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Dissertação

Avaliação dietética em estudos com crianças e adolescentes com transtorno do espectro autista: Revisão sistemática de literatura

Eduarda de Souza Silva

Pelotas, 2022

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Dissertação apresentada ao Programa de Pós-Graduação em Nutrição e Alimentos da Faculdade de Nutrição da Universidade Federal de Pelotas, como requisito parcial à obtenção do título de Mestre em Nutrição e Alimentos

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SILVA, Eduarda de Souza. **Avaliação dietética em estudos com crianças e adolescentes com transtorno do espectro autista: Revisão sistemática de literatura.** Orientadora: Juliana dos Santos Vaz. 2022. 151f. Dissertação (Mestrado em Nutrição e Alimentos) - Faculdade de Nutrição, Programa de Pós-Graduação em Nutrição e Alimentos, Universidade Federal de Pelotas, Pelotas, 2022.

As dificuldades alimentares apresentadas por indivíduos com transtorno do espectro autista (TEA), a exemplo de recusa alimentar e repertório de alimentos limitado, influenciam diretamente na adequação da ingestão nutricional e alterações de peso corporal. Não há consenso entre os estudos sobre quais os métodos que devem ser aplicados na coleta e análises de dados sobre consumo alimentar desses pacientes. Neste contexto, o objetivo deste trabalho foi revisar a literatura para esclarecer como o consumo alimentar de crianças e adolescentes com TEA tem sido avaliado em estudos clínicos e epidemiológicos e analisar de forma crítica a qualidade dos protocolos de coleta e análise de dados dietéticos aplicados. Realizou-se uma revisão sistemática conduzida de acordo com as orientações do *Preferred Reporting Items for Systematic reviews and Meta-Analyses* e registrada no *International Prospective Register of Systematic Reviews* (CRD42020190229). As buscas foram conduzidas nas bases de dados PubMed, PsycINFO, SciELO e Web of Science. A busca foi inicialmente realizada em outubro de 2020 e a atualização em dezembro de 2021. Foram incluídos estudos observacionais e clínicos com avaliação do consumo alimentar de pacientes com TEA (≤19 anos), sendo excluídas revisões, resumos ou cartas editoriais. A avaliação metodológica da avaliação dietética foi realizada com a aplicação dos critérios do *Strengthening the Reporting of Observational Studies in Epidemiology - Nutritional Epidemiology* (STROBE-nut). Foram incluídos 94 estudos, sendo a maioria de delineamento transversal (n=61). Os instrumentos dietéticos mais

frequentes foram o registro alimentar (n=51) e o questionário de frequência alimentar (n=42). A maior parte dos estudos (n=54) empregou instrumentos com questões fechadas e não validados para população, e analisou o consumo de calorias (n=50) e nutrientes (n=59). Itens ou grupos alimentares foram analisados por 48 estudos. Características alimentares relacionadas ao TEA foram investigadas por análise de variedade alimentar (n=15), recusa alimentar (n=13), repertório alimentar (n=3) e consumo elevado diário de determinados itens alimentares (n=2). Ainda, 15 estudos avaliaram a seletividade alimentar. A pontuação média no STROBE-nut foi de 12.5 (5.5-17.5) e os itens referentes ao relato do protocolo de aplicação e validação dos instrumentos dietéticos não foram cumpridos na maior parte dos estudos (≥67%). A maioria dos estudos aplicou instrumentos não validados e/ou obteve baixa pontuação na avaliação do relato de itens referentes ao protocolo de investigação do consumo alimentar. Ressalta-se que futuras pesquisas devem ser criteriosas na elaboração de suas metodologias, visando aprimorar as evidências relacionadas aos aspectos nutricionais de pacientes com TEA.

SILVA, Eduarda de Souza. **Dietary assessment in studies with children and adolescents with autism spectrum disorder: A systematic literature review.** Advisor: Juliana dos Santos Vaz. 2022. 150f. Dissertation (Master's in nutrition and Food) - Faculty of Nutrition, Postgraduate Program in Nutrition and Food, Federal University of Pelotas, Pelotas, 2022.

The eating difficulties presented by individuals with autism spectrum disorder (ASD), such as food refusal and limited food repertoire, directly influence the adequacy of nutritional intake and body weight changes. There is no consensus among the studies on which methods should be applied in the collection and analysis of food intake data for these patients. In this context, the aime of this study was to review the literature to clarify how the dietary intake of children and adolescents with ASD has been evaluated in clinical and epidemiological studies and to critically analyze the quality of the applied dietary data collection and analysis protocols. A systematic review was performed according to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses and registered in the International Prospective Register of Systematic Reviews (CRD42020190229) was performed. Searches were conducted in the PubMed, PsycINFO, SciELO, and Web of Science databases. The search was initially conducted in October 2020 and updated in December 2021. Observational and clinical studies evaluating food intake in patients with ASD (≤19 years) were included, and reviews, abstracts, or editorial letters were excluded. The methodological evaluation of the dietary assessment was performed applying the Strengthening the Reporting of Observational Studies in Epidemiology - Nutritional Epidemiology (STROBE-nut) criteria. Ninety-four studies were included, the majority were cross-sectional in design (n=61). The most frequent dietary instruments were the food record

(n=51) and the food frequency questionnaire (n=42). Most studies (n=54) used closed questions and were not validated for the population and analyzed the intake of calories (n=50) and the intake of nutrients (n=59). Forty-eighty studies analyzed food items or food groups. Food characteristics associated with ASD were investigated by analysis of food variety (n=15), food refusal (n=13), food repertoire (n=3) and daily high consumption of certain food items (n=2). Furthermore, 15 studies evaluated dietary selectivity. The mean score on the STROBE-nut was 12.5 (5.5-17.5) and the items related to the reporting of the application protocol and the validation of the dietary instruments were not met in most studies (≥67%). Most studies applied nonvalidated instruments and/or obtained low scores in the evaluation of the report of items related to the food intake investigation protocol. It is emphasized that future research should be meticulous in developing its methodologies, in order to improve evidence related to the nutritional aspects of patients with ASD.

Keywords: Autism spectrum disorder. Food surveys. Food consumption. Diet.

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Lista de abreviaturas e siglas

ADHD *Attention deficit hyperactivity disorder*

ADI-R *The Autism Diagnostic Interview-Revised*

ADOS *The Autism Diagnostic Observation Schedule*

ALSPAC *Avon Longitudinal Study of Parents and Children*

ASD *Autism spectrum disorder*

BAMBI *Brief Autism Mealtime Behavior Inventory*

BPFAS *Behavioral Pediatrics Feeding Assessment Scale*

CDC *Center for Disease Control and Prevention*

CHAMPS *Children's Activity and Meal Patterns Study*

CID *Classification of Diseases*

DCNT Doenças Crônicas Não Transmissíveis

DD *Other developmental disorders*

DSM *Diagnostic and Statistical Manual of Mental Disorders*

E/I Estatura para idade

FFQ *Food frequency questionnaire*

FODMAPs *Fermentable oligosaccharides, disaccharides, monosaccharides, and polyols*

FR *Food record*

GFCF *Gluten-free and casein-free diet*

HEI Healthy Eating Index

HNMC *Non-medically complex history*

IBGE Instituto Brasileiro de Geografia e Estatística

MESH *Medical Subject Headings*

P/I	Peso para idade
PDD-NOS	*Pervasive Developmental Disorder Not Otherwise Specified*
PREDIMED	*Prevención con Dieta Mediterránea Study*
PRISMA	*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*
PROSPERO	*The International Prospective Register of Systematic Reviews*
QFA	Questionário de Frequência Alimentar
RA	Registro Alimentar
R24H	Recordatório Alimentar de 24 Horas
SN	*Special Needs*
SPIDER	*Sample, Phenomenon of Interest, Design, Evaluation, Research type*
STROBE-nut	*Strengthening the Reporting of Observational Studies in Epidemiology - Nutritional Epidemiology*
TD	*Typical development*
TDAH	Transtorno de Déficit de Atenção e Hiperatividade
TEA	Transtorno do espectro autista
TS	*Tourette Syndrome*
Vs.	*Versus*
ZOOM8	*Study on Nutrition and Physical Activity in Italian Primary School Children*
24HR	*24-hour food recall*

Lista de símbolos

> Maior

≥ Maior igual

<Menor

≤ Menor igual

= Igual

Sumário

Projeto de dissertação

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Instrumentos de avaliação do consumo alimentar empregados em estudos com crianças e adolescentes com transtorno do espectro autista: Revisão sistemática de literatura

Eduarda de Souza Silva

Pelotas, 2021

Resumo

O transtorno do espectro autista (TEA) é um distúrbio de neurodesenvolvimento que compromete os domínios de interação social e comportamentos. Entre as dificuldades características deste transtorno, as dificuldades alimentares, como recusa alimentar e repertório limitado são frequentemente observadas, elevando o risco para inadequações nutricionais e alterações de peso. Diferentes fatores influenciam no consumo alimentar desta população, como o uso de psicoativos que alteram o centro da fome e saciedade, os comportamentos inadequados nas refeições e os transtornos no processamento sensorial. Observa-se que os estudos que investigam o consumo alimentar de pacientes com TEA utilizam diferentes métodos para coleta de dados dietéticos. Este trabalho terá como objetivo revisar como o consumo alimentar de crianças e adolescentes com TEA tem sido avaliado em estudos clínicos e epidemiológicos e discutir a adequação dos instrumentos empregados frente às dificuldades alimentares características desta população. Será realizada uma revisão sistemática de literatura conduzida de acordo com as orientações do *Preferred Reporting Items for Systematic reviews and Meta-Analyses* e com atualização do protocolo no *International Prospective Register of Systematic Reviews* (CRD42020190229). Serão conduzidas buscas nas bases de dados *PubMed, SciELO, PsycINFO* e *Web of Science* por meio de chaves de busca compostas por termos identificados no *Medical Subject Headings.* Os estudos serão selecionados por dois revisores cegados com base nos critérios de elegibilidade previamente estabelecidos pelo acrônimo SPIDER. Serão incluídos estudos clínicos e epidemiológicos que investiguem o consumo alimentar de crianças e adolescentes com TEA (até 19 anos) e serão excluídos estudos de revisão, resumos e cartas ao editor. As discordâncias entre os revisores serão resolvidas por um revisor sênior. A avaliação do relato metodológico será realizada por meio da aplicação do *Strengthening the Reporting of Observational Studies in Epidemiology—Nutritional Epidemiology*. Espera-se identificar os principais instrumentos aplicados na avaliação do consumo alimentar, incluindo a identificação de instrumentos adaptados e não validados para população alvo. Ainda, será possível a identificação das principais variáveis dietéticas analisadas para avaliar o consumo alimentar no TEA. Este trabalho agregará conhecimento sobre os métodos aplicados na investigação do consumo alimentar de pacientes com TEA,

bem como identificará critérios necessários para correta redação de metodologias aplicadas em trabalhos futuros.

Palavras-chave: Transtorno do Espectro Autista. Inquéritos sobre Dietas. Consumo Alimentar. Criança. Adolescente. Revisão Sistemática.

Abstract

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that compromises the domains of social interaction and behaviors. Among the difficulties characteristic of this disorder, eating difficulties, such as food refusal and limited repertoire, are frequently observed, increasing the risk of nutritional deficiencies and weight changes. Different factors influence food consumption in this population, such as the use of psychoactive drugs that alter the center of hunger and satiety, inappropriate meal behaviors, and sensory processing disorders. Studies investigating the food intake of patients with ASD have been found to use different methods to collect dietary data. This dissertation aims to review how the food intake of children and adolescents with ASD has been evaluated in clinical and epidemiological studies and to discuss the suitability of the instruments used in relation to the eating difficulties characteristic of this population. A systematic literature review will be conducted according to the guidelines of the Preferred Reporting Items for Systematic reviews and Meta-Analyses with a protocol update in the International Prospective Register of Systematic Reviews (CRD42020190229). Searches will be conducted in PubMed, SciELO, PsycINFO, and Web of Science databases using search keys composed of terms identified in the Medical Subject Headings. Studies will be selected by two blinded reviewers based on the eligibility criteria previously established by the acronym SPIDER. Clinical and epidemiological studies investigating the food intake of children and adolescents with ASD (up to 19 years) will be included, and review studies, abstracts, and letters to the editor will be excluded. Disagreements between reviewers will be resolved by a senior reviewer. Methodological reporting will be assessed by applying the Strengthening the Reporting of Observational Studies in Epidemiology-Nutritional Epidemiology. It is expected to identify the main instruments applied in the assessment of food intake, including the identification of instruments adapted and not validated for the target population. Furthermore, it will be possible to identify the main dietary variables analyzed to assess food intake in ASD. This work will add knowledge about the methods applied in the investigation of food intake in patients with ASD, as well as identify criteria necessary for the correct writing of methodologies applied in future works.

Keywords: Autistic Spectrum Disorder. Dietary Surveys. Food Consumption. Child. Adolescent. Systematic Review.

1. Introdução

O Transtorno do espectro autista (TEA) é um distúrbio de neurodesenvolvimento, geralmente diagnosticado durante a infância e caracterizado por diferentes graus de déficits em dois domínios: I) comunicação e interação social e II) presença de padrões restritivos e repetitivos de comportamentos, ações e interesses (AMERICAN PSYCHIATRIC ASSOCIATION, 2013). A etiologia desta desordem está relacionada a interação de múltiplos fatores genéticos e ambientais (BÖLTE; GIRDLER; MARSCHIK, 2019; WIŚNIOWIECKA-KOWALNIK; NOWAKOWSKA, 2019).

Segundo estudos de monitoramento realizados pelo *Center for Disease Control and Prevention* (CDC) em 11 estados dos Estados Unidos, a prevalência desta desordem tem se elevado exponencialmente nos últimos anos, sendo a última estimativa de 23 casos a cada 1.000 crianças de 8 anos de idade, ou seja, 1 para 44 (MAENNER, 2020; MAENNER, 2021). O aumento de casos pode ser explicado pelas alterações realizadas nos critérios diagnósticos e pelo aumento da capacitação profissional para identificação precoce de TEA (KING; BEARMAN, 2009).

Entre dificuldades associadas aos indivíduos com TEA, aquelas relacionadas ao consumo alimentar apresentam prevalências entre 46 e 89%, sendo observadas com mais frequência nesta população quando comparada com pacientes em sem desordens de neurodesenvolvimento (SHARP et al., 2013). Estas dificuldades alimentares podem ser causadas por fatores ambientais, comportamentais e intrínsecos que influenciam direta ou indiretamente na ingestão alimentar destes indivíduos (ESTEBAN-FIGUEROLA et al., 2019; MARÍ-BAUSET et al., 2014; SHARP et al., 2013). A seletividades alimentar caracterizada pela alta recusa e repertório limitado de alimentos é frequentemente observada em crianças com TEA (BANDINI et al., 2010; CURTIN et al., 2015).

Além disso, fatores como problemas comportamentais durante as refeições (CASTRO et al., 2016; CURTIN et al., 2015), sensibilidade sensorial (CERMAK; CURTIN; BANDINI, 2010), uso de medicamentos psicoativos (DOVE et al., 2012) e distúrbios gastrointestinais (VISSOKER; LATZER; GAL, 2015) parecem exercer influência sobre as escolhas e consumo dos alimentos por essa população, sendo

frequentemente observada a ingestão insuficiente de nutrientes e alterações de estado nutricional (CASTRO et al., 2016; SHARP et al., 2018).

Diante das repercussões geradas por estas dificuldades alimentares na saúde desta população, é de extrema importância que sejam conduzidas investigações para estabelecer associações entre consumo alimentar e doença (PEREIRA; SICHIERI, 2007). Diferentes instrumentos são utilizados para avaliar o consumo alimentar em pacientes com TEA (MARÍ-BAUSET et al., 2015). Observa-se que entre estes instrumentos alguns são considerados clássicos, como o registro alimentar (RA), o recordatório alimentar de 24 horas (R24H) e o questionário de frequência alimentar (QFA) (PEREIRA; SICHIERI, 2007; SHIM; OH; KIM, 2014). No entanto, métodos adaptados e não validados como o uso de *checklists* de alimentos e instrumentos desenvolvidos para populações distintas são referenciados em alguns estudos, não sendo indicado o uso destes métodos devido a inespecificidade dos instrumentos para população investigada (BANDINI et al., 2010; MARÍ-BAUSET et al., 2015; SCHRECK; WILLIAMS; SMITH, 2004).

Considerando os vieses inerentes à avaliação do consumo alimentar, bem como os diferentes fatores que interferem no consumo alimentar nesta população, a escolha de instrumentos não validados ou com investigação limitada pode acarretar erros na mensuração dietética (PEREIRA; SICHIERI, 2007; SHIM; OH; KIM, 2014).

2. Referencial teórico

2.1. Transtorno do espectro autista

2.1.1. Conceito e diagnóstico

O termo autismo foi inicialmente utilizado em 1911 pelo médico psiquiatra Eugen Bleuler para caracterizar pacientes com graves sintomas comportamentais (EVANS, 2013). Somente em 1943, o autismo foi associado a uma síndrome com influências sobre a interação social, comportamentos e função cognitiva (EVANS, 2013; VERHOEFF, 2013).

O conceito e os critérios diagnósticos de TEA passaram por diversas modificações até sua versão atual definida pelo *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) (AMERICAN PSYCHIATRIC ASSOCIATION, 2013). Os critérios diagnósticos de Transtorno Autista, Síndrome de Asperger e Transtorno Global do Desenvolvimento, passaram a ser agrupados em um único diagnóstico definido como transtorno do espectro autista (TEA), podendo este ser classificado conforme a intensidade dos sintomas em grau leve, moderado ou grave. Esta unificação de critérios diagnósticos foi implementada pela última versão da *Classification of Diseases* (CID) (WORD HEALTH ORGANIZATION, 2020).

Dentre os critérios diagnósticos estabelecidos pelo DSM-5 (2013), destacam-se os distúrbios nos domínios de comunicação e interação social, e a presença de comportamentos e interesses restritivos e repetitivos. Os sintomas do TEA costumam surgir na primeira infância, podendo ser observados entre 12 e 48 meses de idade, mas o diagnóstico geralmente é realizado em torno dos 36 meses de idade (AMERICAN PSYCHIATRIC ASSOCIATION, 2013).

O amplo espectro de características clínicas deste distúrbio, bem como especificidades, como o grau de severidade e idade cronológica, podem tornar difícil o reconhecimento e diagnóstico (JOHNSON; MYERS, 2007). Para auxiliar os profissionais durante o diagnóstico foram validados alguns instrumentos baseados nos critérios estabelecidos pelo DSM e CID, sendo estes também aplicados em recrutamentos de estudos realizados com indivíduos com TEA, tendo como exemplos o *The Autism Diagnostic Observation Schedule* (ADOS) e o *The Autism Diagnostic Interview-Revised* (ADI-R) (VLLASALIU et al., 2016). Ainda, como meio para avaliar a severidade dos sintomas de TEA foram desenvolvidas escalas, a exemplo da

Childhood Autism Rating Scale (CARS), já validada para uso no Brasil (PEREIRA; RIESGO; WAGNER, 2008).

2.1.2. Etiologia e prevalência

Estudos apontam que a etiologia do TEA apresenta causa multifatorial incluindo a interação entre genes e influências de modificadores ambientais pré e perinatais, que alteram a expressão gênica (BÖLTE; GIRDLER; MARSCHIK, 2019).

Os fatores genéticos envolvidos na etiologia desta desordem se evidenciam primeiramente pela hereditariedade, observada em estudos realizados irmãos gêmeos, onde associações de TEA se apresentam maiores entre gêmeos monozigóticos (COLVERT et al., 2015; TICK et al., 2016). Um estudo de coorte multinacional que avaliou dados de mais de 2 milhões de indivíduos de cinco países (Dinamarca, Finlândia, Suécia, Israel e Austrália Ocidental), estimou a hereditariedade do TEA em aproximadamente 80% (BAI et al., 2019). No entanto, as estimativas de prevalência deste fator genético podem alcançar valores acima de 95% (BÖLTE; GIRDLER; MARSCHIK, 2019). Além disso, observa-se uma relação entre o TEA e as síndromes genéticas, a exemplo da Síndrome do X-Frágil que se apresenta em aproximadamente 3% dos pacientes com TEA (LEVY; MANDELL; SCHULTZ, 2009).

Apesar de consolidada a influência dos fatores genéticos, estudos indicam que fatores ambientais como idade avançada dos pais, exposições tóxicas, e eventos perinatais e obstétricos, participam de forma significativa do desenvolvimento do TEA (BÖLTE; GIRDLER; MARSCHIK, 2019; GRABRUCKER, 2013).

O último estudo realizado pelo *Centers for Disease Control and Prevention* (CDC) evidenciou uma prevalência de 23 casos a cada 1.000 (1 para 44) crianças com 8 anos de idade, sendo esta estimativa maior do que a anterior de 1 para 54 (MAENNER, 2020; MAENNER, 2021. Observou-se também uma redução na razão de prevalência de acordo com o gênero, sendo esta 4.2 vezes maior entre os meninos (MAENNER, 2021). No Brasil poucos estudos investigaram a prevalência de TEA. Um estudo com participantes da coorte de nascidos vivos de 2004 em Pelotas, no Rio Grande do Sul, apontou uma prevalência de 0,7% para meninos e 0,1% para meninas (LA MAISON et al., 2018). Enquanto, o estudo realizado por PAULA et al. (2011) com crianças de 7 a 12 anos residentes do estado de São Paulo, estimou uma prevalência de 0,3%. No entanto, deve-se observar que as amostras destes estudos não são representativas a nível nacional.

Com a aprovação da inclusão de dados sobre autismo no próximo Censo Demográfico, com previsão de início em 2022 pelo Instituto Brasileiro de Geografia e Estatística (IBGE) espera-se obter uma melhor estimativa da prevalência de casos no país (BRASIL, 2019). Entretanto, esta estimativa pode não ser acurada devido aos métodos empregados durante a triagem de casas participantes do censo.

2.1.3. Dificuldades alimentares no transtorno do espectro autista

Apesar de serem considerados comuns as alterações no consumo alimentar referentes a qualidade e quantidades consumidas durante as diferentes fases do crescimento e desenvolvimento, o diagnóstico de TEA tem sido associado à maior presença de dificuldades alimentares (BANDINI et al., 2010; SHARP et al., 2013). Estudos apontam que crianças e adolescentes com TEA tem prevalências elevadas de dificuldades alimentares, com estimativas alcançando 89% (BANDINI et al., 2010; MARÍ-BAUSET et al., 2014; SEIVERLING et al., 2018; SHARP et al., 2013).

A seletividade alimentar tem recebido grande destaque no meio científico por ser frequentemente observada em crianças com TEA (CERMAK; CURTIN; BANDINI, 2010; SHARP et al., 2013). Alguns autores que investigaram a seletividade alimentar a definiram como a alta recusa de alimentos acompanhada de um repertório alimentar limitado e o alto consumo de um único alimento (BANDINI et al., 2010; CURTIN et al., 2015). BANDINI et al. (2010) observaram que crianças com TEA, entre 3 e 11 anos, apresentavam significativamente maior recusa alimentar (41,7% vs. 18,9%) e um consumo mais limitando de itens alimentares (19,0% vs. 22,5%) quando comparadas a crianças de mesma faixa etária em desenvolvimento típico. Diferindo-se do estudo citado, SHARP et al. (2018) definiram em seu estudo os seguintes critérios de seletividade alimentar: recusa completa de um ou mais grupos alimentares e a baixa aceitabilidade de itens alimentares semanalmente. Como resultado os autores observaram que 78,0% das crianças omitiram 1 ou mais grupos alimentares, enquanto 38,5% das crianças omitiram ao menos 1 grupo alimentar.

