 2019

Funding sources/sponsors
None

Conflicts of interest

Language
English

Country
Brazil

Stage of review
Review Ongoing

Subject index terms status
Subject indexing assigned by CRD

Subject index terms
Cardiovascular Diseases; Cohort Studies; Humans; Incidence; Longitudinal Studies; Red Meat; Risk

Date of registration in PROSPERO
10 January 2019

Date of publication of this version
28 March 2019

Details of any existing review of the same topic by the same authors

Stage of review at time of this submission

Stage	Started	Completed
Preliminary searches	Yes	Yes
Piloting of the study selection process	Yes	Yes
Formal screening of search results against eligibility criteria	Yes	No
Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

Versions
10 January 2019
06 March 2019
28 March 2019

ANEXO 3 - PARECER CONSUBSTANCIADO DO CEP - EFEITOS DE UMA INTERVENÇÃO DE BASE ESCOLAR SOBRE A FUNÇÃO EXECUTIVA, COMPORTAMENTO SEDENTÁRIO E ESTADO NUTRICIONAL DE ADOLESCENTES

PARECER CONSUBSTANCIADO DO CEP

DADOS DA EMENDA

Título da Pesquisa: Efeitos de uma intervenção de base escolar sobre a função executiva, comportamento sedentário e estado nutricional de adolescentes.

Pesquisador: Grasiela Piuvezam

Área Temática:

Versão: 3

CAAE: 03316518.2.0000.5292

Instituição Proponente: Departamento de Saúde Coletiva

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 3.676.935

Apresentação do Projeto:

O presente estudo tem como objetivo avaliar o efeito de uma intervenção de base escolar sobre a função executiva, comportamento sedentário e estado nutricional de adolescentes. Metodologia: Trata-se de uma pesquisa experimental do tipo ensaio clínico randomizado. A população do estudo será composta por escolares da rede pública de ensino com idade entre 12 a 16 anos. A randomização seguirá os critérios adotados por cluster, onde serão sorteadas quatro escolas para participarem do estudo (Grupo Intervenção = 2 escolas e Grupo Controle = 2 escolas). A amostra será composta por 196 adolescentes por grupo, totalizando 392 adolescentes.

Objetivo da Pesquisa:

Avaliar o efeito de uma intervenção de base escolar sobre a função executiva, comportamento sedentário e estado nutricional de adolescentes.

Avaliação dos Riscos e Benefícios:

Descritos s endo os riscos menores que os benefícios.

Comentários e Considerações sobre a Pesquisa:

Trata-se de uma emenda com mais de 8 modificações com mudanças de titulo e divisão de grupos em vez de quatro grupos dois, um controle e um da pesquisa, recalculo e justificativa de n. Está claro que as mudanças foram para melhorar a qualidade e não encontrei motivo ético para

reprovar.

Considerações sobre os Termos de apresentação obrigatória:

Todos presentes.

Conclusões ou Pendências e Lista de Inadequações:

Não há pendências éticas.

Considerações Finais a critério do CEP:

1. Apresentar relatório parcial da pesquisa, semestralmente, a contar do início da mesma.
2. Apresentar relatório final da pesquisa até 30 dias após o término da mesma.
3. O CEP HUOL deverá ser informado de todos os efeitos adversos ou fatos relevantes que alterem o curso normal do estudo.
4. Quaisquer documentações encaminhadas ao CEP HUOL deverão conter junto uma Carta de Encaminhamento, em que conste o objetivo e justificativa do que esteja sendo apresentado.
5. Caso a pesquisa seja suspensa ou encerrada antes do previsto, o CEP HUOL deverá ser comunicado, estando os motivos expressos no relatório final a ser apresentado.
6. O TCLE deverá ser obtido em duas vias, uma ficará com o pesquisador e a outra com o sujeito de pesquisa.
7. Em conformidade com a Carta Circular nº. 003/2011CONEP/CNS, faz-se obrigatório a rubrica em todas as páginas do TCLE pelo sujeito de pesquisa ou seu responsável e pelo pesquisador.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_1428661_E1.pdf	07/10/2019 10:24:42		Aceito
Outros	Carta_Resposta_Pendencia.pdf	07/10/2019 10:21:39	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE_Resp_NOVO_modificado.docx	07/10/2019 10:17:50	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
Outros	Carta_Emenda.pdf	11/09/2019 15:06:26	Gidyenne Christine Bandeira Silva de	Aceito

Outros	Carta_Emenda.pdf	11/09/2019 15:06:26	Medeiros	Aceito
Projeto Detalhado / Brochura Investigador	Projeto_Emenda_Modificado.pdf	11/09/2019 12:32:05	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TALE_modificado.docx	11/09/2019 11:58:48	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE_modificado.docx	11/09/2019 11:56:48	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
Outros	Folha_Identificacao_Pesquisador_modificada.doc	11/09/2019 11:54:30	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
Folha de Rosto	Folha_rosto_EmendaModificada.pdf	11/09/2019 11:51:32	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
Outros	Carta_Pendencias.pdf	17/12/2018 12:19:17	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
Outros	CARTA_Anuencia.pdf	22/11/2018 19:52:59	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
Outros	TERMO_DE_AUTORIZACAO_DE_IMAGENS.pdf	22/11/2018 18:01:40	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
Outros	GRAVACAO_DE_VOZ.pdf	22/11/2018 18:00:43	Gidyenne Christine Bandeira Silva de Medeiros	Aceito
Outros	DECLARACAO_NAO_INICIO.pdf	22/11/2018 17:45:55	Gidyenne Christine Bandeira Silva de Medeiros	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