Diversos fatores podem influenciar no consumo alimentar observado nesta população. Um exemplo pouco explorado é o uso de medicamentos, à exemplo de antipsicóticos e anticonvulsionantes (DOVE et al., 2012; ROBINSON et al., 2012). Estes medicamentos são utilizados no controle de sintomas comportamentais como a irritabilidade e agitação, bem como no tratamento de outras doenças psiquiátricas que podem se apresentar como comorbidades em indivíduos com TEA, à exemplo do

transtorno de déficit de atenção e hiperatividade (TDAH) e epilepsia (DOVE et al., 2012; ROBINSON et al., 2012; LEVY et al., 2010; SIMONOFF et al., 2008). Estudos indicam que o uso contínuo destes medicamentos ocasiona efeitos adversos como aumento de apetite e ganho de peso corporal (DOVE et al., 2012; POSEY et al., 2008).

Entre os fatores fisiológicos que podem ser relacionados ao consumo alimentar de indivíduos com TEA, pode-se citar a presença de sintomas gastrointestinais (MARÍ-BAUSET et al., 2014; VISSOKER; LATZER; GAL, 2015). Uma meta-análise realizada por MCELHANON et al. (2014), com estudos que investigaram a presença de sintomas gastrointestinais em crianças com TEA, observou que esta população, quando comparadas à controles em desenvolvimento típico, apresentavam maiores chances de manifestar sintomas de diarreia (OR: 3.63; 1.82–7.23), constipação (OR: 3.86; 2.23–6.71) e dor abdominal (OR: 2.45; 1.19–5.07).

Ainda, alterações no processamento sensorial, como hipo ou hipersensibilidade sensorial, podem contribuir para seletividade alimentar observada em indivíduos com TEA, que se associam a afinidade e recusa por alimentos de acordo com suas características de textura, sabor, cor, temperatura, cheiro e apresentação (CERMAK; CURTIN; BANDINI, 2010; MARÍ-BAUSET et al., 2014). Em especial, são observadas preferências por alimentos com alto teor de carboidratos, lanches e processados, sendo a preferência por texturas uma das características mais relatadas (SHARP et al., 2013). Estas alterações sensoriais, bem como a frequente preferência por texturas podem ainda ser resultado de habilidades motoras orais pouco desenvolvidas. (MANNO et al., 2005; MARÍ-BAUSET et al., 2014).

O domínio comportamental é um importante influenciador do hábito alimentar de crianças com TEA que apresentam desde comportamentos relacionados a recusa alimentar, como comportamentos repetitivos ou restritos relacionados aos alimentos (LUÇARDO et al., 2020; LUKENS; LINSCHEID, 2008; MARÍ-BAUSET et al., 2014). Para investigação de comportamentos relacionados aos momentos da alimentação diferentes instrumentos são utilizados, a exemplo do *Behavioral Pediatrics Feeding Assessment Scale* (BPFAS) e o *Brief Autism Mealtime Behavior Inventory* (BAMBI), sendo este último desenvolvido e validado especificamente para crianças com TEA (ALLEN et al., 2015; LUKENS; LINSCHEID, 2008). Estudos que investigam o comportamento no momento das refeições, observaram que os responsáveis de crianças e adolescentes com TEA relataram mais problemas comportamentais

durante as refeições, do que os responsáveis de crianças em desenvolvimento típico (CASTRO et al., 2016; CURTIN et al., 2015; MALHI et al., 2017).

2.1.4. Estado nutricional no transtorno do espectro autista

Os dados encontrados sobre o estado nutricional de pacientes com TEA reportam baixo peso para idade, eutrofia e excesso de peso (MARÍ-BAUSET et al., 2015). Apesar disso, vários estudos observam alta frequência de excesso de peso nesta população. Um estudo realizado na cidade de Pelotas observou uma prevalência de 66% de excesso de peso nessa população (LUÇARDO et al., 2020). Enquanto, outro estudo, realizado no mesmo estado, observou o excesso de peso em quase 50% de sua amostra, que apresentou frequências de 36,7% e 10,2% para obesidade e sobrepeso, respectivamente (CASTRO et al., 2016).

Sabe-se que as dificuldades alimentares apresentadas por crianças e adolescentes com TEA influenciam diretamente na ingestão alimentar. Estudos indicam que indivíduos com TEA apresentam maiores inadequações nutricionais quando comparados com valores de referência e indivíduos em desenvolvimento típico (CASTRO et al., 2016; MEGUID et al., 2017; SHARP et al., 2018). Entre as inadequações nutricionais observadas, destaca-se o consumo insuficiente de vitaminas e minerais (MARÍ-BAUSET et al., 2015). Além disso, estudos que investigaram de maneira qualitativa as preferências alimentares em crianças com TEA, observaram uma maior recusa por alimentos fontes de vitaminas e minerais, como frutas e vegetais (AL-KINDI et al., 2020; SCHRECK; WILLIAMS; SMITH, 2004).

A inadequação da ingestão alimentar combinada a outros fatores como o uso de medicamentos, expõe estes indivíduos ao desenvolvimento de comorbidades metabólicas, à exemplo da obesidade e hipertrigliceridemia (LUÇARDO et al., 2020; POSEY et al., 2008; SHARP et al., 2018).

2.2. Avaliação do consumo alimentar

A avaliação do consumo alimentar consiste na investigação da ingestão dietética de indivíduos e populações, podendo esta ser avaliada de forma qualitativa ou quantitativa para fornecer diferentes dados de consumo, tais como energia, nutrientes, tipos de alimentos, entre outros (PEREIRA; SICHIERI, 2007).

Durante a infância e adolescência observa-se crescimento e desenvolvimento acentuados, sendo estes influenciados por fatores ambientais, socioeconômicos e

genéticos. Entre os fatores ambientais pode-se citar a nutrição, nestas fases ocorre um aumento na demanda de energia e nutrientes para que o crescimento e desenvolvimento ocorram de forma adequada (ROGOL; CLARK; ROEMMICH, 2000). Tanto as carências nutricionais quanto os hábitos alimentares inadequados observados na infância podem repercutir de forma negativa na vida adulta, elevando o risco de morbidades (LLEWELLYN et al., 2016).

Sabe-se que alterações nos hábitos e escolhas alimentares ocorrem durante as diferentes fases de crescimento, por exemplo, as crianças menores de 2 anos passam pelo período de transição alimentar, enquanto as crianças em idade escolar e adolescentes passam a sofrer maiores influências psicossociais sob o seu consumo alimentar (ORTIZ-ANDRELLUCCHI et al., 2009). Tais características podem dificultar a análise descritiva do consumo de energia e nutrientes nestas faixas etárias, porém a avaliação dietética é de extrema importância para avaliação do estado nutricional desta população (LIVINGSTONE; ROBSON; WALLACE, 2004).

Considerando as diferenças nos hábitos alimentares observados entre as faixas etárias, é necessário que sejam considerados alguns fatores para escolha do instrumento dietético. Dentre os fatores que influenciam nesta decisão, as características da população como a idade e habilidades cognitivas merecem atenção, uma vez que crianças com desenvolvimento típico, principalmente em idade pré-escolar, podem não ser capazes de realizar o relato correto do seu consumo devido à ausência da alfabetização, conhecimento limitado sobre tempo e desconhecimento sobre tipos de alimentos, preparações ou ingredientes adicionais (PÉREZ-RODRIGO et al., 2015).

Deve-se ainda considerar que apesar de se observar uma menor variabilidade de ingestão de energia e nutrientes em crianças, ocorrem mudanças nos padrões de consumo quanto aos tipos de alimentos consumidos entre as fases da infância e adolescência, não sendo comum a observação atenta ao tamanho da porção consumida nestas faixas etárias, acarretando em imprecisão de quantidades e omissões de alimentos durante os relatos (viés de memória) (DE CASTRO et al., 2014; LIVINGSTONE; ROBSON; WALLACE, 2004; MAGAREY et al., 2011). Diante destas limitações, os instrumentos empregados em estudos nesta população são frequentemente adaptados para o relato dos responsáveis (LIVINGSTONE;

ROBSON; WALLACE, 2004; MAGAREY et al., 2011; ORTIZ-ANDRELLUCCHI et al., 2009).

Além disso, para escolha do instrumento deve-se considerar que indivíduos em idade escolar passam um período fora de casa, de forma que podem ser perdidos alguns dados de consumo ou estes podem ser relatados de forma imprecisa (LIVINGSTONE; ROBSON; WALLACE, 2004; ORTIZ-ANDRELLUCCHI et al., 2009). Em situações em que a criança frequenta diferente locais durante o dia ou é supervisionada por diferentes responsáveis, sugere-se que sejam realizados relatórios adicionais preenchidos por todos os responsáveis pelo cuidado da criança para que sejam obtidas as informações dietéticas completas (MAGAREY et al., 2011).

Diferentes instrumentos têm sido utilizados na avaliação do consumo em crianças e adolescentes, sendo o QFA frequente nestas investigações (ORTIZ-ANDRELLUCCHI et al., 2009). Observa-se também que estão sendo desenvolvidos QFAs específicos para aplicação nas diferentes faixas etárias, sendo alguns próprios para autopreenchimento (ORTIZ-ANDRELLUCCHI et al., 2009).

Sugere-se que crianças com desenvolvimento típico entre 8 e 10 anos de idade são capazes de reportar seu consumo alimentar (LIVINGSTONE; ROBSON; WALLACE, 2004). No entanto, para utilização de instrumentos preenchidos pelos participantes, deve-se considerar possíveis vieses de memória e relato, e no caso de instrumentos quantitativos (QFA semiquantitativo, quantitativo ou R24H), é possível que as crianças entrevistadas apresentem relatos imprecisos sobre as quantidades consumidas, reforçando a necessidade de supervisão dos responsáveis para auxílio durante o relato (MCPHERSON et al., 2000; ORTIZ-ANDRELLUCCHI et al., 2009).

Ao avaliar a ingestão dietética deve-se considerar a presença de variabilidades de consumo intraindividual e interindividual, ou seja, diferenças diárias no consumo de indivíduos e entre indivíduos. Estas alterações nos padrões alimentares dificultam a análise dietética, de forma que são encontrados atualmente na literatura instrumentos e métodos dietéticos para esta avaliação (HENRÍQUEZ-SÁNCHEZ et al., 2009; SHIM; OH; KIM, 2014).

2.2.1. Avaliação do consumo alimentar de crianças e adolescentes com transtorno do espectro autista

O estado nutricional tem influência sob a saúde geral e a necessidade de cuidados em crianças com deficiência neurológicas, podendo a deficiência de nutrientes afetar os domínios comportamentais, sociais e cognitivos (PENAGINI et al., 2015). Ainda, em crianças e adolescentes com TEA o acompanhamento do estado nutricional e ingestão dietética é de extrema importância, visto que são frequentes e diversas as dificuldades alimentares apresentadas por essa população (SHARP et al., 2013).

A escolha do método de avaliação da ingestão dietética para aplicação em estudos com pacientes com TEA deve levar em consideração não somente os fatores supracitados para avaliação destas faixas etárias, mas também ao grau de desenvolvimento cognitivo apresentado pela criança (LIVINGSTONE; ROBSON; WALLACE, 2004). Sabe-se que o TEA é um distúrbio de neurodesenvolvimento que pode se apresentar em diferentes graus de severidade, ocasionando déficits nos domínios de interação social, comportamentos e intelectual (AMERICAN PSYCHIATRIC ASSOCIATION, 2013; MAENNER, 2020). Assim, algumas crianças com diagnóstico de TEA podem apresentar limitações cognitivas e na comunicação, impossibilitando que auxiliem no preenchimento de instrumentos para avaliação do consumo alimentar (AMERICAN PSYCHIATRIC ASSOCIATION, 2013; LIVINGSTONE; ROBSON; WALLACE, 2004; PÉREZ-RODRIGO et al., 2015).

Observa-se na literatura que os estudos cujo objetivo foi investigar o consumo e a seletividade de crianças e adolescentes com TEA utilizam diversos instrumentos dietéticos para essas finalidades, incluindo instrumentos fechados e adaptados, a exemplo do QFA. Estes instrumentos aplicados de maneira independente podem não ser adequados para investigar a real ingestão alimentar destes indivíduos por não considerarem os fatores comportamentais e de processamento sensorial que influenciam direta e indiretamente no consumo e escolha de alimentos (MARÍ-BAUSET et al., 2014, 2015).

2.2.2. Instrumentos de avaliação do consumo alimentar

Os instrumentos de avaliação do consumo alimentar se diferenciam entre prospectivos, que investigam o consumo atual, a exemplo do RA estimado e com

pesagem de alimentos; e retrospectivos, que investigam o consumo em determinado período do passado, a exemplo do QFA (PEREIRA; SICHIERI, 2007; SHIM; OH; KIM, 2014).

Estes instrumentos podem ainda investigar o consumo por meio de relatório subjetivo ou observação direta. O relatório subjetivo inclui pesquisas abertas ou fechadas, considerando-se o método aberto aquele que permite investigar de forma mais ampla e detalhada a ingestão de alimentos e as condições do consumo (método de preparo, horário e local de consumo), a exemplo do R24H e o RA. Enquanto o método de pergunta fechada avalia o consumo de forma mais restrita, a exemplo do QFA, onde a investigação do consumo é limitada a certo número de alimentos e porções previamente elencados (SHIM; OH; KIM, 2014). Por outro lado, a observação objetiva consiste em métodos de análise de amostras da dieta do paciente ou pesagem de alimentos aplicados por pesquisadores treinados (SHIM; OH; KIM, 2014).

O RA é um método aberto e prospectivo, onde os alimentos e bebidas consumidos são registrados em tempo real, podendo ainda ser pesados para melhor exatidão das quantidades (NASKA; LAGIOU; LAGIOU, 2017; SHIM; OH; KIM, 2014). Por ser um método de registro em tempo real, o RA costuma ser preenchido pelo entrevistado, de forma que é suscetível ao viés de registro e às alterações nos hábitos alimentar durante o estudo (PEREIRA; SICHIERI, 2007; SHIM; OH; KIM, 2014). Enquanto, o R24H é um instrumento aplicado por pesquisados treinados, que avalia de forma aberta e retrospectiva a ingestão dos alimentos consumidos no dia anterior a entrevista, de forma que é passível ao viés de memória por parte do entrevistado (PEREIRA; SICHIERI, 2007).

Ambos os métodos, apesar de abrangentes devido a possibilidade de coletar informações detalhadas do consumo alimentar, exigem múltiplas aplicações para captar a variabilidade intrapessoal e analisar do consumo usual. Além disso, estudos que optam por estes dois métodos devem considerar questões referentes a sazonalidade dos alimentos e o grau de instrução dos entrevistados, uma vez que são métodos que exigem maior comprometimento dos participantes (PEREIRA; SICHIERI, 2007; SHIM; OH; KIM, 2014).

O QFA é o instrumento mais frequentemente utilizados em estudos epidemiológicos devido ao seu baixo custo e facilidade de aplicação (HENRÍQUEZ-SÁNCHEZ et al., 2009). Este método consiste em uma avaliação fechada e retrospectiva do consumo alimentar, geralmente avaliando a frequência de consumo

nos 12 meses anteriores a entrevista possibilitando a análise do consumo usual dos indivíduos (HENRÍQUEZ-SÁNCHEZ et al., 2009; PEREIRA; SICHIERI, 2007). Este instrumento diferencia-se em qualitativo, que avalia somente os tipos de alimentos consumidos; semiquantitativo, que investiga a porção consumida por meio de uma referência e quantitativo, que investiga a porção consumida de forma aberta (PEREIRA; SICHIERI, 2007; SHIM; OH; KIM, 2014).

Apesar de amplamente utilizado, o QFA não é um instrumento indicado para análises descritivas do consumo alimentar por não levar em consideração o padrão de consumo do indivíduo. Além disso, este instrumento limita a sua avaliação à uma lista pré-definida de alimentos, exigindo que o instrumento seja validado e representativo para a população alvo da pesquisa (HENRÍQUEZ-SÁNCHEZ et al., 2009; PEREIRA; SICHIERI, 2007; SHIM; OH; KIM, 2014). Além disso, a maioria dos QFAs é desenvolvido para preenchimento do entrevistado, de forma que além do viés de memória, por ser retrospectivo, é suscetível ao sub ou supra-relato (HENRÍQUEZ-SÁNCHEZ et al., 2009; PEREIRA; SICHIERI, 2007).

Diferentes fatores metodológicos podem acarretar erros nas medidas de consumo alimentar de indivíduos ou populações (RIBAS-BARBA et al., 2009). A fim de reduzir possíveis vieses, a escolha de um instrumento de avaliação do consumo alimentar deve ser realizada levando-se em consideração o objetivo e o desenho do estudo, as características da população e os recursos disponíveis (PEREIRA; SICHIERI, 2007; RIBAS-BARBA et al., 2009; SHIM; OH; KIM, 2014).

Alguns pontos são essenciais para evitar vieses relacionados ao protocolo de aplicação e análise dos instrumentos, como a padronização dos dados coletados por meio da disponibilização de treinamento para o responsável pelo preenchimento do instrumento; uso de materiais para padronização do registro de medidas caseiras; considerar a sazonalidade e a cultura local da população em foco; utilizar tabelas de recomendações dietéticas representativas e atualizadas para população e optar por instrumentos que tenham sido validados por meio de comparação com métodos considerados padrão outro como a água duplamente marcada e os biomarcadores nutricionais (PEREIRA; SICHIERI, 2007; RIBAS-BARBA et al., 2009; SHIM; OH; KIM, 2014).

A combinação de métodos tem sido utilizada para redução de viés e melhor precisão na avaliação do consumo alimentar (SHIM; OH; KIM, 2014). Sugere-se que a combinação de dois métodos distintos como, por exemplo, o RA com o QFA, tornaria

possível que as informações dietéticas coletadas se complementassem, possibilitando a utilização de dados da probabilidade dos alimentos em determinado período, bem como quantidades detalhadas deste consumo (PEREIRA; SICHIERI, 2007).

3. Justificativa

O TEA é um distúrbio do neurodesenvolvimento infantil definido por distúrbios de interação social e pela presença de comportamentos e interesses restritivos e repetitivos (AMERICAN PSYCHIATRIC ASSOCIATION, 2013; WORD HEALTH ORGANIZATION, 2019). Além disso, são frequentes as dificuldades alimentares nestes pacientes, sendo estas ocasionadas por diferentes fatores como a sensibilidade sensorial, uso de medicamentos com ação no centro de fome e saciedade e comportamentos perturbadores durante as refeições (CERMAK; CURTIN; BANDINI, 2010). A presença de dificuldades alimentares repercute em maior recusa de alimentos, limitando o repertório alimentar, muitas vezes constituído com poucos alimentos fontes de vitaminas e mineiras (BANDINI et al., 2010).

Estudos que investigam o consumo alimentar em crianças e adolescentes com TEA observam inadequações nutricionais indicando principalmente o baixo consumo de micronutrientes (ESTEBAN-FIGUEROLA et al., 2019; SHARP et al., 2013). No entanto, deve-se observar que estes estudos utilizam diversos instrumentos para esta avaliação. Alguns destes instrumentos podem não apresentar resultados acurados, pois não consideram as características alimentares do TEA como, por exemplo, o uso de inquéritos alimentares fechados não permite uma ampla investigação do consumo em casos de seletividade alimentar ocasionada por transtornos no processamento sensorial (BANDINI et al., 2010; MARÍ-BAUSET et al., 2015). Ainda, análises de consumo para características do TEA, a exemplo da recusa alimentar, são pioneiras nesta temática e quando baseadas em dados não acurados podem estimar de forma incorreta problemas nutricionais, influenciando no conhecimento científico e na tomada de decisões clínicas de intervenções nutricionais.

Até o momento não há investigações que analisem qual o melhor protocolo para investigar o consumo alimentar desta população, bem como revisões publicadas que analisem e discutam sobre a metodologia aplicada em investigações dietéticas no TEA. Neste cenário este trabalho justifica-se por investigar quais instrumentos têm sido aplicados em estudos clínicos e epidemiológicos, discutindo as limitações inerentes de cada instrumento, bem como a necessidade de melhorias no protocolo de aplicação. A revisão poderá contribuir para nortear a escolha adequada do instrumento para avaliar o consumo alimentar em futuras pesquisas desenvolvidas com esta população.

4. Objetivos

4.1. Objetivo geral

Investigar os instrumentos aplicados na avaliação do consumo alimentar de crianças e adolescentes com TEA em estudos clínicos e epidemiológicos.

4.2. Objetivos específicos

I) Revisar a literatura e descrever os instrumentos de avaliação do consumo alimentar aplicados em estudos com crianças e adolescentes com TEA;

II) Identificar as vantagens e limitações inerentes aos instrumentos de avaliação do consumo alimentar e vieses relacionados a utilização destes instrumentos em estudos com crianças e adolescentes com TEA;

III) Identificar quais as variáveis dietéticas investigadas e relacionadas as particularidades do consumo alimentar no autismo;

IV) Avaliar a qualidade dos estudos quanto ao método de avaliação do consumo alimentar.

5. Hipóteses

A presente revisão testará as seguintes hipóteses:

I) A maior parte dos estudos empregam instrumentos adaptados e não validados para crianças e adolescentes;

II) A maior parte dos estudos realiza análises de adequação de energia e nutrientes;

III) A maior parte dos protocolos que investigam as características alimentares do TEA utilizam análises adaptadas;

IV) A maioria dos estudos tem baixa qualidade metodológica quanto ao protocolo de avaliação do consumo alimentar.

6. Metodologia

6.1. Desenho do estudo

Para o presente estudo será realizada uma revisão sistemática de literatura para investigação de instrumentos de avaliação do consumo alimentar utilizados em estudos clínicos e epidemiológicos com crianças e adolescentes com TEA. A revisão será conduzida de acordo com as orientações do *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) (PAGE et al., 2021)*.*

6.2. Registro do protocolo

O *The International Prospective Register of Systematic Reviews* (PROSPERO) é um banco de dados internacional para o registro de revisões sistemáticas nas áreas de saúde e assistência social, desenvolvida pelo Centro de Revisões e Disseminação (CRD) da Universidade de York, na Inglaterra. Esta base de registros permite que os protocolos dos trabalhos sejam acompanhados quanto ao seu andamento desde a concepção da questão de pesquisa e critérios de elegibilidade até a publicação do artigo de revisão. Além disso, este registro auxilia para que sejam evitadas investigações duplicadas (BOOTH et al., 2012).

O protocolo da presente revisão foi previamente registrado no PROSPERO em julho de 2020, sob o identificador CRD42020190229 (Apêndice A) e será atualizado de acordo com o desenvolvimento das etapas da revisão.

6.3. Questão de pesquisa e critérios de elegibilidade

A questão norteadora de pesquisa "Quais instrumentos têm sido utilizados em estudos epidemiológicos e clínicos com crianças e adolescentes com TEA?" e os critérios de elegibilidade para seleção de referências foram previamente elaborados a partir da estratégia SPIDER (*Sample, Phenomenon of Interest, Design, Evaluation, Research type*) (METHLEY et al., 2014), cuja definição de critérios está descrita no **Quadro 1.**

Critério	Descrição
Amostra (**S**)	Crianças e adolescentes com transtorno do espectro autista
Fenômeno de interesse (**PI**)	Instrumentos de avaliação do consumo alimentar
Delineamento (**D**)	Transversais, longitudinais, casos controles, ensaios clínicos
Avaliação (**E**)	Qualidade e eficácia dos instrumentos de avaliação do consumo alimentar
Tipo de pesquisa (**R**)	Estudos quantitativos e mistos

Quadro 1. Descrição dos critérios do acrônimo SPIDER.

6.4. Critérios de inclusão e exclusão

De acordo com os critérios de elegibilidade, serão incluídos nesta revisão os estudos que investigaram de forma quantitativa ou qualitativa o consumo alimentar de indivíduos (até 19 anos) com diagnóstico de TEA, de delineamento do tipo transversal, caso-controle, ensaio clínico, acompanhamento (coorte) ou de validação para instrumentos de investigação dietética.

Os seguintes critérios de exclusão serão aplicados durante a seleção: estudos com avaliações exclusivas do comportamento alimentar, experimentos com modelos animais e estudos de literatura cinza. Não será definida limitação quanto ao idioma e a data de publicação.

6.5. Estratégia de busca

A busca bibliográfica será conduzida nas bases de dados eletrônicas PubMed, SciELO, *Web of Science* e PsycINFO, por meio de duas chaves de busca compostas pela combinação de termos de língua inglesa indexados no *Medical Subject Headings* (MeSH), termos livres e os operadores "OR" e "AND" (**Quadro 2**). Após a seleção de estudos, será realizada uma busca nas seguintes fontes secundárias: a) referências citadas em estudos incluídos na revisão e b) referências de estudos de revisão sobre o mesmo assunto ou assunto similar.

Base de dados	Combinação de chaves de busca
PsicINFO	*("autistic disorder" OR "autism spectrum disorder" OR "asperger disease" OR "asperger disorder") AND ("diet records" OR "diet surveys" OR "dietary assessment" OR "dietary survey methods" OR "dietary record" OR "estimated dietary record" OR eating OR "feeding behavior" OR diet)*
PubMed	
Web of Science	
SciELO	*("autistic disorder" OR "autism spectrum disorder" OR "asperger disease" OR "asperger disorder") AND (eating OR "feeding behavior" OR diet)*

Quadro 2. Combinações de chaves de busca utilizadas nas bases de dados.

6.6. Gerenciamento em *Software* de referências

Todas as referências identificadas nas bases de dados serão exportadas ao *Software* ZOTERO 5.0 e submetidas à identificação e remoção de duplicatas para posterior organização do processo de seleção de estudos.

6.7. Seleção de estudos

A seleção dos estudos será realizada em 3 etapas: I) Leitura de títulos, II) Leitura de resumos, III) Leitura de textos na íntegra e IV) Revisão de estudos excluídos.

Durante o processo de seleção nas etapas I, II e III, os estudos serão avaliados e selecionados de forma independente por dois revisores cegados (ESS, GSL), de acordo com os critérios de inclusão e exclusão previamente estabelecidos. Após cada etapa de seleção por pares, um terceiro revisor (KCG) será responsável pela avaliação e decisão final em casos de inconsistências entre as seleções independentes (**Figura 1**).

Ao final da seleção um revisor (RH) reavaliará os estudos previamente excluídos no processo de seleção, por meio da leitura simultânea de títulos e resumos. Após esta revisão, os estudos considerados elegíveis serão reavaliados em nova seleção por dois revisores cegados (ESS, GSL), sendo as discordâncias novamente analisadas por um terceiro revisor (KCG).

Estudos localizados em fontes secundárias serão avaliados quanto a elegibilidade por dois revisores (ESS, GSL). Por fim, os estudos considerados elegíveis serão incluídos para extração de dados.
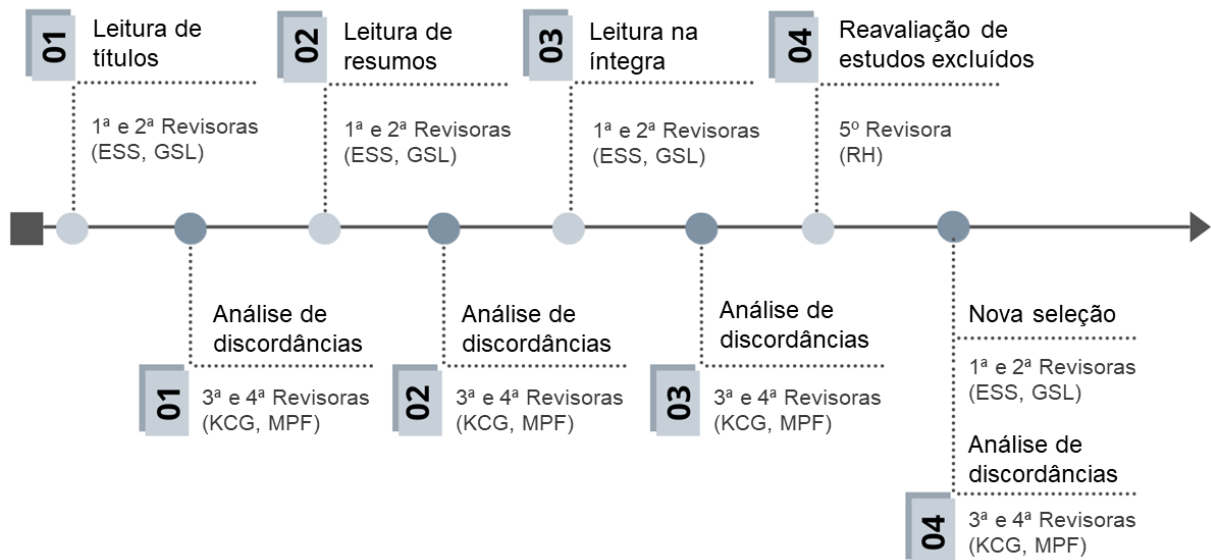
Figura 1. Fluxo representativo das etapas de seleção de estudos.

6.8. Extração de dados

A extração de dados será realizada pelo revisor principal (ESS) e posteriormente verificada pela equipe de pesquisa (GSL, RH, KCG, MPF). Para esta etapa será elaborada uma planilha no *Software* Excel, onde serão coletados os seguintes dados:

- Ano de publicação
- País onde o estudo foi realizado
- Período de realização do estudo
- Delineamento
- Objetivo(s)
- Exposição e desfecho
- População (tamanho de amostra, faixa etária, distribuição de sexo)
- Instrumento ou critério utilizado para o diagnóstico de TEA
- Instrumento de avaliação do consumo alimentar
- Protocolo de aplicação do instrumento de avaliação do consumo alimentar
- Variáveis referentes ao consumo alimentar

- Resultados referentes ao consumo alimentar
- Observações dos autores sobre as limitações do instrumento dietético

Quando necessário, serão enviados e-mails aos autores para solicitação de dados adicionais ou não identificados nos estudos, dando-se preferência por contatar o primeiro autor (Apêndice B).

6.9. Avaliação da qualidade de relato dos estudos

Para avaliar o relato metodológico dos estudos incluídos na revisão será aplicada uma lista de verificação baseada nos critérios do *Strengthening the Reporting of Observational Studies in Epidemiology - Nutritional Epidemiology* (STROBE-nut) (LACHAT et al., 2016) (Anexo A). Esta versão do STROBE trata-se de uma extensão com 24 recomendações específicas para o relato de estudos de epidemiologia nutricional, possibilitando a avalição da descrição realizada para os métodos de investigação do consumo alimentar. Para aplicação nos estudos será elaborada uma planilha contendo os critérios do STROBE-nut, para os quais cada estudo será avaliado pelo revisor principal (ESS). Os critérios Nut-8.4, Nut-12.3 e Nut-22.2 não serão considerados na avaliação por não serem correspondentes ao escopo desta revisão. Durante a avaliação, para cada critério serão utilizadas as alternativas "sim", "parcialmente sim", "não" e "não se aplica". A pontuação final será gerada da seguinte forma: 1 ponto para "sim" e "não se aplica", 0.5 para "parcialmente sim" e 0 para "não" (ZHANG et al., 2021). A revisão da avaliação será conduzida por outros dois revisores (KCG, JSV). Os resultados da avaliação serão descritos em texto narrativo e apresentados em tabelas e material suplementar.

6.10. Atualização da revisão

A atualização da revisão será realizada 2 meses antes da submissão do manuscrito ao periódico científico, por meio de nova busca nas bases de dados com o objetivo de identificar estudos elegíveis que tenham sido publicados no período posterior a primeira busca.

6.11. Síntese dos resultados e submissão do manuscrito

Os dados extraídos serão sintetizados em um manuscrito com tabelas, figuras e texto narrativo para publicação em periódico científico. Para avaliação da redação

do manuscrito desta revisão, serão aplicadas as novas versões do *Checklist* PRISMA, contendo 27 itens que descrevem o que deve ser contemplado em cada secção de uma revisão sistemática (Título, Introdução, Métodos, Resultados, Discussão e Informações adicionais) (Apêndice C), e o *Checklist* PRISMA para redação do resumo da revisão, contendo 12 itens com instruções de informações necessárias para cada tópico do resumo (Título, Objetivos, Métodos, Resultados, Discussão, Financiamento e Registro) (Apêndice D) (PAGE et al., 2021).

O **Quadro 3** apresenta a descrição de periódicos elegíveis para submissão com a classificação Qualis da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) e o Fator de Impacto, acessados pela Plataforma Sucupira e pela base de dados *Web of Science.*

Periódico	Qualis CAPES (área)	Fator de Impacto
Nutrition Reviews	A1 (Nutrição)	6.500
Autism Research	A1 (Interdisciplinar)	3.727
Research in Autism Spectrum Disorder	A2 (Interdisciplinar)	1.688

Quadro 3. Descrição do Qualis CAPES e do Fator de Impacto dos periódicos considerados para submissão da revisão sistemática.

6.12. Orçamento

A estimativa dos custos necessários para o desenvolvimento deste estudo está apresentada no **Quadro 4**, sendo estes custos responsabilidade da autora principal.

Produtos e serviços	Valor
Impressões	R$ 500,00
Tradução do manuscrito para inglês	R$ 2.000,00
Total	R$ 2.500,00

Quadro 4. Custos de produtos e serviços necessários para a execução da revisão sistemática.

6.13. Cronograma

Atividades referentes a revisão sistemática	2020								2021												2022		
	Maio	Jun.	Jul.	Ago.	Set.	Out.	Nov.	Dez.	Jan.	Fev.	Mar.	Abr.	Maio	Jun.	Jul.	Ago.	Set.	Out.	Nov.	Dez.	Jan.	Fev.	Mar.
Busca por revisões similares no PROSPERO	X																						
Definição da questão de pesquisa e chaves de busca		X																					
Elaboração do protocolo da revisão		X																					
Registro do protocolo de revisão			X																				
Busca nas bases de dados				X																			
Seleção de estudos					X	X	X																
Extração de dados							X	X	X														
Síntese dos resultados									X														
Redação inicial do manuscrito										X	X	X											
Busca por estudos em fontes secundárias													X										
Avaliação da qualidade dos estudos													X	X									
Redação do projeto de dissertação													X	X									
Qualificação do projeto de dissertação															X								
Redação do manuscrito															X	X	X						
Elaboração de materiais suplementares																		X	X				
Atualização da revisão																				X	X		
Formatação do manuscrito e materiais																					X	X	
Defesa da dissertação																							X
Tradução e submissão do manuscrito																							X
Atualização do protocolo do PROSPERO																							X

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Manuscrito

Manuscrito redigido de acordo com as normas da *Nutrition Reviews* (Anexo B)

1 **Critical analysis of dietary instruments applied in clinical and epidemiological studies in**

2 **patients with autism spectrum disorder: a systematic review**

3

4 **ABSTRACT**

5 **Context:** Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized

6 by behavioral and sensory difficulties that influence nutritional status. There is a growing

7 number of studies in the literature that investigate aspects of food consumption in ASD.

8 However, there is no criticism regarding the adequacy of such methods and the ways of

9 evaluating food consumption in ASD.

10 **Objective:** To evaluate the instruments and dietary variables used in the investigation of food

11 consumption in children and adolescents with ASD.

12 **Methods:** The search performed in October 2020 and updated in December 2021 included

13 manuscripts published in the electronic databases PsycINFO, PubMed, SciELO, and Web of

14 Science. Clinical and epidemiological studies investigating food consumption in children and

15 adolescents with ASD were selected, excluding reviews, abstracts, or editorial letters. Data on

16 the methods of assessment of food consumption and the application protocol were extracted,

17 as well as the dietary variables analyzed by each study for presentation in narrative synthesis

18 and tables. The quality of reporting in the studies was assessed by the Strengthening the

19 Reporting of Observational Studies in Epidemiology - Nutritional Epidemiology (STROBE-

20 nut).

21 **Results:** 94 studies were included, most of them cross-sectional (n=61). The most frequent

22 dietary instruments were the food record (n=51) and the food frequency questionnaire (n=42).

23 Non-validated instruments with closed questions were administered in most studies (n=54).

24 The dietary variables most explored were calorie intake (n=50), nutrients (n=59), food

25 items/groups (n=48). Fifteen studies evaluated food selectivity. Other studies investigated

26   eating difficulties, such as food variety (n=15), food refusal (n=13), food repertoire (n=3) and

27   high daily consumption of food items (n=2). The mean STROBE-nut score of the studies was

28   12.5 (5.5-17.5). The items referring to the reporting of the application protocol and the

29   validation of the dietary instruments were not completed in most studies (≥67%).

30   **Conclusion:** Most published studies on food consumption and ASD applied non-validated

31   dietary instruments and have low scores in the evaluation of the methodological report. The

32   importance of improving the dietary assessment protocol for advances in scientific evidence

33   related to nutrition in ASD is highlighted.

34   **Protocol and financing:** Protocol registered with PROSPERO (CRD42020190229). Support

35   from the Coordination for the Improvement of Higher Education Personnel (CAPES).

36   **Keywords:** autism spectrum disorder; diet surveys; food consumption; systematic review.

37

38   **INTRODUCTION**

39   Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by

40   impairments in the domains of communication and social interaction, repetitive behaviors and

41   restricted interests, and sensory processing difficulties[1]. These characteristics interfere with

42   food consumption, reflecting at mealtimes with insufficient nutrient intake[2,3], restricted and

43   repetitive food repertoire[4,5] and food selectivity[6–8]. Such conditions are reported in the

44   literature with prevalence between 33.3% and 66%[5,9] and have a negative impact on

45   nutritional status, such as the risk of nutrient deficiencies and alterations in body

46   composition[2,10].

47   The methodological quality of studies investigating nutritional aspects is essential

48   considering that the results obtained from these studies collaborate with decisions related to

49   clinical interventions[11]. Studies on food consumption in children and adolescents with ASD

50   are growing in the scientific literature, as are proposals for dietary interventions[3,8,12].

51   However, there is no consensus on which specific nutritional aspects should be evaluated in

52   these individuals, as research in this scope has different proposals without a clear objective of

53   what is essential in investigations between food consumption and ASD, such as analyses of

54   micronutrient deficiencies[13,14], calorie intake[15,16] and food groups[17,18].

55   Numerous instruments can be used to assess food consumption, regardless of the

56   objective and design of the studies[19]. However, some issues need to be considered when

57   choosing the method to be applied. For example, the Food Frequency Questionnaire (FFQ) is

58   a practical instrument to administer, but it overestimates the consumption of calories and

59   micronutrients, while the food record (FR) and the 24-hour dietary recall (24HR) require

60   replication of data collection and greater detail in the description of foods[2,20]. Furthermore,

61   studies that investigate the food consumption of children and adolescents must consider that

62   reporting will be carried out by parents or caregivers, which are susceptible to inaccuracies.

63   Another important issue is about the temporality of the information on food consumption:

64   retrospective instruments, such as the FFQ and 24HR, depend on the interviewee's memory,

65   while prospective instruments (such as the FR) require greater involvement of individuals in

66   the food record[21,22]. In addition to these issues, the choice of dietary instrument in ASD

67   should also consider the overload of activities for parents and caregivers, since it is a clinical

68   condition in which individuals with ASD are regularly involved in therapeutic activities[23,24].

69   To date, no studies have been published to evaluate the methodological quality of the

70   instruments used in dietary investigations of patients with ASD. The Strengthening the

71   Reporting of Observational Studies in Epidemiology - nutritional epidemiology (STROBE-

72   nut)[11] is a 24-item instrument that guides the definition of methods for research and analysis

73   of nutritional data. Recently, this protocol has been used as a tool to assess the quality of the

74   methodological reporting of manuscripts on nutritional investigations, identifying critical

75   points to improve among studies[25,26].

76   The objective of this systematic review was to evaluate the instruments and dietary

77   variables used to investigate the food consumption of children and adolescents with ASD in

78   clinical and epidemiological studies and to discuss the quality of the methodological reporting

79   of the dietary instruments applied, identifying factors that may limit the quality of the studies.

80

81   **METHODS**

82   **Research protocol**

83   The review was conducted in accordance with the Preferred Reporting Items for

84   Systematic Review and Meta-Analyses[27]. The protocol was registered in The International

85   Prospective Register of Systematic Reviews (registration number: CRD42020190229).

86   **Search strategy**

87   The search was performed in July 2020 and updated in December 2021. The electronic

88   databases PubMed, PsycINFO, SciELO, and Web of Science were consulted with search keys

89   composed of the combination of terms indexed in the Medical Subject Headings (MeSH), free

90   terms and the operators "OR" and "AND" (Supplementary table 1). Secondary sources

91   studies were identified by analyzing references cited in studies and reviews that addressed

92   topics related to food consumption and ASD.

93   **Criteria for eligibility**

94   The eligibility criteria were based on the acronym SPIDER (Sample, Phenomenon of

95   Interest, Design, Evaluation, Research type) shown in Table 1. The selection included: i)

96   original studies (excluding reviews, abstracts, or editorial letters); ii) studies that evaluated the

97   food consumption of children and adolescents (up to 19 years old) diagnosed with ASD; iii)

98   cross-sectional studies, case-control studies, clinical trials, cohort (follow-up) studies,

99   instrument validation studies. No restrictions were applied to the language and year of

100   publication.

Study selection process, data extraction, and results synthesis

The identified studies were added to the ZOTERO 5.0 reference management software

and underwent the steps of eliminating duplicates and selecting by reading titles, abstracts,

and full texts. During selection, studies were independently evaluated and selected by two

blind reviewers. A senior reviewer was responsible for resolving inconsistencies at each step.

Data were extracted on the characteristics of the studies (year, country, design, and

participants), the food consumption assessment protocol, the dietary variables analyzed, and

the statistical procedures. Data not identified in the studies were requested from the authors

by email. In the absence of data, these were not considered for the discussion of results. Data

were organized into a narrative synthesis combined with tables for further discussion.

Assessment of the quality of the methodological reporting

To evaluate the reporting of the studies, the criteria proposed by the STROBE-nut[11]

were applied. It consists of a guide with 24 criteria for research carried out in the line of

nutritional epidemiology. The assessment was applied by the principal reviewer and reviewed

by the senior. The answers "Yes", "Partially yes", "No" and "Not applicable" were

considered, with the following scores being assigned: 1.0 (Yes; Not applicable), 0.5 (Partially

yes) and 0 (No), as defined by Zhang et al.[25]. The items Nut-8.4, Nut-12.3 and Nut-22.2 were

disregarded, as they did not address criteria corresponding to the scope of this review.

RESULTS

The initial search identified 1.975 studies. After the removal of duplicates and

screening steps, 58 studies were eligible. Twenty additional references were identified in the

secondary search (Supplementary figure 1) and 16 in the review update (Figure 1). The final

review included 94 articles, published between 1982 and 2021, described in Table 2. Study

designs were cross-sectional (n=61)[2,4,5,9,13,15,16,18,20,28–79], case-control (n=24)[10,14,17,80–100],

126 follow-up (n=5)[6,101–104], cross-sectional with instrument validation (n=2)[105,106], crossover

127 clinical trial (n=1)[107] and controlled randomized clinical trial (n=1)[108].

Food consumption assessment tools

129 The FR was the instrument most frequently applied among studies (n=51)[2,4,6,10,13,15–

130 17,30–33,35,37–39,42,46,48,49,51,52,54–57,59,63–65,67,69,71,72,76,77,80,81,84,86–89,91,98,100,101,103,104,106,108], with the 3-

131 day record protocol being the most used (n=48)[2,4,6,10,13,15–17,30,32,33,35,37–39,42,46,48,49,51,52,54–

132 57,59,64,65,67,69,71,72,77,80,81,84,86–89,91,98,100,101,103,104,106,108]. Only one study used weighing food on 5

133 consecutive weekdays, this being combined with 2 weekend days of FR[63].

134 The 24HR was applied in eight studies, using protocols of 1 (n=3)[36,96,105] and 3 days

135 (n=5)[34,43,90,94,95]. The interviews were conducted face-to-face in seven studies[34,36,43,90,94–96] and

136 by telephone in one study[105]. Only one study reported interviews on non-consecutive days[43]

137 and two studies reported the inclusion of 1 weekend day[34,95]. Four studies indicated the

138 application of the instrument by trained interviewers or a nutritionist[90,95,96,105].

139 The FFQ was applied in 39 studies[4–6,14,20,34,36,40,44,45,47,50,53,58,60–62,64,65,68,69,72–

140 74,79,81,83,85,92,93,95,97–102,105,107]. Among those validated for the age group of children, the

141 Youth/Adolescent Questionnaire (YAQ) was used in 11 studies, with adaptations to the food

142 list that ranged from 126 to 156 items[4–6,44,58,60,64,65,85,101,105]. The 72-item Block Kids

143 Questionnaire and the Harvard Semi Quantitative FFQ were applied in two separate

144 studies[47,50]. Another FFQs used were developed and validated for application in American

145 adults, such as the Women's Health Initiative FFQ (122 items)[20], the Short Dietary

146 Questionnaire of Yarnell[36], the FFQ to assess calcium and vitamin D consumption (22

147 items)[53], the FFQ to assess omega-3 consumption (152 items)[68], the Reduced Dietary

148 Questionnaire of Block (60 items)[14] and a modified version of the Reduced Dietary

149 Questionnaire of Block with Omani food (119 items)[93]. One study applied versions of the

150   Brief self-administered Dietary History Questionnaire (54-57 items), validated for Japanese

151   adults[74].

152   Ten studies did not specify the FFQ applied[34,61,62,69,73,81,83,92,95,100]. Five studies used

153   their own instruments without indicating validation[45,72,79,102,107]. One study applied a 56-item

154   FFQ, previously developed for a cohort study[40] and two other studies used FFQs adapted

155   from previous studies carried out with Italian children aged between 8 and 9 years[99] and

156   Spanish adults (137 items)[98]. Food frequency questions without validation were included in

157   questionnaires used in three studies[18,66,78] and one study referred to the use of part of the

158   Eating Habits Survey to investigate food frequency[97].

159   Non-validated instruments such as the Food Preference Inventory/Questionnaire (60-

160   123 items)[17,28,29,55,70,75,82] and Food Lists (70-139 items)[9,14–16,38,41,94,104] were applied in fifteen

161   studies. Combinations of two food consumption assessment instruments were used in 23

162   studies[4,6,14–17,34,36,38,55,63–65,69,72,81,94,95,98,100,101,104,105], the most frequent use being FR and FFQ

163   (n=10) [4,6,64,65,69,72,81,98,100,101], followed by FFQ and 24HR (n=4)[34,36,95,105], FR and food list

164   (n=4)[15,16,38,104].