NATAL, 01 de Novembro de 2019

Assinado por:
jose diniz junior
(Coordenador(a))

Endereço: Avenida Nilo Peçanha, 620 - Prédio Administrativo - 1º Andar - Espaço João Machado
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ANEXO 4 - CARTA DE ANUÊNCIA - SECRETÁRIA ESTADUAL DE EDUCAÇÃO E CULTURA DO RN

GOVERNO DO ESTADO
DO RIO GRANDE DO NORTE
Secretaria de Estado da Educação e da Cultura – SEEC
Coordenadoria de Desenvolvimento Escolar - CODESE
Subcoordenadoria de Assistência ao Educando – SUASE

CARTA DE ANUÊNCIA

Solicitamos autorização institucional para realização da pesquisa intitulada **Efeitos de uma intervenção combinada de prática de exercícios físicos e educação alimentar e nutricional sobre a função executiva de adolescentes escolares** a ser realizada em escolas estaduais da rede pública de ensino de Natal/RN. Participarão deste estudo os pesquisador(es) Gidyenne Christine Bandeira Silva de Medeiros, Kesley Pablo Morais de Azevedo, e Victor Hugo de Oliveira Segundo, sob orientação da Profª Dra. Grasiela Piuvezam (pesquisadora responsável), que utilizará a seguinte metodologia: será uma pesquisa experimental do tipo ensaio clínico profilático. A população do estudo será adolescentes escolares da rede pública de ensino com idade entre 12 e 16 anos. As escolas públicas serão selecionadas por conveniência, em conjunto com a Secretaria Estadual de Educação e Cultura do RN (SEEC/RN), e em seguida elas serão alocadas por sorteio em um dos cinco grupos: Grupo de Intervenção Combinada (IC**),** Grupo de Intervenção nas atividades físicas (AF), Grupo de intervenção sobre comportamentos sedentários (CS), Grupo de intervenção na educação alimentar e nutricional (EAN), e um grupo controle. A amostra será composta por 205 adolescentes, 41 em cada grupo. Serão avaliados a [1]capacidade cognitiva através do computadorizado Teste de Stroop (Testinpacs®); o [2]comportamento sedentário através de questionário sobre o uso de equipamentos de tela; [3]marcadores antropométricos e [4]composição corporal através do peso corporal, a estatura, perímetro abdominal, dobras subescapular e tricipital, o estadiamento puberal auto-referido; [5]pressão arterial sistêmica através de esfigmomanômetro digital (aparelho de verificar pressão arterial); [6]parâmetros bioquímicos: glicemia de jejum, insulina de jejum, perfil lipídico e marcadores inflamatórios e de estresse oxidativo através da coleta de sangue no período da manhã, na própria escola, por profissional habilitado e capacitado, após jejum de 12 a 14 h; o [7]consumo alimentar através de questionário validado da Pesquisa Nacional de Saúde do Escolar; e [8]as barreiras e os facilitadores para práticas de atividades físicas, redução de comportamento sedentário e consumo alimentar saudável através de entrevista narrativa.

A pesquisa tem como objetivo principal avaliar o efeito de uma intervenção combinada de atividades físicas e educação alimentar e nutricional (EAN) sobre a função executiva, comportamento sedentário e consumo alimentar de adolescentes escolares, necessitando portanto, ter acesso as escolas estaduais (direção, professores, alunos, funcionários), a fim de implementar o ensaio clínico proposto.

Ao mesmo tempo, pedimos autorização para que o nome desta secretaria possa constar no relatório final e em futuras publicações na forma de

artigo científico e também autorização para realizarmos gravação de áudio, vídeo e registro fotográfico dentro das escolas com autorização prévia por escrito e verbal dos participantes.

Ressaltamos que os dados coletados, bem como o nome das escolas e o nome dos adolescentes serão mantidos em absoluto sigilo, de acordo com a Resolução do Conselho Nacional de Saúde (CNS/MS) 466/12, que trata da Pesquisa envolvendo Seres Humanos. E salientamos que tais dados serão utilizados tão somente para realização deste estudo.

Na certeza de contarmos com a colaboração e empenho desta secretaria agradecemos antecipadamente a atenção, ficando à disposição para quaisquer esclarecimentos que se fizerem necessários.

Natal, 20 de novembro de 2018.

Grasiela Piuvezam
Mat. SIAPE 2495705
Coordenadora do PPG Qualisaúde

Grasiela Piuvezam

(X) Concordamos com a solicitação. ( ) Não concordamos com a solicitação.

Mônica Maria Guimarães
Secretária Adjunta da Educação
e da Cultura
Portaria nº 237/2018-GSEC/RN

Cláudia Sueli Rodrigues Santa Rosa

Secretária Estadual de Educação e Cultura do RN