Analysis of energy and nutrient intake

166   Most studies investigated the consumption of calories (n=50)[2,10,15–17,20,30–36,38–

167   40,42,43,46,47,49,50,52,55–57,63,65,67–69,71,74,77,80,81,83,84,86–88,90,91,94,95,98,100,101,106,108], macronutrients

168   (n=43)[2,10,15,17,20,30,31,33,36–40,42,43,46,47,49–52,55–57,63,65,67–69,71,77,80,81,83,84,89–91,94,98,101,106,108] and/or

169   micronutrients (n=57)[2,4,10,13–15,17,20,30,31,33,34,36–40,42,43,46–57,59,62,65,67–69,71,74,77,80,81,84,86–

170   91,94,95,98,100,101,103,106,108], with FR (n=46)[2,4,10,13,15–17,30–33,35,37–39,42,46,48,49,51,52,54–

171   57,59,63,65,67,69,71,77,80,81,84,86–89,91,98,100,101,103,106,108] as the most frequently applied instrument. The

172   calorie contribution of macronutrients was investigated in 25 studies[10,15,32–

173   35,42,46,47,51,52,56,65,67,74,77,81,86–88,90,95,100,101,108]. Analyses of adequacy of estimated intake

174   according to dietary reference recommendations were performed in 52 studies[2,4,10,13,15,17,20,30–

175   39,42,43,46,47,49–57,59,62,63,69,71,77,80,81,84,86–91,95,98,100,101,103,106,108. Details of the nutrients analyzed by

176   the studies can be accessed in the Supplementary table 2.

Analysis by food groups and dietary patterns

178   The frequency and average consumption of items and/or portions of food groups were

179   investigated in 48 studies, and FFQ (n=29)[4,6,18,34,36,40,44,45,50,58,60,61,64–66,72,73,78,79,81,93,95,98–

180   102,105,107] and FR (n=12)[4,6,30–32,39,52,64,72,80,87,104] were the most applied instruments. Seven

181   studies compared estimated consumption portions with dietary

182   recommendations[32,34,52,95,98,100,102]. The preference for certain food items was investigated in

183   five studies using FR (n=1)[2], food preference questionnaire (n=1)[75] and food list (n=3)[9,15,38].

184   Only three studies identified dietary patterns by principal component analyses[65,98,101].

185   The Healthy Eating Index[15,52,76,80,86–88] and the Chinese Children Dietary Index[100] were used

186   to assess food quality in eight studies.

Analysis of food consumption according to ASD characteristics

188   The characteristics of food consumption associated with eating difficulties in ASD

189   were analyzed in 25 studies by investigating food refusal of isolated items and by food groups

190   (n=13)[2,4–6,29,58,60,61,64,85,92,94,95], food variety (n=15)[2,16,34,38,40,41,50,64,72,80,86–88,100,104], food

191   repertoire (n=3)[4,6,64] and high daily consumption of food items (n=2)[4,58]. The FFQ was the

192   most applied instrument to assess food refusal (n=11)[4–6,58,60,61,64,85,92,95,97] and the only one

193   applied to assess high daily consumption of food items (n= 2)[4,58]. Food variety was evaluated

194   mainly by FR (n=7)[2,38,72,80,86–88], followed by FFQ (n=5)[40,50,64,72,100]. To evaluate the food

195   repertoire, FR was the only method used (n= 3)[4,6,64].

196   Food selectivity was analyzed in 15 studies[2,4–6,9,10,17,29,50,55,58,60,64,92,95] based on the

197   acceptance or refusal of food items or food groups, with the FFQ being the instrument most

198   used for this purpose (n=8)[4–6,58,60,64,92,95]. Although different criteria were defined for this

199   evaluation. Two studies established cut-off points based on the variety of food items accepted

200   by neurotypical children, with the application of FFQ[50] and the food preference inventory[29].

201   One study established the omission of one or more complete food groups or the consumption

202   of five or fewer food items as criteria for selectivity, assessed using FR[2]. Other studies were

203   based on the count of consumed or refused food items, with data collected from FR (n=1)[10],

204   food preference inventory (n=1)[55] and the food list (n=1)[9], however, only the study based on

205   the food list defined a cut-off point for selectivity (consumption of up to 20 items).

206   Domains to evaluate food selectivity regarding food refusal and high daily

207   consumption of food items, according to the application of FFQ, and the food repertoire,

208   evaluated by filling in an FR, were defined in a cross-sectional study[4], and replicated in two

209   other studies[58,64]. One study[5] used as a cut-off point the food refusal of 33% or more of the

210   food items evaluated using FFQ, and this criterion was later replicated in three other studies in

211   this review[6,92,95].

212   **Evaluation of the methodological reporting of the studies**

213   The mean score of the studies in STROBE-nut was 12.5 (5.5-17.5) (Supplementary

214   Table 3). Most studies (≥54.3%) presented satisfactory reporting for the following items:

215   inclusion of the instrument in the title and/or abstract (Nut-1), dietary or nutritional criteria

216   considered in the selection of participants (Nut-5 and Nut-6) , investigated dietary variables

217   (Nut-7.1), time of collection of non-dietary data (Nut-8.5), statistical methods applied to

218   dietary data (Nut-12.1), participant characteristics (Nut-14), instrument limitations and/or

219   dietary analyses (Nut-19), relevance of results and discussion (Nut-20) and ethical approval

220   (Nut-22.1). Meanwhile, 52.1% of the studies presented partial reporting of the references of

221   nutritional composition tables used in the dietary analyzes (Nut-8.2).

222   Items referring to the reporting of the application protocol for the food consumption

223   assessment instrument (Nut-8.1), dietary recommendations used for comparison with intake

224   estimates (Nut-8.3), assessment of bias in dietary data (Nut-9), validation of dietary

225   instruments (Nut-8.6), statistical adjustments to dietary data (Nut-12.2), exclusions of

226   participants for missing or implausible data (Nut-13), and sensitivity analyses on dietary data

227   (Nut-17), were not complied with for most studies ($\geq$54.3%) (Supplementary figure 2)

228   (Supplementary table 3).

229

230   **DISCUSSION**

231   This systematic review identified a variety of dietary assessment tools applied in

232   studies that evaluated the food consumption of children and adolescents with ASD. The

233   reporting of STROBE-nut items referring to the methodology for collecting and analyzing

234   dietary data was not fully complied with in most studies. Also, instruments with closed

235   questions and non-validated for the target population of the studies were frequently used.

236   Dietary assessment requires the collection of data on the consumption of food and

237   beverages by individuals; however, the detailing of these data depends directly on the

238   instrument used. In this review, most studies did not score on STROBE-nut items referring to

239   the reporting of the application protocol and validity of dietary instruments (Nut-8.1 and Nut-

240   8.6). The FR was the instrument most frequently applied, especially in cross-sectional and

241   case-control designs, which included the largest number of studies. This instrument, as well as

242   the 24HR, allows us to collect information on the types and amounts of food consumed, in

243   addition to investigating the method of preparation and presentation of foods, which are

244   important characteristics in the study of food selectivity in patients with ASD[6,7,22].

245   Most studies applied 3-day record or recall protocols. This protocol has been

246   considered adequate to estimate calorie intake[22,109,110]. Although less variability was observed

247   in food consumption during childhood, the number of days of record or recall needed to

248   assess actual food consumption in children and adolescents varies among the studies and can

249   be reduced using statistical models[111–113]. Regarding the assessment of patients with ASD, the

250   authors suggest that only 3 days may not be enough to measure real food consumption,

251   especially those of nutrients with great variability[4,19,35,39,52,64]. Thus, although 3-day protocols

252   proved to be sufficient to estimate daily fiber consumption in children with ASD[39], none of

253   the studies aimed to assess the variability of food consumption and determine the number of

254   days needed to estimate nutrients intake in this population, limiting adjustments to dietary

255   estimates without considering the severity level of ASD[46,80].

256   FFQ is one of the most applied instruments to assess food consumption in

257   epidemiological studies[21] and the second most frequently used in ASD studies. This tool

258   retrospectively evaluates habitual food consumption in a given period, using a pre-defined list

259   of foods or food groups, which the interviewee must fill in or indicate to the researcher the

260   frequency of consumption of each item (per day, week, month, semester, or year)[22,114–116].

261   However, it was observed that most of the FFQs used were not validated for the age groups

262   studied. The use of this instrument without indication for the population has limitations, since

263   it depends on a pre-defined food list that may not represent the habits of populations with

264   divergent dietary patterns, in addition to not providing accurate and absolute measures of food

265   consumption[22,115,116].

266   Closed instruments with food lists or questions developed by the authors were used to

267   assess food acceptance and variety prospectively and retrospectively. Although some of these

268   instruments were applied in previous studies[29,41] and allow adaptations to their lists[17,29,55] or

269   questions[28,29,82], none was previously validated, so it is not possible to guarantee the accuracy

270   of the data obtained.

271   It is known that all food consumption assessment instruments are susceptible to bias.

272   Regarding the instruments in which food consumption is reported by the interviewee, these

273   are susceptible to under- or overestimation of dietary data. Meanwhile, retrospective

274   assessments should predict the inherent inaccuracies of recall bias[21,22,114]. Different strategies

275   can be applied to reduce bias during the application of instruments and data analysis;

276   however, no study in this review reported strategies for verifying and correcting bias in

277   dietary data (Nut-9), and most did not perform sensitivity analyzes to identify deviations in

278   the data (Nut-17).

279   The quality of the collected data must be guaranteed from the moment of choice of

280   instrument, where the objective and design of the research must be considered, giving

281   preference to validated instruments[21,22,114,116]. Furthermore, the target population of the study

282   is considered a crucial factor in choosing the instrument, since different age groups, cultural

283   and socioeconomic aspects, as well as other characteristics, such as eating difficulties in ASD,

284   can influence food consumption[21,117,118]. It should also be considered that in research with

285   children, the reporting of food consumption is carried out mainly by a parent or the main

286   caregiver[21,109]. Furthermore, patients with ASD, both in childhood and in adolescence, may

287   present some degree of cognitive impairment that prevents them from contributing to the

288   assessment[1].

289   In this scenario, prospective instruments completed by parents or caregivers, such as

290   weighed FR, can influence the food offered to children during the study and, when not

291   reviewed after application, increase the risk that items are not recorded or reported

292   inaccurately[22,114,115]. There is also difficulty in recording the food consumed during school

293   and therapy hours[20,35,37,67]. In addition, because they require greater commitment from the

294   interviewees, these instruments may contribute to a higher level of overload in the daily

295   routine, resulting in a lower participation in the research[115,116].

296   Alternatively, instruments with closed questions, such as the FFQ and food lists, limit

297   the evaluation to a list of pre-established foods and portions, preventing a broader analysis of

298   characteristics that can influence the food consumption of patients with ASD, such as the

299 presentation and preparation of foods that allow the identification of acceptance of certain

300 textures[7,22,102].

301   Therefore, both FR and 24HR are good options for application in this population

302 because they are open investigation instruments that allow the collection of detailed data on

303 food consumption characteristics and do not require prior validation[22,115]. Moreover, the

304 24HR does not represent an overload factor for the interviewees during its application[22,115].

305 However, an FFQ previously validated for the region and age group of participants may be

306 the instrument of choice in studies whose sample sizes make it impossible to apply

307 prospective methods, such as cohort studies[21,22].

308   As applied in some studies in this review, it is possible to choose a combination of two

309 instruments for assessment of food consumption, this protocol being indicated in the literature

310 to reduce methodological biases and to correct limitations presented when data are provided

311 by a single instrument[22,114].

312   Application protocols with adequate designs guarantee more accurate results in food

313 consumption estimates. Therefore, for adequate methodological quality, it is essential to

314 guarantee training for the person responsible for filling out the instrument or for the interview,

315 in order to obtain a standardization in data collection, and one can still count on the help of

316 visual guides and measurement tools to estimate food portions in quantitative instruments,

317 and request labels and recipes for better accuracy of ingredients and composition used in

318 analyses. Finally, the review of instruments completed by respondents should be carried out

319 to identify and correct missing and incomplete data[22,115,116].

320   Also, the use of non-validated instruments or with inadequate application protocols

321 interfere in the analysis and interpretation of data about food characteristics in ASD, such as

322 refusal, food variety and selectivity, constantly evaluated through closed instruments such as

323 the FFQ[5,6,58]. These assessments, although replicated in different studies, do not have prior

324 validation and do not consider the diversity of behavioral and dietary characteristics of ASD,

325 so that incorrect methodologies for choosing and applying the instrument, as well as the

326 definition of the analyzes of the collected data, influence the observed data to be inconclusive

327 for both scientific literature and clinical practice.

328   A diversity of proposals for dietary analysis is observed, so it is difficult to define

329 what the research objectives should be, and which analyzes should be performed to

330 investigate the diet of patients with ASD. In this review, nutrient intake analyzes were

331 frequent; however, few studies specified which composition table was used to estimate

332 participants' intake (Nut-8.2) or reported adjustments in dietary data (Nut-12.2). During the

333 planning of analyzes, it is necessary to choose software and food composition tables

334 consistent with the population studied. Furthermore, to investigate the adequacy of dietary

335 intake, both the composition table used to estimate intake and the reference recommendations

336 must be appropriate for the age group and country of the study[22,46,119]. Additionally, the use of

337 dietary supplements should be investigated, and the reporting of the decision to include or not

338 these data in the nutrient intake analyses should be carried out by the studies (Nut-16)[11,30,59].

339   Currently, no dietary instrument allows the investigation of behavioral characteristics,

340 and although instruments with open questions, such as the FR and the 24HR, collect data on

341 the characteristics of the foods consumed, these data are sufficient to observe few sensory

342 characteristics of foods, such as texture, color, and flavor. Thus, studies that investigate

343 nutritional aspects in patients with ASD must add to this evaluation other instruments or

344 methods aimed at evaluating aspects related to this population[4,117] (sensory disorders[7,64],

345 gastrointestinal symptoms[45,120], behaviors during meals[60,105], use of medications[121,122] and the

346 family diet influence[28,93]).

347   This review was the first study to critically analyze the dietary instruments applied to

348 the population with ASD. In addition, it included a wide diversity of studies in the area of

349 nutrition and ASD. With the application of STROBE-nut, it was possible to evaluate the

350 reporting referring to the dietary investigation methodology of the studies. As a limitation,

351 this review did not include studies from the grey literature, so research within this scope may

352 not have been identified. Furthermore, data on the investigation of behavioral factors and

353 sensory sensitivity were not explored. Finally, the methodological data extracted were limited

354 to the reporting of the studies, which mostly did not fully describe the details necessary for

355 such an evaluation. It is suggested that future investigations develop validated or adapted

356 instruments for patients with ASD that allow the crossing of dietary, behavioral, and sensory

357 data. Furthermore, studies that aim to analyze dietary data must follow the criteria established

358 by STROBE-nut for the adequacy of methodological reporting.

359

360 **CONCLUSION**

361   The wide variety of dietary instruments used in studies on ASD and the use of non-

362 validated instruments reveal the absence of criteria when choosing the method of

363 investigating food consumption in ASD. Among the dietary instruments, prospective ones

364 such as the FR and the 24HR are the most suitable for descriptive dietary assessment in the

365 population with ASD because they provide detailed data on food intake, and do not require

366 validation for age group. In addition, journals must be critical of the methodological reporting

367 of studies, to ensure an adequate and transparent definition of the instrument application

368 protocol and data analysis to ensure a better quality of scientific evidence related to nutritional

369 problems in ASD.

370

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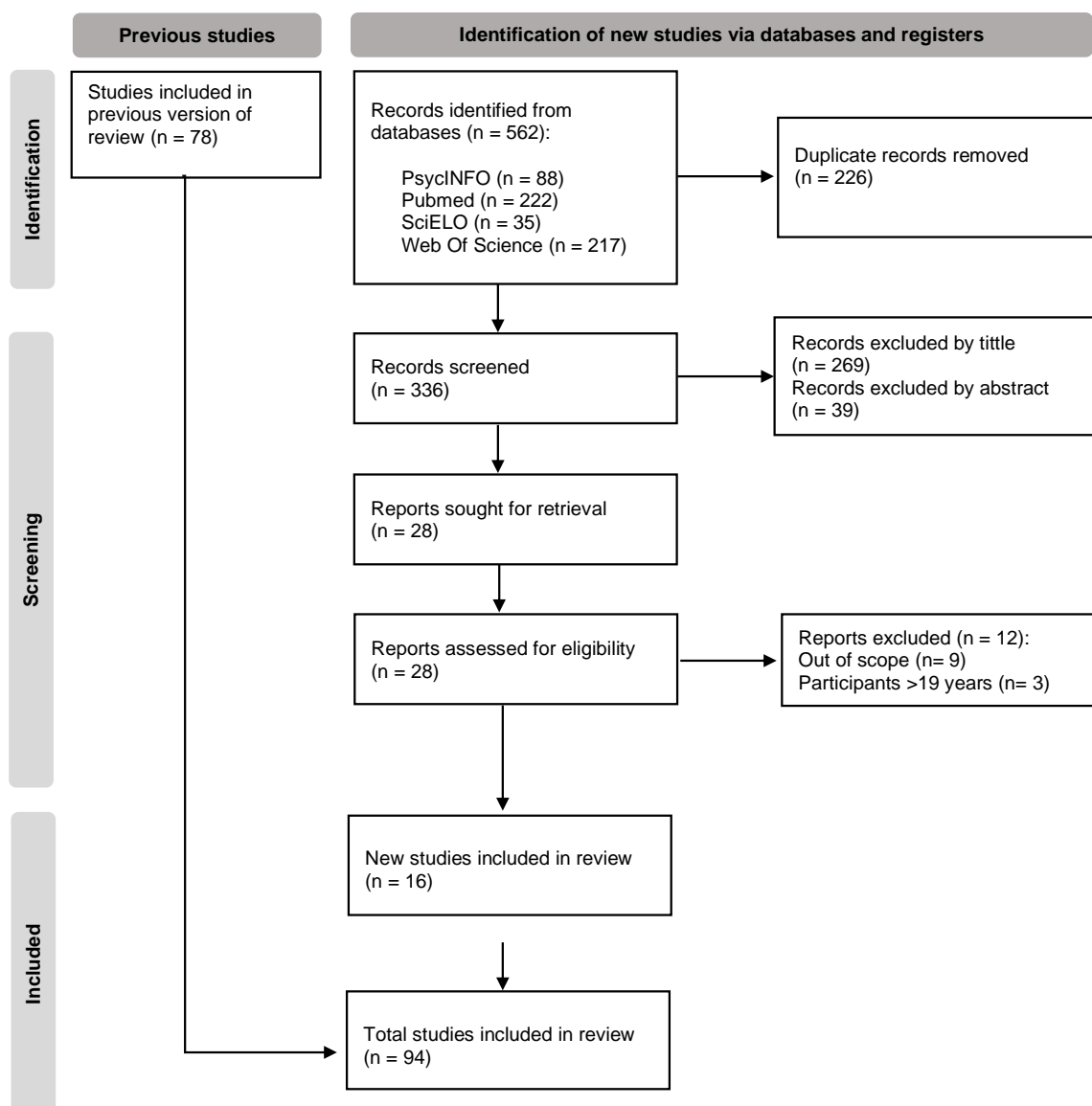
Figure 1. Preferred reporting items for systematic reviews and meta-analyses flow diagram of updated search process and literature screening.

Table 1. SPIDER criteria for developing the research question and eligibility criteria.

Parameter	Description
Sample	Children and adolescents with autistic spectrum disorder
Phenomenon of interest	Food consumption assessment tools
Design	Cross-sectional, longitudinal, case-control, clinical trials
Evaluation	Quality and efficacy of food consumption assessment instruments
Research type	Quantitative and mixed studies

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Author, year (country)	Design	Sample	Instrument application protocol details	Dietary outcomes[a]	STROBE-nut
FOOD RECORD (n=51)					
Shearer et al., 1982[30] (NR)	Cross-Sectional	Study age group: Not reported Cases: 12 children with ASD Age: 8.0±0.8 years Male: Not reported Female: Not reported Controls:12 children in TD Age: 8.4±0.6 years Male: Not reported Female: Not reported	Number of days: 3 days Responsible for filling out: Parents or guardians Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients, daily servings of food groups, daily sugar consumption, and caloric contribution from sugar	5.5
Raiten; Massaro, 1986[31] (United States)	Cross-Sectional	Study age group: Not reported Cases: 40 children with ASD Age: 10.6±4.3 years Male: 28 (60%) Female: 12 (30%) Controls: 34 children in TD Age: 8.8±4.8 years Male: 19 (55.9%) Female: 15 (44.1%)	Number of days: 7 days Responsible for filling out: Primary caregivers Training: Written and by phone call instructions Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients, frequency and average of food group items	10.0
Ho et al., 1997[32] (Canada)	Cross-Sectional	Study age group: Not reported N: 54 children with ASD Age: 13.3 years Male: 55 (85.9%) Female: 9 (14.1%)	Number of days: 3 consecutive days (1 weekend day) Responsible for filling out: Parents or primary caregivers Training: Written instructions Estimation of food portions: Food models Review of diet instrument after completion: Performed by a dietician	Calories, calorie contribution of macronutrients and daily servings of food groups	8.0
Cornish, 2002[33] (England)	Cross-Sectional	Study age group: 3-16 years N: 37 children and adolescents with ASD Age: 7 years (had never done GFCF diet) and 5 years (had already performed GFCF diet) Male: 31 (83.7%) Female: 6 (16.2%)	Number of days: 3 days Responsible for filling out: Caregivers Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients, calorie contribution of macronutrients and average servings of food groups	10.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Williams et al., 2005[72] (United States)	Cross-Sectional	Study age group: ≥2 years Cases: 64 children and adolescents with ASD Age: 5.1 years Male: 58 (90.6%) Female: 6 (9.6%) Controls 1: 45 children and adolescents with SN Age: 4.4 years Male: 35 (77.8%) Female: 10 (22.2%) Controls 2: 69 children and adolescents in TD Age: 4.6 years Male: 40 (58.0%) Female: 29 (42.0%)	Number of days: 3 consecutive days Responsible for filling out: Caregivers Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Performed during a presential interview	Average of food group items (food variety) and daily fluid intake	11.5
Levy et al., 2007[35] (United States)	Cross-Sectional (Part of a double-blind placebo-controlled)	Study age group: 5-8 years N: 62 children with ASD Age: 6.1 years Male: 50 (89.6%) Female: 12 (10.4%)	Number of days:Number of days: 3 days Responsible for filling out: Parents or caregivers Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories and calorie contribution of macronutrients	10.5
Lockner et al., 2008[37] (United States)	Cross-Sectional	Study age group: 3-5 years Cases: 20 children with ASD Controls: 20 children in TD Male: 34 (85%) (N:40) Female: 6 (15%) (N: 40) Age: 4.36 years (N:40)	Number of days: 3 non-consecutive days (1 weekend day) Responsible for filling out: Parents Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Macronutrients and micronutrients	13.5
Schmitt et al., 2008[38] (United States)	Cross-Sectional	Study age group: 7-10 years Cases: 20 children with ASD Age: Not reported Male: 20 (100%) Controls: 18 children in TD Age: Not reported Male: 18 (100%)	Number of days: 3 days Responsible for filling out: Parents Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients and score of food variety (HEI method)	9.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Herndon et al., 2009[39] (United States)	Cross-Sectional	Study age group: Not reported Cases: 46 children with ASD Age: 4.6±1.1 years Male: 44 (95.7%) Female: 2 (4.3%) Controls: 31 children in TD Age: 5.0±1.4 years Male: 23 (74.2%) Female: 8 (25.8%)	Number of days: 3 days Responsible for filling out: Parents Training: Standardized instructions Estimation of food portions: Serving Guide Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients, and servings of food groups	12.0
Bandini et al., 2010[4] (United States)	Cross-Sectional (Data from the CHAMPS study)	Study age group: 3-11 years Cases: 53 children and adolescents with ASD Age: 6.6±2.1 years Male: 44 (83%) Female: 9 (17%) Controls: 58 children and adolescents in TD Age: 6.7±2.4 years Male: 45 (78%) Female: 13 (22%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents and teachers Training: Filling instructions Estimation of food portions: Not reported Review of diet instrument after completion: Performed by a dietician or a nutrition undergraduate	Micronutrients and number of foods consumed (Food repertoire - food selectivity domain)	11.0
Xia et al., 2010[42] (China)	Cross-Sectional	Study age group: 2-9 years N: 111 children with ASD Age: 4.9 years Male: 99 (89.2%) Female: 12 (10.8%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents and guardians Training: Filling instructions Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients and calorie contribution of macronutrients	11.5
Sharp et al., 2011[104] (United States)	Follow-up	Study age group: 2-6 years N: 13 children with ASD Age: 4 years and 5 months Male: 11 (84.6%) Female: 2 (15.4%)	Number of days: 3 days Responsible for filling out: Caregivers Training: Training instructions Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Average number of items accepted by food groups, total percentage of food items and solid items accepted (Food variety)	13.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Hyman et al., 2012[46] (United States)	Cross-Sectional	Study age group: 2-11 years N: 252 children and adolescents with ASD Age: 5.58±2.51 years Male: 217 (86%) Female: 35 (14%)	Number of days: 3 consecutive days (1 weekend day) Responsible for filling out: Parents Training: Standardized instructions Estimation of food portions: Not reported Review of diet instrument after completion: Performed by dietician	Calories, macronutrients, micronutrients and calorie contribution of macronutrients	14.5
Reynolds et al., 2012[48] (United States)	Cross-Sectional	Study age group: 2-11 years N: 222 children and adolescents with ASD Age: 5.37±2.50 years Male: 193 (87%) Female: 29 (13%)	Number of days: 3 consecutive days (1 weekend day) Responsible for filling out: Parents Training:Standardized instructions Estimation of food portions: Not reported Review of diet instrument after completion: Performed by dietician	Micronutrient (Iron)	13.0
Soden et al., 2012[49] (United States)	Cross-Sectional	Study age group: 10-18 years N: 26 adolescents with ASD Age: 13 years and 4 months Male: 21 (80.8%) Female: 5 (19.2%)	Registration period: 72 consecutive hours Responsible for filling out: Parents Training: Verbal and written instructions Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients and micronutrients	12.5
Bicer; Alfassar, 2013[51] (Turkey)	Cross-Sectional	Study age group: 4-18 years N: 164 children and adolescentswith ASD Age: 28 (17%) among 4-8 years; 85 (52%) among 9-13 years and 51 (31%) among 14-18 years Male: 133 (81%) Female: 31 (19%)	Number of days: 3 non-consecutive days (1 weekend day) Responsible for filling out: Parents or caregivers Training: Filling instructions Estimation of food portions: Serving Guide Review of diet instrument after completion: Not reported	Macronutrients, micronutrients and calorie contribution of macronutrients	16.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Graf-Myles et al., 2013[52] (United States)	Cross-Sectional	Study age group: 1-6 years Cases: 69 children with ASD Age: 5.72±1.93 years Male: 57 (83%) Female: 12 (17%) Controls 1: 14 children with DD Age: 5.89±2.19 years Male: 9 (64%) Female: 5 (36%) Controls 2: 37 children in TD Age: 4.75±1.83 years Male: 27 (73%) Female: 10 (27%)	Number of days: 3 consecutive days (1 weekend day) Responsible for filling out: Caregivers Training: Written instructions Estimation of food portions: Visual serving guide used in the review Review of diet instrument after completion: Performed in a presential interview with a dietician	Calories, macronutrients, micronutrients, and calorie contribution of macronutrients, percentage of servings of food groups according to reference, and HEI	15.5
Hamlin et al., 2013[13] (United States)	Cross-Sectional	Study age group: 1-11 years Cases: 288 children and adolescents with ASD Age: 74 (25.7%) among 1-3 years, 177 (61.5%) among 4-8 years and 37 (12.8%) among 9-11 years Male: 248 (86.1%) Female: 40 (13.9%) Controls: 32 children and adolescents in TD Age: Not reported Male: Not reported Female: Not reported	Number of days: 3 consecutive days (1 weekend day) Responsible for filling out: Caregivers Training: Standardized instructions Estimation of food portions: Not reported Review of diet instrument after completion: Performed, ND	Micronutrients (Choline and Betaine)	10.5
Sun et al., 2013[84] (China)	Case-control	Study age group: 4-6 years Cases: 53 children with ASD Age: 4.9±0.6 years Male: 45 (84.9%) Female: 8 (15.1%) Controls: 53 children in TD Age: 5.0±0.6 years Male: 45 (84.9%) Female: 8 (15.1%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents Training: Not reported Estimation of food portions: Local food visual guide Review of diet instrument after completion: Not reported	Calories, macronutrients and micronutrients	12.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Lane et al., 2014[54] (United States)	Cross-Sectional	Study age group: 3-10 years N: 30 children with ASD Age: 6.7 years Male: 26 (88%) Female: 4 (12%)	Number of days: 3 consecutive days (1 weekend day) Responsible for filling out: Caregivers Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Micronutrients	9.5
Marí-Bauset et al., 2014[86] (Spain)	Case-control	Study age group: 6-9 years Cases: 40 children with ASD Age: 7.01±1.01 years Male: 35 (87%) Female: 5 (13 %) Controls: 113 children in TD Age: 8.34±1.19 years Male: 63 (56%) Female: 50 (44 %)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents and primary caregivers Training: Filling instructions Estimation of food portions: Visual serving guide Review of diet instrument after completion: Performed, not detail	Calories, micronutrients, calorie contribution of macronutrients , HEI and score of food variety (HEI component)	16.0
Attle et al., 2015[55] (United Arab Emirates)	Cross-Sectional	Study age group: 5-16 years N: 23 children and adolescents with ASD Age: 4 (17.4%) among 5–7.9 years, 4 (17.4%) among 8–10.9 years, 11 (47.8%) among 11-13.9 years and 4 (17.4%) among 14–16 years Male: 18 (78.3%) Female: 4 (21.7%)	Number of days: 3 days Responsible for filling out: Parents Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients and micronutrients	11.0
Barnhill et al. 2015[71] (United States)	Cross-Sectional	Study age group: 2-14 years N: 120 children and adolescents with ASD Age: 27 (22.5%) among 2-3 years, 72 (60%) among 4-8 years, 20 (15%) among 9-13 years and 3 (2.5%) with 14 years Male: 108 (90%) Female: 12 (10%)	Number of days: 3 non-consecutive days (1 weekend day) Responsible for filling out: Parents Training: Filling instructions Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients and micronutrients	12.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Bicer; Alfassar, 2015[56] (Turkey)	Cross-Sectional	Study age group: 12-18 years N: 117 adolescents with ASD Age: 15.32 years Male: 117 (100%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents and caregivers Training: Standardized instructions Estimation of food portions: Visual serving guide Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients and calorie contribution of macronutrients	11.5
Marí-Bauset et al., 2015[87] (Spain)	Case-control	Study age group: 6-9 years Cases: 20 children with ASD in GFCF diet Age: 7.6±1.3 years Male: 17 (85%) Female: 3 (15%) Controls: 85 children with ASD in regular diet Age: 7.8±1.2 years Male: 76 (89.4%) Female: 9 (10.6%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents and caregivers in school hours Training: Filling instructions Estimation of food portions: Visual serving guide Review of diet instrument after completion: Performed, not detail	Calories, micronutrients and calorie contribution of macronutrients, consumption of food groups (grams), HEI and score of food variety (HEI component)	16.5
Marí-Bauset et al., 2015[88] (Spain)	Case-control	Study age group: 5-9 years Cases: 105 children with ASD Age: 7.8±1.2 years Male: 93 (89%)Female: 12 (11%) Controls: 495 children in TD Male: 266 (54%) Female: 229 (46%) Age: 7.9±1.1 years	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents Training: Filling instructions Estimation of food portions: Visual serving guide Review of diet instrument after completion: Performed, not detail	Calories, micronutrients, calorie contribution of macronutrients , HEI and score of food variety (HEI component)	16.0
Meguid et al., 2015[57] (Egypt)	Cross-Sectional	Study age group: 3-9 years N: 80 children with ASD Age: Not reported Male: 41 (51.25%) Female: 39 (48.75%)	Number of days: 3 consecutive days (1 weekend day) Responsible for filling out: Parents and caregivers Training: Filling instructions Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients and micronutrients	9.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Shmaya et al., 2015[89] (Israel)	Case-control	Study age group: 3-6 years (grupos ASD and Control 2) and 3-12 years (Control 1) Cases: 50 children with ASD Age: 4.5±0.9 years Male: 41 (80.4%) Female: 9 (19.6%) Controls 1: 12 siblings in TD Age: 6.4±2.6 years Male: 10 (71.4%) Female: 2 (28.6%) Control 2: 29 children in TD Age: 4.3±0.9 years Male: 22 (75.9%) Female: 7 (24.1%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents Training: Filling instructions Estimation of food portions: Serving guide Review of diet instrument after completion: Performed by a dietician	Macronutrients and micronutrients	14.0
Stewart et al., 2015[59] (United States)	Cross-Sectional	Study age group: 2-11 years N: 288 children and adolescents with ASD Age: 74 (26%) among 2-3 years; 177 (61%) among 4-8 years, 37 (13%) boys among 9-11 years and 9 (1%) girls among 9-11 years Male: 248 (86.1%) Female: 40 (13.9%)	Number of days: 3 consecutive days (1 weekend day) Responsible for filling out: Caregivers Training: Standardized instructions Estimation of food portions: Not reported Review of diet instrument after completion: Performed by a dietician	Micronutrients	16.0
Castro et al., 2016[10] (Brazil)	Case-control	Study age group: 4-16 years Cases: 49 children and adolescents with ASD Age: 10.0±3.8 years Male: 49 (100%) Controls: 49 children and adolescents in TD Age: 10.0±2.8 years Male: 49 (100%)	Number of days: 3 consecutive days (1 weekend day) Responsible for filling out: Parents and guardians Training: Filling instructions Estimation of food portions: Not reported Review of diet instrument after completion: Performed by a dietician	Calories, macronutrients, micronutrients, calorie contribution of macronutrients and total food items consumed (food selectivity)	11.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Liu et al., 2016[63] (China)	Cross-Sectional	Study age group: Not reported Cases: 154 children with ASD Age: 5.2±1.8 years Male: 141 (91.6%) Female: 13 (8.4%) Controls: 73 children in TD Age: 4.8±0.8 years Male: 67 (91.8%) Female: 6 (8.2%)	Number of days: 2 consecutive weekend days Responsible for filling out: Parents Training: Standardized instructions Estimation of food portions: Food models Review of diet instrument after completion: Not reported	Calories and macronutrients	11.0
Marí-Bauset et al., 2016[80] (Spain)	Case-control	Study age group: 6-9 years Cases: 105 children with ASD Age: 7.8±1.2 years Male: 93 (89%) Female: 12 (11%) Controls: 495 children in TD Age: 7.9±1.1 years Male: 266 (54%) Female: 229 (46%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents and caregivers in school hours Training: Filling instructions Estimation of food portions: Serving guide Review of diet instrument after completion: Performed, not detail	Calories, macronutrients, micronutrients, consumption of food groups (grams), HEI and score of food variety (HEI method)	16.5
Marshall et al., 2016[16] (Australia)	Cross-Sectional	Study age group: 2-6 years Cases: 33 children with ASD Age: 4.34±0.93 years Male: 25 (76%) Female: 8 (24%) Controls: 35 children with HNMCAge: 4.05±0.95 years Male: 25 (71%) Female: 10 (29%)	Number of days: 3 non-consecutive days Responsible for filling out: Parents Training: Standardized instructions Estimation of food portions: Visual guide, measuring cups, measuring spoons and scales Review of diet instrument after completion: Not reported	Total calories and calories from beverages	9.0
Bandini et al., 2017[6] (United States)	Follow-up (Baseline and 6.4 years)	Study age group: 3-11 years N: 18 children and adolescents with ASD Age: 6.8±2.3 (Baseline) and 13.2±2.5 years (Follow-up) Male: 16 (89%) Female: 2 (11%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Number of foods consumed (Food repertoire - food selectivity domain)	14.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Chistol et al., 2017[64] (United States)	Cross-Sectional (Data from the CHAMPS study)	Study age group: 3-11 years Cases: 53 children and adolescents with ASD Age: 6.6±2.1 years Male: 44 (83%) Female: 9 (17%) Controls: 58 children and adolescents in TD Age: 6.7±2.4 years Male: 45 (78%) Female: 13 (22%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Number of unique foods consumed (Food repertoire - food selectivity domain)	14.5
Malhi et al., 2017[17] (India)	Case-control	Study age group: 4-10 years Cases: 63 children with ASD Age: 6.11±1.97 years Male: 57 (90.5%) Female: 6 (8.5%) Controls: 50 children in TD Age: 6.52±1.93 years Male: 22 (44%) Female: 28 (56%)	Number of days: 3 non-consecutive days (1 weekend day) Responsible for filling out: Parents Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients, and micronutrients	10.5
Meguid et al., 2017[81] (Egypt)	Case-control	Study age group: 4-6 years Cases: 80 children with ASD Age: 3.9 ± 0.72 years Male: 63 (78.8%) Female: 17 (21.3%) Controls: 80 children in TD Age: 3.7 ± 0.52 years Male: 62 (77.5%) Female: 18 (22.5%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients, and calorie contribution from macronutrients	11.0
Barnhill et al. 2018[91] (United States)	Case-control	Study age group: 2-8 years Cases: 86 children with ASD Age: 5.51±1.66 years Male: 79 (92%) Female: 7 (8%) Controls: 57 children in TD Age: 6.2±1.85 years Male: 47 (82%) Female: 10 (18%)	Number of days: 3 non-consecutive days (1 weekend day) Responsible for filling out: Parents Training: Filling instructions Estimation of food portions: Visual instruments and serving references Review of diet instrument after completion: Not reported	Calories, macronutrients, andmicronutrients	12.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Berding; Donovan, 2018[65] (United States)	Cross-Sectional (Data from a longitudinal study)	Study age group: 2-7 years Cases: 26 children with ASD Age: 4.1±1.6 years Male: 19 (73%) Female: 7 (27%) Controls: 32 children in TD Age: 4.8±1.8 years Male: 19 (59.3%) Female: 13 (40.7%)	Number of days: 3 days before collecting the stool sample (1 weekend day) Responsible for filling out: Parents Training: Filling instructions Estimation of food portions: Not reported Review of diet instrument after completion: Performed by researcher	Calories, macronutrients, micronutrients, and calorie contribution of macronutrients	9.0
Kim et al., 2018[105] (South Korea)	Follow-up	Study age group: 2-5 years and 6 months Cases: 13 children with ASD Age: 4.4± 0.5 years Male: 11 (84.6%) Female: 2 (15.4%) Controls: 14 children with ASD Age: 4.0 ± 1.0 years Male: 13 (92.9%) Female: 1 (8.1%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Micronutrients	11.5
Neumeyer et al., 2018[67] (United States)	Cross-Sectional	Study age group: 8-17 years Cases: 27 children and adolescents with ASD Age: 12.7±0.5 years Male: 27 (100%) Controls: 24 children and adolescents in TD, including siblings in TD Age: 13.5±0.5 years Male: 24 (100%)	Number of days: 3 days Responsible for filling out: Parents Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients, and calorie contribution of macronutrients	12.0
Sharp et al., 2018[2] (United States)	Cross-Sectional	Study age group: 2-17 years N: 70 children and adolescents with ASD Age: 5.09 years Male: 56 (80%) Female: 14 (20%)	Number of days: 3 consecutive days (no weekend days required) Responsible for filling out: Caregivers Training: Filling instructions Estimation of food portions: Not reported Review of diet instrument after completion: Performed by a dietician	Calories, macronutrients, micronutrients, preferred food items and omission of food groups (Food variety and criterion for food selectivity)	13.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Siddiqi et al., 2019[69] (India)	Cross-Sectional (Pilot study)	Study age group: 2-13 years N: 53 children and adolescents with ASD Age: 20 (37%) among 2-4 years, 19 (36.5%) among 5-7 years, 12 (23%) among 8-10 years and 2 (4%) among 11-13 years Male: 45 (84.9%) Female: 8 (15.1%)	Number of days: 3 non-consecutive days (1 weekend day) Responsible for filling out: Parents, guardians and caregivers Training: Not reported Estimation of food portions: Standardized measuring cups and visual guides Review of diet instrument after completion: Not reported	Calories, macronutrients, and micronutrientes	11.0
Withrow; Alvidrez, 2019[106] (United States)	Cross-Sectional with instrument validation	Study age group: 2-8 years Cases: 57 children with ASD Age: 8 (14%) among 2-3 years; 22 (38.6%) among 4-5 years; 18 (31.6%) among 6-7 years; 9 (15.8%) with 8 years Male: 37 (64.9%) Female: 20 (35.1%) Controls: 105 children in TD Age: 39 (37.1%) among 2–3 years, 31 (29.5%) among 4-5 years, 28 (26.7%) among 6-7 years and 7 (6.7%) with 8 years Male: 55 (52.4%) Female: 50 (47.6%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Primary caregivers Training: Not reported Estimation of food portions: Pictures and examples of common conversions and measurements Review of diet instrument after completion: Performed, not detail	Calories, macronutrients, and micronutrients	13.5
Berding; Donovan, 2020[101] (United States)	Follow-up (Baseline, 6 weeks and 6 months)	Study age group: 2-7 years Cases: 26 children with ASD Age: 4.1±1.6 years Male: 19 (73%) Female: 7 (27%) Controls: 32 children in TD Age: 4.8±1.8 years Male: 19 (59.3%) Female: 13 (40.7%)	Number of days: 3 days before collecting the stool sample (1 weekend day) Responsible for filling out: Parents Training: Filling instructions Estimation of food portions: Not reported Review of diet instrument after completion: Performed by researcher	Calories, macronutrients, micronutrients, and calorie contribution of macronutrients	9.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Study	Design	Population	Method	Outcomes	Score
Nogay et al., 2020[108] (United States)	Randomized controlled	Study age group: 6-17 years N: 15 children with ASD Age: 11.7 ± 3.3 years Male: 10 (66.7%) Female: 5 (33.3%)	Number of days: 3 days (filled out before the study started and during the last 3 days of the study) Responsible for filling out: Parents and caregivers Training: Not reported Estimation of food portions: Not reportedReview of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients, calorie contribution of macronutrients , and FODMAPs	11.5
Zeybek; Yurttagul, 2020[15] (Turkey)	Cross-Sectional	Study age group: 3-18 years N: 40 children with ASD Age: 10 ± 4.1 years Male:33 (82.5%) Female: 7 (17.5%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Not reported Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients, calorie contribution of macronutrients and HEI	9.0
Buro et al., 2020[76] (United States)	Cross-Sectional	Study age group: 2-17 years N: 41 children with ASD Age: 8.3 ± 4.0 years Male: 30 (73%) Female: 11 (27%)	Number of days: 1 day Responsible for filling out: Parents Training: Not reported Estimation of food portions: Not reported Review of diet instrument after completion: Performed by a dietitian or trained researcher via telephone contact	Total score and by components of the HEI	13.0
Eow et al., 2021[77] (Malaysia)	Cross-Sectional	Study age group: 3-7 years N: 224 children with ASD Age: 5.19 ± 0.87 years Male: 185 (82.6%) Female: 39 (17.4%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Mothers Training: Not reported Estimation of food portions: Pictures of measuring cups and spoons Review of diet instrument after completion: Not reported	Calories, macronutrients, micronutrients, and calorie contribution of macronutrients	14.5
Plaza-Diaz et al., 2021[98] (Spain)	Case-control	Study age group: 2-6 years Cases:54 children with ASD Age: 3.5 years Male: 45 (83.3%) Female: 9 (16.4%) Controls: 57 children in TD Age: 4.3 years Male: 43 (75%) Female: 14 (25%)	Number of days: 3 non-consecutive days (1 weekend day) Responsible for filling out: Parents Training: Filling according to European Food Safety Agency guidelines Estimation of food portions: Not reported Review of diet instrument after completion: Not reported	Calories, macronutrients, and micronutrients	11.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Yeung et al., 2021[100] (China)	Case-control	Study age group: 3-6 years Cases: 65 children with ASD Age: 4.9±1.0 years Male: 54 (83.1%) Female: 11 (16.9%) Controls: 65 children in TD Age: 4.6±1.1 years Male: 54 (83.1%) Female: 11 (16.9%)	Number of days: 3 days (1 weekend day) Responsible for filling out: Parents Training: Not reported Estimation of food portions: Pictures of individual portions of food Review of diet instrument after completion: Performed by researcher.	Calories, micronutrients, calorie contribution of macronutrients and Chinese Children Dietary Index	10.0
WEIGHING OF FOOD (n=1)					
Liu et al., 2016[63] (China)	[b]	[b]	Number of days:Number of days: 5 consecutive weekdays Responsible for weighing and filling out: Trained researchers Place: Educational environment	Calories and macronutrients	[b]
24-HOUR FOOD RECALL (n=8)					
Cornish, 1998[34] (England)	Cross-Sectional	Study age group: 3 years and 6 months - 9 years and 9 months N: 17 children with ASD Age: Not reported Male: Not reported Female: Not reported	Number of days: 3 days (1 weekend day) Responsible for filling out: Not reported Interview: Presential Estimation of food portions: Food models and home measures	Calories, micronutrients, calorie contribution of macronutrients , servings of food groups and food items consumed (Food variety)	6.0
Johnson et al., 2008[36] (United States)	Cross-Sectional	Study age group: 2-4 years Cases: 19 children with ASD Age: 3.26±0.74 years Male: Not reported Female: Not reported Controls: 15 children in TD Age: 3.03±0.78 years Male: Not reported Female: Not reported	Number of days: 1 day Responsible for filling out: Not reported Interview: Presential Estimation of food portions: Not reported	Calories, macronutrients and micronutrients	8.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Lukens; Linscheid, 2008[105] (United States)	Cross-Sectional with instrument validation	Study age group: 3-10 years Cases: 68 children with ASD Male: 56 (82.4%) Female: 12 (17.6%) Controls: 40 children in TD Male: 20 (50%) Female: 20 (50%) Age: 6.1±2.5 years (N: 108)	Number of days: 1 day Responsible for filling out: Researcher Interview: Telephone Estimation of food portions: Household utensils (e.g. cups, spoons)	Servings of vegetables	13.0
Sadowska; Cierebiej, 2011[43] (Poland)	Cross-Sectional	Study age group: 4-8 years N: 20 children with ASD Age: 12 (60%) among 4-6 years and 8 (40%) among 7-8 years Male: 18 (90%) Female: 2 (10%)	Number of days: 3 non-consecutive days Responsible for filling out: Not reported Interview: Presential Estimation of food portions: Serving photo album	Calories, macronutrients, micronutrients, percentage of food groups per meal and average number of food group items	5.5
Bicer; Alfassar, 2016[90] (Turkey)	Case-control	Study age group: 12-18 years Cases: 118 adolescents with ASD Age: 14.9±1.6 years Male: 118 (100%) Controls: 97 adolescents in TD Age: 15.3±1.6 years Male: 97 (100%)	Number of days: 3 days Responsible for filling out: Trained researcher Interview: Presential Estimation of food portions: Not reported	Calories, macronutrients, micronutrients, and calorie contribution of macronutrients	10.5
Malhi et al., 2021[94] (India)	Case-control	Study age group: 4-10 years Cases: 50 children with ASD Age: 5.3±1.38 years Male: 36 (72%) Female: 14 (28%) Controls: 28 children in TD Age: 5.96±1.38 years Male: 19 (67.9%) Female: 9 (32.1%)	Number of days: 3 days Responsible for filling out: Not reported Interview: Presential Estimation of food portions: Not reported	Calories, macronutrients, and 92icronutrientes	8.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Molina-López et al., 2021[95] (Spain)	Case-control	Study age group: 6-18 years Cases: 51 children with ASD Age: 9.57±1.67 years Male: 37 (72.5%) Female: 14 (27.5%) Controls: 93 children in TD Age: 12.8±2.98 years Male: 50 (53.8%) Female: 43 (46.2%)	Number of days: 3 days (72 hours) (1 weekend day) Responsible for filling out: Dietitian Interview: Presential,after informative workshops Estimation of food portions: Not reported	Calories, micronutrients, and calorie contribution of macronutrients	10.5
Moorthy et al., 2021[96] (India)	Case-control	Study age group: 5-12 years Cases: 136 children with ASD Age: 7.7±2.1 years Male: 96 (70.6%) Female: 40 (29.4%) Controls: 136 children in TD Age: 7.9±2.1 years Male: 97 (71.3%) Female: 39 (28.7%)	Number of days: 1 day Responsible for filling out: Principal researcher Interview: Presential and with registration in the Dental Diet Diary application Estimation of food portions: Not reported	Sugar exposures per day	17.5

FOOD FREQUENCY QUESTIONNAIRE/QUESTIONS (n=42)

Cornish, 1998[34] (England)	b	b	Instrument name not reported Food items: Not reported Responsible for filling out: Not reported Food groups: Not reportedRecall period: Not reported	Calories, micronutrients, calorie contribution of macronutrients and servings of food groups and food items consumed (Food variety)	b
Williams et al., 2005[72] (United States)	b	b	Instrument name not reported Food items: 145 Responsible for filling out: Caregivers Food groups.: fruits, vegetables, snacks, dairy, starches, and proteins Recall period: Not reported	Average of food group items (Food variety)	b
Lindsay et al., 2006[20] (United States)	Cross-Sectional (Data from a placebo-controlled trial)	Study age group: 5-17 years N: 20 children and adolescents with ASD Age: 8.38±2.21 years Male: 19 (95%) Female: 1 (5%)	Women's Health Initiative Food Frequency Questionnaire Food items: 122 Responsible for filling out: Parents and caregivers Food groups: Not reported Recall period: 1 month	Calories, macronutrients and micronutrients	12.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Study	Design	Population	Questionnaire	Outcomes	Score
Johnson et al., 2008[36] (United States)	b	b	Short Dietary Questionnaire of Yarnell Food items:: Not reported Responsible for filling out: Parents Food groups: Not reported Recall period: Not reported	Calories, macronutrients, micronutrients and consumption of water, fruits and vegetables	b
Lukens; Linscheid, 2008[105] (United States)	b	b	Youth/Adolescent Questionnaire Food items: 148 Responsible for filling out: Caregivers G.A: Not reported Recall period: 12 months	Servings of meats, fruits and vegetables.	b
Bandini et al., 2010[7] (United States)	b	b	Youth/Adolescent Questionnaire Food items: 131 Responsible for filling out: Parents Food groups: Not reported Adaptations: Inclusion of food items and questions for investigation of food offer and refusal Recall period: 12 months	Number of foods not consumed and percentage of offered foods not consumed (Food refusal - food selectivity domain) and number of food items consumed 4-5 times a day (high daily consumption of food items - food selectivity domain)	b
Emond et al., 2010[40] (England)	Cross-Sectional (Data from the ALSPAC cohort study)	Study age group: 38 months Cases: 64 children with ASD Male: Not reported Female: Not reported Controls: 9550 children in TD Male: Not reported Female: Not reported Age: 3.16 years (N: 9.614)	FFQ developed for the ALSPAC cohort study Food items: 56 Responsible for filling out: Caregivers Food groups: Not reported Recall period: Not reported	Calories, macronutrients, micronutrients, items consumed from food groups and food items never consumed (Score of food variety)	10.5
Evans et al., 2012[44] (United States)	Cross-Sectional	Study age group: 3-11 years Cases: 53 children and adolescents with ASD Age: 6.6±2.1 years Male: 44 (83%) Female: 9 (17%) Controls: 58 children and adolescents in TD Age: 6.7±2.4 years Male: 45 (78%) Female: 13 (22%)	Youth/Adolescent Questionnaire Food items: 131 Responsible for filling out: Parents Food groups: Not reported Adaptations: Inclusion of food items and questions for food refusal investigation Recall period: 12 months	Average servings of food groups	15.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Harris; Card, 2012[45] (United States)	Cross-Sectional	Study age group: 5-12 years N: 13 children and adolescents with ASD Age: 9.0 ± 1.9 years Male: 9 (69.2%) Female: 4 (30.8%)	FFQ elaborated by the authors Food items: 38 Responsible for filling out: Guardians Food groups: Not reported Recall period: Not reported	Average number of gluten-free and casein-free food items consumed (adherence to the GFCF diet)	17.5
Moore et al., 2012[47] (United States)	Cross-Sectional	Study age group: 3-10 years N: 54 children with ASD Age: 4.94 years Male: 47 (87%) Female: 7 (13%)	Block Kids Questionnaire Food items: 72 Responsible for filling out: Study coordinator Food groups: Not reported Recall period: 7 days	Calories, macronutrients, micronutrients, and calorie contribution of macronutrients	9.5
Wang et al., 2012[83] (Australia)	Case-control	Study age group: Not reported Cases: 23 children with ASD Age: 10.25±0.75 years Male: 21 (91.3%) Female: 2 (8.7%) Controls: 31 children in TD, including 22 siblings Age: 11.33±0.75 years Male: 15 (48.4%) Female: 16 (51.6%)	Cancer Council Victoria Questionnaire (not detail about version) Food items: Not reported Responsible for filling out: Caregivers Food groups: Not reported Recall period: Not reported	Calories and macronutrients	6.5
Zimmer et al., 2012[50] (United States)	Cross-Sectional	Study age group: Not reported Cases: 22 children with ASD Age: 8.2±3.2 years Male: 20 (91%) Female: 2 (9%) Controls: 22 children in TD Age: 8.1±3.3 years Male: 10 (45%) Female: 12 (55%)	Harvard Semiquantitative Food Frequency Questionnaire Food items: 174 Responsible for filling out: Parents or caregivers Food groups: Not reported Recall period: 1 month	Calories, macronutrients, micronutrients, items consumed at least once a month (Score of food variety/ Food selectivity)	9.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Al-Farsi et al., 2013[14] (Sultanate of Oman)	Case-control	Study age group: 3-5 years Cases: 40 children with ASD Age: 4.8±0.3 years Male: 20 (50%) Female: 20 (50%) Controls: 40 children in TD Age: 4.8±0.3 years Male: 20 (50%) Female: 20 (50%)	Reduced Dietary Questionnaire of Block Food items: 60 Responsible for filling out: Researcher Food groups: Not reported Recall period: Not reported	Micronutrients (Folate and Vitamin B12)	8.5
Williams-Hooker et al., 2013[53] (United States)	Cross-Sectional	Study age group: 7-12 years N: 47 children and adolescents with ASD Age: 22 (46.8%) among 7-8 years and 25 (53.2%) among 9-12 years Male: 47 (100%)	FFQ for assessing vitamin D and calcium intake Food items: 22 Responsible for filling out: Parents and caregivers Food groups: Not reported Recall period: 12 months	Micronutrients (Calcium and Vitamin D)	12.0
Diolordi et al., 2014[102] (Italy)	Follow-up (Baseline and 12 months)	Study age group: Not reported Cases: 33 children with ASD Age: 4.85±1.85 years Male: 27 (81.8 %) Female: 6 (18.2 %) Controls: 35 children in TD Age: 5.2±2.05 years Male: 17 (48.6 %) Female: 18 (51.4 %)	FFQ elaborated by the authors Food items: Not reported Responsible for filling out: Not reported Food groups : Not reported Recall period: Not reported Applied at baseline and 12-month follow-up	Average servings of food groups	13.0
Hubbard et al., 2014[85] (United States)	Case-control (Data from the CHAMPS study)	Study age group: 3-11 years Cases: 53 children and adolescents with ASD Age: 6.6±2.1 years Male: 44 (83%) Female: 9 (17%) Controls: 58 children and adolescents in TD Age: 6.7±2.4 years Male: 45 (78%) Female: 13 (22%)	Youth/Adolescent Questionnaire Food items: 131 Responsible for filling out: Parents Food groups: Not reported Adaptation: Inclusion of food items and questions for investigation of food offer and refusal Recall period: 12 months	Total food refusal and by food groups (Fruits, vegetables, and Fruits/Vegetables) according to food characteristics	17.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Murshid, 2014[18] (Saudi Arabia)	Cross-Sectional	Study age group: 3-14 years N: 344 children and adolescents with ASD Age: Not reported Male: 261 (75.9%) Female: 83 (24.1%)	Food frequency questions developed by the authors Responsible for filling out: Parents Food groups: Sweet foods, non-sweet snacks, and soft drinks Frequency options: Never, sometimes, 1x/day, 2x/day, 3x or more/day, don't know/missing Recall period: Not reported	Frequency of consumption of food groups	13.5
Curtin et al., 2015[5] (United States)	Cross-Sectional (Data from the CHAMPS study)	Study age group: 3-11 years Cases: 53 children and adolescents with ASD Age: 6.6±2.1 years Male: 44 (83%) Female: 9 (17%) Controls: 58 children and adolescents in TD Age: 6.7±2.4 years Male: 45 (78%) Female: 13 (22%)	Youth/Adolescent Questionnaire Food items: with 131 Responsible for filling out: Parents Food groups: Not reported Adaptations: Inclusion of food items and questions for investigation of food offer and refusal Recall period: 12 months	Number of foods not consumed and percentage of offered foods not consumed (Refusal/Food selectivity)	14.5
Postorino et al., 2015[58] (Italy)	Cross-Sectional	Study age group: 3-12 years Cases: 79 children and adolescents with ASD and food selectivity Age: 7.22 ± 2.04 years Male: 67 (84.8%) Female: 12 (15.2%) Controls: 79 children and adolescents with ASD Age: 7.10 ± 2.06 years Male: 69 (87.3%) Female: 10 (12.7%)	Youth/Adolescent Questionnaire Food items: 131 Responsible for filling out: Parents Food groups: Not reported Adaptations: Inclusion of food items and questions for investigation of food offer and refusal Recall period: 12 months	Number of foods not consumed and percentage of offered foods not consumed (Food refusal - food selectivity domain) and number of food items consumed 4-5 times a day (high daily consumption of food items - food selectivity domain)	14.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Tanner et al., 2015[60] (United States)	Cross-Sectional	Study age group: 4-10 years Cases: 17 children with ASD and food selectivity Age: 6.58±1.87 years Male: 15 (88.2%) Female: 2 (11.8%) Controls: 18 children with ASD Age: 6.96±1.95 years Male: 17 (94.4%) Female: 1 (5.6%)	Youth/Adolescent Questionnaire Food items: 126 Responsible for filling out: Parents Food groups: Not reported Recall period: 12 months	Average food items consumed (Food selectivity) and food refusal rate	15.0
Aponte; Romanczyk, 2016[61] (United States)	Cross-Sectional	Study age group: 3-11 years Cases: 38 children and adolescents with ASD Age: 6.9 years Male: 32 (84.2%) Female: 6 (15.8%) Control 1: 28 siblings in TD Age: Not reported Male: Not reported Female: Not reported Control 2: 37 Guardians Age: Not reported Male: Not reported Female: Not reported	Instrument name not reported Food items: 167 Responsible for filling out: Parents Food groups: Vegetables, fruits, carbohydrates, dairy, combination and mixed Recall period: Not reported	Percentage of food group items consumed, and percentage and average of food group items never consumed	16.5
Fahmy et al., 2016[62] (Egypt)	Cross-Sectional	Study age group: 3-15 years Cases: 42 children and adolescents with ASD Age: 7.1 ± 2.3 years Male: 34 (81%) Female: 8 (19%) Controls: 40 children and adolescents in TD Age: 7.6±3.1 years Male: 19 (47.5%) Female: 21 (52.5%)	FFQ for assessing vitamin D intake Food items: Not reported Responsible for filling out: Applied by researcher Food groups: Not reported Recall period: Not reported	Micronutrient (Vitamin D)	11.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Study			Instrument	Outcome	
Bandini et al., 2017[6] (United States)	[b]	[b]	Youth/Adolescent Questionnaire Food items: 131 Responsible for filling out: Parents Food groups: Not reported Adaptations: Inclusion of food items and questions for investigation of food offer and refusal Recall period: 12 months Applied at baseline and 6.4 years follow-up	Average and percentage of items not consumed (Food refusal), average of items not offered, percentage of vegetables and fruits not consumed, daily servings of fruits and vegetables and frequency of refusal of food items equal to or greater than 33% (Food selectivity)	[b]
Chistol et al., 2017[64] (United States)	[b]	[b]	Youth/Adolescent Questionnaire Food items: 131 Responsible for filling out: Parents Food groups: Not reported Adaptations: Inclusion of questions for investigation of offer and refusal of food Recall period: 12 months	Average percentage of offered food not consumed (Food refusal) and average variety of fruits and vegetables consumed	[b]
Meguid et al., 2017[81] (Egypt)	[b]	[b]	Instrument name not reported Food items: Not reported Responsible for filling out: Not reported Food groups: Not reportedRecall period: Not reported	Frequency of consumption of food items.	[b]
Berding; Donovan, 2018[65] (United States)	[b]	[b]	Youth/Adolescent Questionnaire Food items: 156 Responsible for filling out: Parents Adaptation: Number of food items and inclusion of questions to investigate food offer and refusal Food groups: Not reported Recall period: 12 months	Dietary patterns and daily servings of food groups	[b]
Kotha et al., 2018[66] (Saudi Arabia)	Cross-Sectional	Study age group: Not reported N: Not reported Age: 5.8 years Male: Not reported Female: Not reported	Food frequency questions developed by the authors Responsible for filling out: Parents Food groups: Soft drinks, nuts/ leguminous, confectionery, fruits and legumes, fast-food, snacks, reward foods, and recommended diet Frequency options: occasionally/regularly, and yes/no (reward, soft drinks, recommended diet) Recall period: Not reported	Frequency of consumption of food groups	12.2

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Ferguson et al., 2019[68] (United States)	Cross-Sectional	Study age group: 6-18 years N: 120 children and adolescents with ASD Age: 11.8±3.8 years Male: 108 (90%) Female: 12 (10%)	FFQ with foods containing 10mg of omega-3 per serving Food items: 152 Responsible for filling out: Parents and caregivers Food groups: Not reported Recall period: 1 month	Calories, macronutrients, and micronutrients	13.5
Gonzalez-Domenech et al., 2019[107] (Spain)	Cross-over clinical trial	Study age group: 3-18 years N: 28 children and adolescents with ASD Age: 8.1 years Male: 25 (89%) Female: 3 (11%)	FFQ elaborated by the authors Food items: 120 Responsible for filling out: Researcher Food groups: Dairy, eggs/meat/fish, vegetables, fruits, leguminous/cereal, oils/fats, bakery products, beverages and mixed Recall period: 3 months Applied at baseline, after intervention and after cross-over (3 months among each stage)	Mean score of frequency of consumption of food groups	17.5
Leiva-Garcia et al., 2019[92] (United States)	Case-control	Study age group: 6-18 years Cases: 51 children and adolescents with ASD Age: 12.84±3.67 years Male: 37 (74%) Female: 13 (26%) Controls: 93 children and adolescents in TD Age: 9.56 ±1.67 years Male: 50 (53.8%) Female: 43 (46.2%)	Instrument name not reported Food items: 200 Responsible for filling out: Parents Food groups: Not reported Recall period: Not reported	Refusal frequency of food items equal to or greater than 33% (Food selectivity)	16.0
Siddiqi et al., 2019[69] (India)	b	b	Instrument name not reported Food items: Not reported Responsible for filling out: Parents, Caregivers and guardians Food groups: Not reported Recall period: Not reported	Not detail	b

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Al-Kindi et al., 2020[93] (Sultanate of Oman)	Case-control	Study age group: 4-13 years Cases: 163 children and adolescents with ASD Age: 7.23 ±2.51 years Male: 129 (79.1%) Female: 34 (20.9%) Control 1: 212 children and adolescents in TD Age: 7.71±2.63 years Male: 104 (49.1%) Female: 108 (50.9%) Control 2 :163 relatives de children with ASD Age: 36 (22.1%) among 20-30 years, 102 (62.6%) among 31-41 years and 25 (15.3%) among 41 and 51 yearsControl 3: 212 relatives de children in TD Age: 52 (24.5%) among 20-30 years, 116 (54.7%) among 31-41 years and 44 (20.8%) among 41 and 51 years	Block Food Frequency Questionnaire Food items: 119 Responsible for filling out: Researcher Adaptations: FFQ previously adapted for Omani food Food groups: Vegetables, fruits, meat/meat substitutes, milk/derivatives, traditional Omani food/miscellaneous dishes, breads, desserts, drinks, sandwiches, and fast-food Recall period: 12 months	Percentage and average of items consumed by food groups	17.0
Berding; Donovan, 2020[101] (United States)	b	b	Youth/Adolescent Questionnaire Food items: 156 Responsible for filling out: Parents Adaptation: Number of food items and inclusion of questions to investigate food offer and refusal Food groups : Not reported Recall period: 12 months Applied at baseline and at 6-week and 6-month follow-up	Dietary patterns and daily servings of food groups	b
Gok et al., 2020[73] (Turkey)	Cross-Sectional	Study age group: 3-18 years Cases: 61 children and adolescents with ASDControls: Controls: 41 children and adolescents with PDD-NOS Age: 9.5±3.9 years (N: 102) Male: 19 (18.6%) (N: 102) Female: 83 (81.4%) (N:102)	Instrument name not reported Food items: Not reported Responsible for filling out: Not reported Food groups: Not reported Recall period: Not reported	Frequency of consumption of items and food groups	15.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Tsujiguchi et al., 2020[74] (Japan)	Cross-Sectional	Study age group: 7-15 years Cases: 82 children and adolescents with traits of ASD Age: 10.91 years Male: 43 (52.4%) Female: 39 (47.6%) Controls: 1026 children and adolescents sem traits of ASD Age: 10.96 years Male: 491 (47.9%) Female: 535 (52.1%)	Brief self-administered Dietary History Questionnaire (10 years and 15 years) Food items: 54 (10 years) and 57 (15 years) Responsible for filling out: Guardians and participants Food groups: Not reported Recall period: 1 month	Calories, micronutrients, and calorie contribution of macronutrients	14.0
Molina-López et al., 2021[95] (Spain)	b	b	Instrument name not reported Food items: 200 Responsible for filling out: Not reported Food groups: Not reported Recall period: Not reported	Frequency of consumption of food groups and frequency of refusal of food items equal to or greater than 33% (Food selectivity)	b
Nadeau et al., 2021[97] (United States)	Case-control	Study age group: 4-17 years Cases: 185 children with ASD Age: 8.65 ± 3.04 years Male: 134 (72.4%) Female: 51 (27.6%) Controls: 111 children in TD Age: 9.18 ± 3.64 years Male: 51 (46%) Female: 60 (54%)	Food frequency portion of the Eating Habits Survey Food items: Not reported Responsible for filling out: Not reported Food groups: Fruits, legumes, savory bread products, sweet bread products, meats, and dairy Recall period: Not reported	Infrequency of consumption of food groups	14.0
Panjwani et al., 2021[78] (United States)	Cross-Sectional	Study age group: 2-17 years N: 200 children with ASD Age: 7.7±4.1 years Male: 149 (75.6%) Female: 48 (24.4%)	Frequency questions elaborated by the authors Responsible for filling out: Parents Food groups: Meat, seafood, vegetables, fruits, grains, dairy, eggs, sweets, fats, sugary drinks, artificially sweetened drinks, and 100% juice Frequency options: <1×/week, ≥1×/week, 1×/day, 3-4×/day and >4×/day. Recall period: Answered in a single interview for before and after the pandemic of the new coronavirus (COVID-19).	Frequency of consumption of food groups	15.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Study	Design	Sample	Instrument	Outcome	Score
Plaza-Diaz et al., 2021[98] (Spain)	[b]	[b]	FFQ previously modified and adapted for the PREDIMED study Food items: 137 Responsible for filling out: Parents Food groups: Not reported Recall period: 12 months	Average servings of food groups, dietary patterns and servings daily of solid and pureed texture foods by food groups	[b]
Raspini et al., 2021[99] (Italy)	Case-control	Study age group: 1.3-6.4 years Cases: 65 children with ASD Age: 3.6±1.2 years Male: 57 (87.7%) Female: 8 (12.3%) Controls: 82 children in TD Age: 3.7±1.3 years Male: 48 (58.5%) Female: 34 (41.5%)	FFQ adapted from the ZOOM8 study Food items: Not reported Responsible for filling out: Parents Food groups: Not reported Recall period: 12 months	Average servings of food items	16.0
Şengüzel et al., 2021[79] (Turkey)	Cross-Sectional	Study age group: 2-10 years N: 46 children with ASD Age: 26 (56.5%) among 2 and 5 years and 20 (43.5%) among 6 and 10 years. Male: 38 (82.6%) Female: 8 (17.4%)	FFQ elaborated by the authors Food items: Not reported Responsible for filling out: Dietitian Food groups: Not reported Recall period: 1 month	Frequency of consumption of items and food groups	16.0
Yeung et al., 2021[100] (China)	[b]	[b]	Instrument name not reported Food items: 262 Responsible for filling out: Parents Food groups: Not reported Recall period: 12 months	Average of food groups, Chinese Children Dietary Index and food variety	[b]

FOOD LIST (n=8)

Study	Design	Sample	Instrument	Outcome	Score
Schmitt et al., 2008[38] (United States)	[b]	[b]	Typ e: Checklist Food items: Not reported Responsible for filling out: Guardians Food groups: Not reported Options: Really like, will eat, don't like and haven't tried Recall period: Current	Preferred food items	[b]

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Study	Design	Population	Instrument	Outcome	Value
Hendy et al., 2010[41] (United States)	Cross-Sectional	Study age group: Not reported Cases: 50 children with ASD Control 1: 84 children with NE Control 2: 102 children in TD Male: 153 (64.8%) (N: 236) Female: 83 (35.2%) (N: 236) Age: 4.8±3.6 years (N: 236)	Type: Checklist Food items: 139 Responsible for filling out: Guardians Food groups: Fruits, vegetables, dairy, proteins, starches and others Recall period: Current	Average number of food items accepted (Food variety)	12.0
Sharp et al., 2011[104] (United States)	b	b	Type: Free list Food items: Not reported Responsible for filling out: Guardians Food groups: Fruits, proteins, vegetables, cereals, sweets, and dairy Recall period: Current	Total solid items accepted (Food variety)	b
Al-Farsi et al., 2013[14] (Sultanate of Oman)	b	b	Food Diary Type: Free list Responsible for filling out: Mothers Food groups: Not applicable Recall period: 12 months	Not detail	b
Suarez; Crinion, 2015[9] (United States)	Cross-Sectional	Study age group: 4.6-10.6 years N: 54 children with ASD Age: Not reported Male: 48 (88%) Female: 6 (12%)	Type: Checklist Food items: 70 items Responsible for filling out: Parents Food groups: Legumes, fruits, proteins, dairy products, grains/snack/potatoes, and dessert/sweets Recall period: 1 month	Total food items accepted (Food selectivity), average percentage of foods accepted by food groups, and preferred foods from the vegetables and fruits groups	14.0
Marshall et al., 2016[16] (Australia)	b	b	Type: Free list Food items: Not reported Responsible for filling out: Parents Food groups: Not reported Recall period: Current	Average number of food items accepted total and by food group. (Food variety)	b
Zeybek; Yurttagul, 2020[15] (Turkey)	b	b	Type: Checklist Food items: Not reported Responsible for filling out: Parents Recall period: Current	Preferred food items	b

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Malhi et al., 2021[94] (India)	b	b	Type: Checklist Food items: Not reported Responsible for filling out: Parents Food groups: Vegetables, proteins, fruits, dairy, and carbohydrates Options: Almost Never/Rarely, Sometimes and Often/Every Time Recall period: Current	Refusal of food items.	b

FOOD PREFERENCE INVENTORY/QUESTIONNAIRE (n=7)

Schreck et al., 2004[82] (United States)	Case-control	Study age group: 5-12 years Cases: 138 children and adolescents with ASD Age: 8.15 years Male: 121 (88%) Female: 14 (10%) No gender information: 3 (2%) Controls: 298 children and adolescents in TD Age: 9 years Male: 158 (53%) Female: 140 (47%)	Food Items: 138 Responsible for filling out: Caregivers Food groups: Fruits, vegetables, dairy, proteins, and starches	Average number of items accepted per food group	16.5
Schreck et al., 2006[28] (United States)	Cross-Sectional	Study age group: 5-12 years Cases: 138 children and adolescents with ASD Male: 121 (88%) Female: 14 (10%) No gender information: 3 (2%) Age: 8.3±2.5 years Controls: 175 relatives Male: Not reported Female: Not reported Age: Not reported	Food items: 138 Responsible for filling out: Caregivers Food groups: Fruits, vegetables, dairy, proteins, carbohydrates and mixed	Average and percentage of items accepted by food group	14.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

Attle et al., 2015[55] (United Arab Emirates)	b	b	Food items: 132 Responsible for filling out: Parents Food groups: Fruits, vegetables, proteins, carbohydrates, dairy, and snacks/ mixed Options: No consumption, weekly, daily, monthly	Percentage of items not consumed total and by food group (Food selectivity)	b
Malhi et al., 2017[17] (India)	b	b	Food items: 60 Responsible for filling out: Parents Food groups: Proteins, carbohydrates, dairy, fruits, and vegetables	Average of items accepted by food group (Food selectivity)	b
Riccio et al., 2018[29] (Italy)	Cross-Sectional	Study age group: Not reported Cases: 43 children with ASD Age: 6.28±2.3 years Male: 33 (76.7%) Female: 10 (23.3%) Control 1: 41 children in TD Age: 7.2 years Male: Not reported Female: Not reported	Food items: 86 Responsible for filling out: Parents Food groups: Vegetables, fruits, cereals, meats, fish, sausages, dairy, cakes, eggs, pastries and beverages	Average number of food items accepted total and by food group (Refusal/Food selectivity)	13.5
Smith et al., 2020[70] (Reino Unido)	Cross-Sectional	Study age group: Not reported Cases: 27 children with ASD Age: 10.4±3.2 years Male: 16 (59.2%) Female: 11 (40.8%) Control 1: 17 children with ADHD Age: 10.8±3.6 years Male: 10 (58.8%) Female: 7 (41.2%) Control 2: 27 children with TS Age: 10.2±2.6 years Male: 22 (81.5%) Female: 5 (18.5%) Control 3: 27 children in TD Age: 9.7±2.4 years Male: 22 (81.5%) Female: 5 (18.5%)	Food items: 75 Responsible for filling out: Caregivers Food groups: Fruits, vegetables, meat/fish, dairy, snacks and carbohydrates Options: Never tried - Likes it a lot (Likert)	Score of accepted food items by food group	16.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=94).

| Adams et al., 2021[75] (South Africa) | Cross-Sectional | Study age group: 3- 9.6 years N: 40 children with ASD Age: Not reported Male: 32 (82%) Female: 8 (8%) | Food items: 70 Responsible for filling out: Caregivers Food groups: Starches, snacks, dairy, meat/fish, fruits, and legumes Options: Dislike very much - Like very much (Likert), and never tried | Average and percentage of preferred items and food groups | 16.0 |

[a]Calories and/ou nutrients, indexes, food groups. [b]Study applied two instruments to evaluate food consumption, information described previously (n=18). Age = Average age or percentage of participants by study age group. ALSPAC = Avon Longitudinal Study of Parents and Children. ASD = Autistic Spectrum Disorder. ADHD = Attention Deficit Hyperactivity Disorder. CHAMPS = Children's Activity and Meal Patterns Study. DD = Other developmental disorders. TD = Typical development. FFQ = Food frequency questionnaire. FODMAPs = Fermentable oligosaccharides, disaccharides, monosaccharides, and polyols. GFCF= Gluten-free and casein-free diet. HEI = Healthy Eating Index. HNMC= Non-medically complex history. PDD-NOS = Pervasive Developmental Disorder Not Otherwise Specified. PREDIMED = Prevención con Dieta Mediterránea Study. SN = Special Needs. TS = Tourette Syndrome. ZOOM8 = Study on Nutrition and Physical Activity in Italian Primary School Children.

SUPPLEMENTARY MATERIAL

Supplementary table 1. Search keys employed in the databases

Database	Search Key
PubMed, PsycINFO and Web of Science	*("autistic disorder" OR "autism spectrum disorder" OR "asperger disease" OR "asperger disorder") AND ("diet records" OR "diet surveys" OR "dietary assessment" OR "dietary survey methods" OR "dietary record" OR "estimated dietary record" OR eating OR "feeding behavior" OR diet)*
SciELO	*("autistic disorder" OR "autism spectrum disorder" OR "asperger disease" OR "asperger disorder") AND (eating OR "feeding behavior" OR diet)*

Supplementary table 2. Nutrients analyzed in the studies included in the systematic review of food intake assessment tools applied in research with children and adolescents with ASD. (n=94). (Available as an Excel spreadsheet)

Supplementary table 3. Assessment of reporting quality with STROBE-nut items (n=94).

Item[a]	Description	Yes* n (%)	NA** n (%)	Partially yes n (%)	No n (%)
Title and abstract					
nut-1	State the dietary/nutritional assessment method(s) used in the title, abstract, or keywords.	62 (66)	0	0	32 (34)
Methods - Definitions and participants					
nut-5	Describe any characteristics of the study settings that might affect the dietary intake or nutritional status of the participants, if applicable.	70 (74.5)	0	7 (7.4)	17 (18.1)
nut-6	Report particular dietary, physiological, or nutritional characteristics that were considered when selecting the target population.	71 (75.5)	0	1 (1.1)	22 (23.4)
Methods - Variables					
nut-7.1	Clearly define foods, food groups, nutrients, or other food components.	55 (58.5)	0	25 (26.6)	14 (14.9)
nut-7.2	When using dietary patterns or indices, describe the methods to obtain them and their nutritional properties.	69 (73.4)	58 (61.7)	24 (25.5)	1 (1.1)
Methods - Data sources and measurements					
nut-8.1	Describe the dietary assessment method(s), e.g., portion size estimation, number of days and items recorded, how it was developed and administered, and how quality was assured. Report if and how supplement intake was assessed.	4 (4.3)	0	27 (28.7)	63 (67)
nut-8.2	Describe and justify food composition data used. Explain the procedure to match food composition with consumption data. Describe the use of conversion factors, if applicable.	35 (37.2)	31 (33)	49 (52.1)	10 (10.6)
nut-8.3	Describe the nutrient requirements, recommendations, or dietary guidelines and the evaluation approach used to compare intake with the dietary reference values, if applicable.	37 (39.4)	34 (36.2)	1 (1)	56 (59.6)

Supplementary table 3. Assessment of reporting quality with STROBE-nut items (n=94).

nut-8.5	Describe the assessment of nondietary data (e.g., nutritional status and influencing factors) and timing of the assessment of these variables in relation to dietary assessment.	51 (54.3)	0	3 (3.2)	40 (42.6)
nut-8.6	Report on the validity of the dietary or nutritional assessment methods and any internal or external validation used in the study, if applicable.	15 (16)	0	0	79 (84)
Methods- Bias					
nut-9	Report how bias in dietary or nutritional assessment was addressed, e.g., misreporting, changes in habits as a result of being measured, or data imputation from other sources.	1 (1.1)	0	0	93 (98.9)
Methods - Quantitative variables					
nut-11	Explain the categorization of dietary/nutritional data (e.g., use of N-tiles and handling of nonconsumers) and the choice of reference category, if applicable.	80 (85.1)	46 (48.9)	5 (5,3)	9 (9.6)
Methods - Statistical analysis					
nut-12.1	Describe any statistical method used to combine dietary or nutritional data, if applicable.	77 (81.9)	0	11 (11.7)	6 (6.4)
nut-12.2	Describe and justify the method for energy adjustments, intake modeling, and use of weighting factors, if applicable.	38 (40.4)	31 (33)	0	59 (59.6)
Results					
nut-13	Report the number of individuals excluded based on missing, incomplete, or implausible dietary/nutritional data.	28 (29.8)	0	15 (16)	51 (54.3)
nut-14	Give the distribution of participant characteristics across the exposure variables if applicable. Specify if food consumption of total population or consumers only were used to obtain results.	77 (81.9)	0	0	17 (18.1)
nut-16	Specify if nutrient intakes are reported with or without inclusion of dietary supplement intake, if applicable.	60 (63.8)	31 (33)	0	34 (36.2)
nut-17	Report any sensitivity analysis (e.g., exclusion of misreporters or outliers) and data imputation, if applicable.	37 (39.4)	31 (33)	0	57 (60.6)

Supplementary table 3. Assessment of reporting quality with STROBE-nut items (n=94).

Discussion

nut-19	Describe the main limitations of the data sources and assessment methods used and implications for the interpretation of the findings.	56 (59.6)	0	0	38 (40.4)
nut-20	Report the nutritional relevance of the findings, given the complexity of diet or nutrition as an exposure.	92 (97.9)	0	0	2 (2.1)
Other information					
nut-22.1	Describe the procedure for consent and study approval from ethics committee(s).	78 (83)	0	0	16 (17)
Total score* **	12.5 (5.5-17.5)				
Total score without NSA* **	10.2 (3.5-16.5)				

[a]The studies were not assessed for nut-8.4, nut-12.3 and nut-22.2, more information about these items can be found in Lachat et al. (2016).
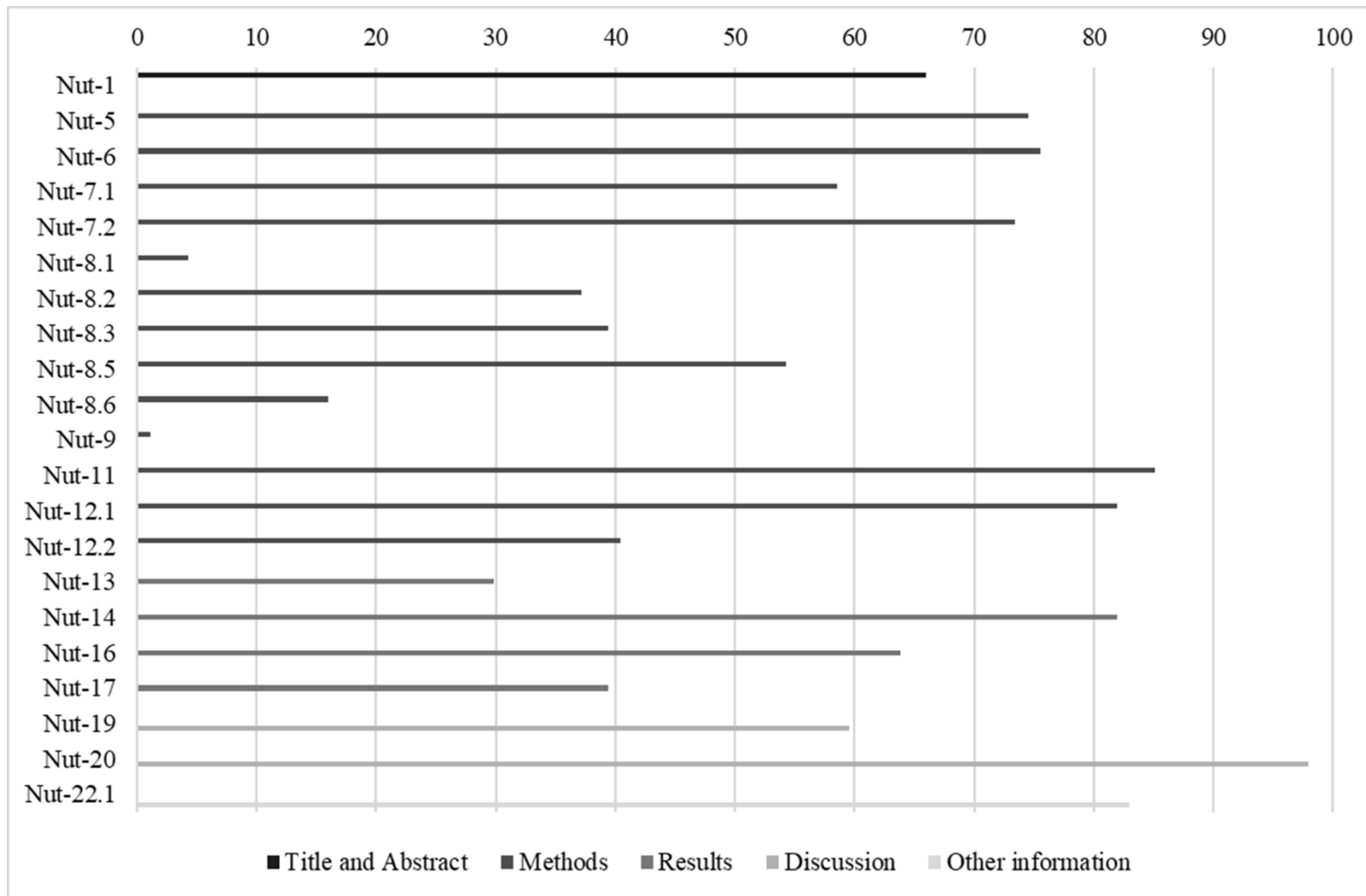
*Refer to score 1.0 for yes and not applicable.

**Not applicable.

***Average (Minimum-Maximum).
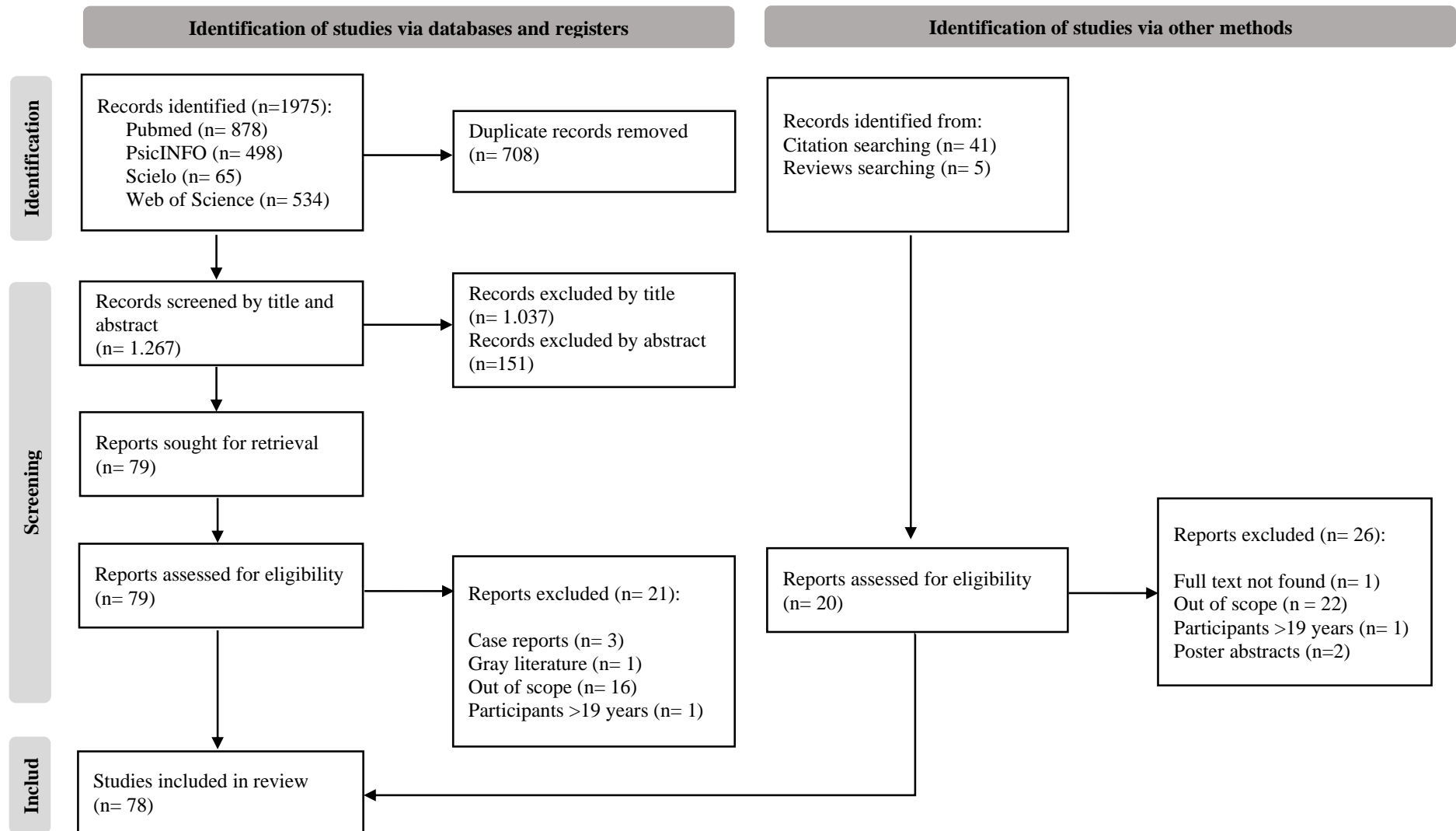
Supplementary figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses flow diagram of primary literature search and screening process.

Supplementary figure 2. Percentage of studies that met the STROBE-nut items in the topics of titles and abstracts, methods, results, discussion, and other information (n=94).

Apêndices

Apêndice A- Protocolo de registro no PROSPERO

Citation

Eduarda Silva, Giulia Pereira, Mayra Fernandes, Kamila Castro, Sandra Valle, Juliana Vaz. Food intake assessment applied to patients with autism spectrum disorder: a systematic review. PROSPERO 2020 CRD42020190229 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020190229

Review question

How dietary intake of children and adolescents with autism spectrum disorder has been evaluated in clinical and epidemiological investigations?

Searches

This review will be conducted in the PubMed, SciELO, PsycINFO and Web of Science databases. The search strategy will include the use of combined terms describing the autism disorder with dietary assessment methods terms (dietary intake, food consumption, feeding behavior). Terms will be selected at the Medical Subject Headings (MeSH) combined with free text terms. No restrictions about language and publication period will be applied. Studies will be selected according to pre-defined inclusion and exclusion criteria.

Types of study to be included [1 change]

Cross-sectional, case-control, clinical trials, cohort, validation studies

Condition or domain being studied [2 changes]

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by repetitive and stereotyped behaviors and socialization and communication difficulties (DSM-5, 2013). Children and adolescents with ASD frequently have long term persistent feeding difficulties and nutritional deficiencies when compared to children with typical neurodevelopmental. Dietary intake assessment can be prospective or retrospective and should be chosen according to the research purpose. However, assessment of dietary intake adds an additional task to parents and caregivers' and methodologies are usually adapted/ abbreviated which may result in data collection with lower precision. The focus of the current systematic review is to provide a critical revision on dietary assessment methods that have been applied in investigations with

children and adolescents with ADS to better assist the choice in future clinical and epidemiological investigations.

Participants/population

Inclusion: Children and adolescents (up to 19 years) with autism spectrum disorder (ASD).

Exclusion: Adults (over 19 years old), seniors (over 60 years old)

Intervention(s), exposure(s)

Not applicable

Comparator(s)/control

Not applicable

Context [1 change]

This review will include epidemiological and clinical studies, conducted with children and adolescents (<19 years) with ASD, that have investigated food consumption. Review studies, experimental studies with animal models, dissertations or theses and studies that do not fit the scope of the research question will not be selected for this review.

Main outcome(s)

Dietary assessment methods.

Measures of effect

Not applicable

Additional outcome(s)

Not applicable

Measures of effect

Not applicable

Data extraction (selection and coding) [1 change]

Study selection

The first stage of the review process will include a definition of terms through MeSH and free terms combined with OR and AND operators to obtain the search key. The search key will be used in PubMed, SciELO, PsycINFO and Web of Science electronic databases. The search will be performed by two blinded reviewers and the selected studies will be transferred into Zotero 5.0 software. In a second stage, the reviewers will select the studies by titles, abstracts and reading the studies in their full text, according to the pre-defined criteria of inclusion and exclusion. Disagreements in the selection of studies will be discussed with the review research team.

Data extraction

After full text reading, the following data will be extracts:

Year of publication

Study design

Period in which the study was conducted

Place and country where the study was conducted

Aim of the study

Sample characteristics (age, gender, sample size, recruitment)

Instrument used for the diagnosis of ASD

Method of food consumption evaluation

Protocol for the application of the food consumption assessment method

Results referring to the dietetic consumption

Analyzed nutrients

Dietetic analysis software

Statistical analysis

Limitations reported by the author

Risk of bias (quality) assessment [2 changes]

The primary reviewer will assess the quality of the methodological reporting of the studies by applying the Strengthening the Reporting of Observational Studies in Epidemiology—Nutritional Epidemiology (PMID: 27270749), without blinding the authorship or journal. Discrepancies will be solved by discussion with the review research team.

Strategy for data synthesis [1 change]

The results of the systematic review will be summarized in a table according to the data extracted from the manuscripts (i.e., type of study, gender, age, sample size, study protocol and others) for later discussion of common data.

Analysis of subgroups or subsets

Not applicable

Contact details for further information

Eduarda de Souza Silva

98silvaeduarda@gmail.com

Organisational affiliation of the review

Universidade Federal de Pelotas

Review team members and their organisational affiliations [2 changes]

Eduarda Silva. Postgraduate Program of Nutrition and Food, Federal University of Pelotas

Giulia Pereira. Faculty of Nutrition, Federal University of Pelotas

Mayra Fernandes. Postgraduate Program of Epidemiology, Federal University of Pelotas

Kamila Castro. Hospital de Clínicas de Porto Alegre, Neuropediatrics Service

Sandra Valle. Faculty of Nutrition, Federal University of Pelotas

Juliana Vaz. Faculty of Nutrition, Federal University of Pelotas

Type and method of review [1 change]

Systematic review

Anticipated or actual start date

15 June 2020

Anticipated completion date [3 changes]

15 December 2021

Funding sources/sponsors

None

Conflicts of interest

None known

Language

English

Country

Brazil

Stage of review [1 change]

Review Completed not published

Subject index terms status

Subject indexing assigned by CRD

Subject index terms

Adolescent; Autism Spectrum Disorder; Child; Eating; Humans

Date of registration in PROSPERO

11 July 2020

Stage of review at time of this submission [3 changes]

Stage	Started	Completed
Preliminary searches	Yes	Yes
Piloting of the study selection process	Yes	Yes
Formal screening of search results against eligibility criteria	Yes	Yes
Data extraction	Yes	Yes
Risk of bias (quality) assessment	Yes	Yes
Data analysis	Yes	Yes

Revision note

During the writing of the manuscript for this review, the databases search (PubMed, PsycINFO, SciELO, and Web of Science) was updated to include studies published through December 2021.

The record owner confirms that the information they have supplied for this submission is accurate and complete and they understand that deliberate provision of inaccurate information or omission of data may be construed as scientific misconduct.

The record owner confirms that they will update the status of the review when it is completed and will add publication details in due course.

Versions

11 July 2020

17 August 2021

13 January 2022

27 January 2022

Apêndice B – Modelo de e-mail para solicitação de dados aos autores

Dear (**Author name**)

My name is Eduarda Silva and I am a part of the Autism & Nutrition research group in Brazil, under coordination of Prof. Juliana Vaz (in CC).

We are in process of writing a systematic review (PROPERO: CRD42020190229) concerning the nutritional aspects and ASD. One of your papers (see below) were selected to be include in our study and I am wondering if you can provide us some additional information about this paper. Please, see the details below:

Paper: (**Study reference**)

Additional information: (**Requested information**)

I really appreciate your attention.

Thank you in advanced.

Best regards, Eduarda Silva

Master's degree student in the Nutrition and Food Postgraduate Program, Federal University of Pelotas.

Apêndice C – *Checklist* PRISMA

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Line 1-2
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Line 4-35
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Line 47-54; 69-70
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Line 76-79
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Line 94-100
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Line 87-88; 91-92
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Line 88-90
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Line 102-105
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Line 106-110

Section and Topic	Item #	Checklist item	Location where item is reported
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Line 106-108
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Line 106-109
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	NA
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	NA
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	NA
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	NA
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Line 109-110
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	NA
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	NA
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA

Section and Topic	Item #	Checklist item	Location where item is reported
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Line 121-124
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Figure 1 and Supplementary figure 2.
Study characteristics	17	Cite each included study and present its characteristics.	Table 2
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	NA
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	NA
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	NA
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	NA
	20c	Present results of all investigations of possible causes of heterogeneity among study	NA

Section and Topic	Item #	Checklist item	Location where item is reported
		results.	
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Line 231-235
	23b	Discuss any limitations of the evidence included in the review.	Line 350-355
	23c	Discuss any limitations of the review processes used.	Line 350-352
	23d	Discuss implications of the results for practice, policy, and future research.	Line 355-369
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Line 84-85
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Line 84-85
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Line 373-374
Competing interests	26	Declare any competing interests of review authors.	Line 375
Availability of	27	Report which of the following are publicly available and where they can be found:	Supplementary

Section and Topic	Item #	Checklist item	Location where item is reported
data, code and other materials		template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	tables 3-3 and Supplementary figures 1 and 2.

Apêndice D – *Checklist* PRISMA para resumos

Section and Topic	Item #	Checklist item	Reported (Yes/No)
TITLE			
Title	1	Identify the report as a systematic review.	Yes
BACKGROUND			
Objectives	2	Provide an explicit statement of the main objective(s) or question(s) the review addresses.	Yes
METHODS			
Eligibility criteria	3	Specify the inclusion and exclusion criteria for the review.	Yes
Information sources	4	Specify the information sources (e.g. databases, registers) used to identify studies and the date when each was last searched.	Yes
Risk of bias	5	Specify the methods used to assess risk of bias in the included studies.	Yes
Synthesis of results	6	Specify the methods used to present and synthesise results.	Yes
RESULTS			
Included studies	7	Give the total number of included studies and participants and summarise relevant characteristics of studies.	Yes
Synthesis of results	8	Present results for main outcomes, preferably indicating the number of included studies and participants for each. If meta-analysis was done, report the summary estimate and confidence/credible interval. If comparing groups, indicate the direction of the effect (i.e. which group is favoured).	Yes
DISCUSSION			
Limitations of evidence	9	Provide a brief summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency and imprecision).	Yes
Interpretation	10	Provide a general interpretation of the results and important implications.	Yes
OTHER			
Funding	11	Specify the primary source of funding for the review.	Yes

Section and Topic	Item #	Checklist item	Reported (Yes/No)
Registration	12	Provide the register name and registration number.	Yes

Anexos

Anexo A – Recomendações do STROBE-NUT

Table 1. STROBE-nut: An extension of the STROBE statement for nutritional epidemiology

Lachat C et al. (2016) STrengthening the Reporting of OBservational studies in Epidemiology – Nutritional Epidemiology (STROBE-nut): an extension of the STROBE statement. Plos Medicine 13(6). Available from: http://dx.doi.org/10.1371/journal.pmed.1002036

Item	Item nr	STROBE recommendations	Extension for Nutritional Epidemiology studies (STROBE-nut)	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract. (b) Provide in the abstract an informative and balanced summary of what was done and what was found.	**nut-1** State the dietary/nutritional assessment method(s) used in the title, abstract, or keywords.	
Introduction				
Background rationale	2	Explain the scientific background and rationale for the investigation being reported.		
Objectives	3	State specific objectives, including any pre-specified hypotheses.		

Item	Item nr	STROBE recommendations	Extension for Nutritional Epidemiology studies (STROBE-nut)	Reported on page #
Methods				
Study design	4	Present key elements of study design early in the paper.		
Settings	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection.	**nut-5** Describe any characteristics of the study settings that might affect the dietary intake or nutritional status of the participants, if applicable.	
Participants	6	a) Cohort study—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up. Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls. Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants. (b) Cohort study—For matched studies, give matching criteria and number of exposed and unexposed.	**nut-6** Report particular dietary, physiological or nutritional characteristics that were considered when selecting the target population.	

Item	Item nr	STROBE recommendations	Extension for Nutritional Epidemiology studies (STROBE-nut)	Reported on page #
		Case-control study—For matched studies, give matching criteria and the number of controls per case.		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	**nut-7.1** Clearly define foods, food groups, nutrients, or other food components. **nut-7.2** When using dietary patterns or indices, describe the methods to obtain them and their nutritional properties.	
Data sources - measurements	8	For each variable of interest, give sources of data and details of methods of assessment (measurement).Describe comparability of assessment methods if there is more than one group.	**nut-8.1** Describe the dietary assessment method(s), e.g., portion size estimation, number of days and items recorded, how it was developed and administered, and how quality was assured. Report if and how supplement intake was assessed. **nut-8.2** Describe and justify food composition data used. Explain the procedure to match food composition with consumption data. Describe the use of conversion factors, if applicable. **nut-8.3** Describe the nutrient requirements, recommendations, or dietary guidelines and the evaluation	

Item	Item nr	STROBE recommendations	Extension for Nutritional Epidemiology studies (STROBE-nut)	Reported on page #
			approach used to compare intake with the dietary reference values, if applicable.	
			nut-8.4 When using nutritional biomarkers, additionally use the STROBE Extension for Molecular Epidemiology (STROBE-ME). Report the type of biomarkers used and their usefulness as dietary exposure markers.	
			nut-8.5 Describe the assessment of nondietary data (e.g., nutritional status and influencing factors) and timing of the assessment of these variables in relation to dietary assessment.	
			nut-8.6 Report on the validity of the dietary or nutritional assessment methods and any internal or external validation used in the study, if applicable.	
Bias	9	Describe any efforts to address potential sources of bias.	**nut-9** Report how bias in dietary or nutritional assessment was addressed, e.g., misreporting, changes in habits as a result of being measured, or data imputation from other sources	

Item	Item nr	STROBE recommendations	Extension for Nutritional Epidemiology studies (STROBE-nut)	Reported on page #
Study Size	10	Explain how the study size was arrived at.		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why.	**nut-11** Explain categorization of dietary/nutritional data (e.g., use of N-tiles and handling of nonconsumers) and the choice of reference category, if applicable.	
Statistical Methods	12	(a) Describe all statistical methods, including those used to control for confounding	**nut-12.1** Describe any statistical method used to combine dietary or nutritional data, if applicable.	
		(b) Describe any methods used to examine subgroups and interactions.	**nut-12.2** Describe and justify the method for energy adjustments, intake modeling, and use of weighting factors, if applicable.	
		(c) Explain how missing data were addressed.	**nut-12.3** Report any adjustments for measurement error, i.e,. from a validity or calibration study.	
		(d) Cohort study—If applicable, explain how loss to follow-up was addressed.		
		Case-control study—If applicable, explain how matching of cases and controls was addressed.		
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy.		

Item	Item nr	STROBE recommendations	Extension for Nutritional Epidemiology studies (STROBE-nut)	Reported on page #
		(e) Describe any sensitivity analyses.		
Results				
Participants	13	(a) Report the numbers of individuals at each stage of the study—e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analyzed. (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram.	**nut-13** Report the number of individuals excluded based on missing, incomplete or implausible dietary/nutritional data.	
Descriptive data	14	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) Cohort study—Summarize follow-up time (e.g., average and total amount)	**nut-14** Give the distribution of participant characteristics across the exposure variables if applicable. Specify if food consumption of total population or consumers only were used to obtain results.	
Outcome data	15	Cohort study—Report numbers of outcome events or summary measures over time.		

Item	Item nr	STROBE recommendations	Extension for Nutritional Epidemiology studies (STROBE-nut)	Reported on page #
		Case-control study—Report numbers in each exposure category, or summary measures of exposure. Cross-sectional study—Report numbers of outcome events or summary measures.		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included. (b) Report category boundaries when continuous variables were categorized. (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period.	**nut-16** Specify if nutrient intakes are reported with or without inclusion of dietary supplement intake, if applicable.	
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions and sensitivity analyses.	**nut-17** Report any sensitivity analysis (e.g., exclusion of misreporters or outliers) and data imputation, if applicable.	
Discussion				

Item	Item nr	STROBE recommendations	Extension for Nutritional Epidemiology studies (STROBE-nut)	Reported on page #
Key results	18	Summarize key results with reference to study objectives.		
Limitation	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	**nut-19** Describe the main limitations of the data sources and assessment methods used and implications for the interpretation of the findings.	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	**nut-20** Report the nutritional relevance of the findings, given the complexity of diet or nutrition as an exposure.	
Generalizability	21	Discuss the generalizability (external validity) of the study results.		
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based.		
Ethics			**nut-22.1** Describe the procedure for consent and study approval from ethics committee(s).	

Item	Item nr	STROBE recommendations	Extension for Nutritional Epidemiology studies (STROBE-nut)	Reported on page #
Supplementary material			**nut-22.2** Provide data collection tools and data as online material or explain how they can be accessed.	

Anexo B – Normas da *Nutrition Reviews*

Instructions to Authors.

Available from https://academic.oup.com/nutritionreviews/pages/General_Instructions

Scope and audience

Nutrition Reviews is a highly cited, monthly, international, peer-reviewed journal that specializes in the publication of authoritative, innovative, and critical literature reviews that provide new insights on current and emerging topics in nutritional sciences, food sciences, clinical nutrition, community nutrition, and nutrition policy. Readers of *Nutrition Reviews* include nutrition scientists, biomedical researchers, clinical and dietetic practitioners, and advanced students of nutrition.

Articles selected for publication will be consistent with the journal's mission and should clearly outline both the biological and practical nutritional implications of a timely topic, so the reader obtains a clear understanding of both the topic's nature and its relevance. The journal does not publish primary research. Reviews and commentaries on current cutting-edge nutrition topics are eligible for consideration, provided they are prepared in accordance with established guidelines. Unsolicited submissions written in English are welcome from all countries from individual scientists and research teams.

Mission and history

Nutrition Reviews was founded in 1942 in response to a recognized need for expert analysis and synthesis of the vast amounts of nutrition science research being generated worldwide. Today, that need is greater still and *Nutrition Reviews* continues to serve it with the same goal in mind: To help nutrition scientists, scholars, practitioners, and policy makers stay abreast of significant developments in the field through concise reports prepared with objectivity and a critical focus.

Article types

Nutrition Reviews publishes five types of review articles in both the narrative and systematic review formats. Additionally, commentaries about recent nutrition issues and events along with letters to the editor are also published. All review articles must address a clearly defined research question that is articulated in an abstract; they must also follow recognized approaches to the literature selection, analysis, and conclusions, as outlined in accepted guidelines. It is recommended that authors consult existing literature on what constitutes various types of reviews. *Nutrition Reviews* does not publish original research articles. Authors are required to identify the type of article that is being submitted according the following categories:

Scoping Reviews provide an evaluation of the type and amount of research available on a topic, as well as potential knowledge gaps. These reviews should address the big picture of an issue to present new concepts and frameworks being proposed for the field of nutrition.

Narrative Reviews provide critical reviews that explain and summarize the literature on a specific nutrition topic that adds new knowledge to the current literature. Manuscripts that describe a concept or a process (e.g., a biochemical pathway, nutrition mechanism, or methodology) are well suited to be submitted as a narrative review. Narrative reviews do not require any specific guidance for determining which papers are used for the reviews but need to provide a critical and balanced review of the topic. Nutritional topics for which there is a significant amount of data and peer reviewed publications should be addressed by systematic reviews.

Systematic Reviews provide a comprehensive review on a specific topic that has not been addressed, or include new literature that either substantiates past findings or provides new insight for the nutrition field. Systematic reviews need to follow and describe a structured approach for identifying a comprehensive search of the literature, and should analyze the literature based on accepted methodology so the approach can be replicated and compared with past reviews. Systematic reviews can include papers that have used qualitative, quantitative, or mixed method approaches to study a nutrition topic. Systematic reviews should be conducted by a research team.

Meta-Analyses provide a systematic review of the literature that quantitatively combines data to provide an overall evaluation that supports or refutes the probability of a cause-and-effect nutrition relationship. Meta-analyses are especially helpful to determine a nutrition-disease link or the potential impact of nutrition interventions.

Umbrella Reviews evaluate exiting systematic reviews and meta-analyses. These reviews should summarize the similarities and differences in the methods and conclusions from past reviews to help readers better understand a topic for which there have not been consistent results between previous reviews.

Commentaries provide a discussion on the importance of a current method, study, or group of studies in nutrition research presented in the context of the larger body of research on that topic.

Letters to the Editor are welcome. Letters should address issues related to a recently published review in the *Nutrition Reviews*. Letters should add to the discourse regarding the article by highlighting factors that may have influenced the outcome of a review. Upon acceptance of a letter, authors of the published review will be provided the opportunity to respond to the issues raised in the letter.

Identification of Nutrition Topics

Papers will be published under the type of review that was conducted. Upon submission, authors need to provide 5-7 key words to identify the nutrition topic that is being addressed by the manuscript.

Terms of consideration

All manuscripts submitted to the journal must be original works of authorship that are not under simultaneous consideration elsewhere and do not infringe the intellectual property rights of any individual or organization. All previously published information, whether by the authors themselves or other individuals, groups, or entities, must be

appropriately cited. The final version must have been read and approved by all of the individuals named as authors. The work must present novel information that differs substantially from that presented in works published by the authors previously. Authors should attest to these terms in their cover letter.

Authorship and originality

To qualify for authorship, individuals *must meet all of the following criteria*: 1) contributed significantly to the work's conception, design, data collection (as applicable), or data interpretation and analysis; 2) participated in the writing or critical revision of the article in a manner sufficient to establish ownership of the intellectual content; and 3) read and approved the version of the manuscript being submitted. All authors share responsibility for ensuring the manuscript complies with the journal's style requirements and terms of consideration. Any requests for changes to author names, or order of appearance, that are received post submission will need to be approved in writing by all authors.

Funding and sponsorship

All sources of funding for the article's research, preparation, and publication should be noted in the article's Acknowledgments section under the subheading "Funding" and be acknowledged in the cover letter. The full name of the funding agency should be provided and grant numbers should be supplied. If grants or other funding were given to specific authors, the relevant individuals should be identified by their initials in parentheses.

The role any sponsor played in the study design, data collection and analysis, manuscript preparation and revision, and publication decisions should be made clear in the Funding declaration in the Acknowledgments section. Authors should also indicate whether they received complete access to data pertaining to the publication that was owned by the sponsor.

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In order to meet the CHORUS at Oxford University Press authors are required to name their funding sources, or state if there are none, during the submission process. For further information on this process or to find out more about CHORUS, visit the CHORUS initiative.

Declaration of Interests

All authors are required to disclose relevant competing interests by noting them in the Acknowledgments section of the manuscript under the subheading "Declaration of Interest." Guidelines regarding what constitutes a competing interest are included in the Declaration of Interest form. Completed Declaration of Interest forms for each author should be uploaded as supporting Information at the time of manuscript submission.

Manuscript preparation

Cover letter. The cover letter should address the following topics: description of the work and its novelty; authorship; and originality. The description of the work should

clearly indicate what novel contribution the submitted article makes to the existing literature. A statement should indicate that all listed authors meet the criteria for authorship (see *Authorship and Originality* entry above) and that no individual meeting these criteria has been omitted. Regarding originality, the following should be declared or, if untrue, explained: 1) the submitted article represents the original work of the authors; 2) the article is not currently under consideration elsewhere, nor has it been previously published in the same or substantially similar form; and 3) no copyright to any other work was breached in the manuscript's creation.

Manuscript format. Manuscripts should be prepared electronically using word-processing software, preferably Microsoft Word. Article pages should be formatted as double-spaced and left-justified text with 1-inch margins and 12-point type. Pages and lines must be numbered.

Length restrictions. Articles in any category must be formatted as indicated in the *Manuscript format* guidelines section and reviews may not exceed 50 double-spaced pages in length, including references and illustrative material. Each article should provide a focused, concise, and objective investigation of a clearly defined topic. Commentaries should be less than 2000 words and letters to the editors should be less than 500 words.

Supplemental information. The option to publish certain material as "Supplemental Information" in an online-only format is provided. Authors are encouraged to make use of this option to accommodate material that may be of interest to the reader but is not integral to the work itself. Examples would include extensive summary tables and appendices. It is particularly important that the main text of an article include everything essential for a complete understanding of the review and that the main text stands alone from the Supplemental Information. Readers should not need to toggle between documents to obtain or understand information. If references are included in Supporting information documents, they should be listed at the end of each document and appear in a numerical sequence pertaining solely to that document.

Cover page. The following information should be included on the cover page:

Article type. Choose one of the article types in which the journal specializes. Editors may change this designation if they find the article is better suited to another category.

Title. The title of the article should be short (200 characters or less), specific, and accurately describe the topic of the work. Abbreviations and acronyms should not be used unless they are widely recognized and generally understood, e.g. HIV, DNA. Articles and phrases such as "the use of," "the treatment of," and "a report of" should be avoided.

Author names. Please list the first name, middle initial(s), last name and academic degrees of each author in descending order of their contributions to the article. Each author should provide an ORCID identification. Individuals who provided technical or administrative support should be recognized in the Acknowledgments section.

Author affiliations. The names of all authors affiliated with a particular institution should be listed directly above the affiliation. Each affiliation should include the department, institution, city, state (spelled out, if applicable), and country.

Corresponding author. The name, complete mailing address, telephone and e-mail address should be provided for the author responsible for correspondence.

Abstract. All reviews need to include a formatted abstract. The length should not exceed 300 words. Abstracts exceeding these word limits will be shortened during copyediting. References, tables, and figures should not be cited in the abstract. Abstracts are to have the following sections:

Objectives that describes the primary reason for the review

Background that identifies the justification for the review

Methods of data sourcing and extraction and data synthesis (as applicable)

Results that summarizes the main findings

Conclusion that identifies the contribution the paper has made to the literature and recommendations as appropriate.

Key words. At least three to five key words or phrases need to be provided.

Sections and headings

Scoping and Narrative Reviews

Each manuscript should contain at a minimum the following sections in addition to the abstract:

Introduction that includes the justification and objectives for the review.

Methods used to review the literature by describing how you identified what papers were used. There is no set format for this section.

Discussion regarding the topic being reviewed.

Conclusion (at the end of the text).

Acknowledgements (after the Conclusion).

Funding and sponsorship (as part of the Acknowledgments).

Declaration of interest (as part of the Acknowledgments).

References (after the Acknowledgments).

List of any Supporting Information included (after the acknowledgements and before the reference list)

Table Legend and Figure Legend listing the tables and figures included in the manuscript (after the reference list)

Between the Introduction and Conclusion, additional headings and subheadings are at the discretion of the author. Headings and subheadings should be used to organize the text and guide the reader.

Systematic reviews and Meta-Analyses

Articles of this type should be prepared in accordance with relevant, existing guidelines (e.g., PRISMA or MOOSE checklists) and be structured accordingly. If the guidelines used include a checklist, the completed checklist should be uploaded as Supporting Information during the manuscript submission process. Questions regarding the acceptability of chosen guidelines can be sent to the journal's editorial office via e-mail (nutritionreviews@ilsi.org). Each manuscript should contain at a minimum the following sections:

A structured, concise abstract containing the following subheadings: Context, Objective, Data Sources, Data Extraction, Data Analysis, Conclusions.

Introduction that includes a sufficient amount of background information to justify the review, and the objectives for the review including the question(s) being addressed by the review.

Methods used to review and evaluate the literature using standardized procedures. This should include the databases used for the review, the key search terms, the criteria for excluding or including previous studies, and how the studies were evaluated and by whom. Finally, the methods should include how the data were analyzed including the statistical methods for any meta-analyses that were conducted.

PICOS criteria (participants, interventions, comparisons, outcomes, and study design) used to define the research question as Table 1 and cite the table at an appropriate place in the text.

A flow chart of the literature search process.

A completed MOOSE/PRISMA checklist as part of the Supporting Information.

Results to report what previous papers were identified, reviewed and included in study (number and types of articles). An analysis should include the methods used to determine the quality of the studies. Key characteristics of the studies used for the review should be included within a table (e.g. study designs, characteristics of subjects, sample size, risk of bias and outcomes). Meta-analyses need to include the results of the statistical analyses and should illustrate the results using appropriate graphic presentations.

Discussion that summarizes the main results of the review, compares the findings of the review to existing literature, and states limitations of the review. The discussion section also includes the author's interpretation of the results and their implications for policy, practice and future research.

Conclusion that summarizes the impact of the review and provides recommendations for studies, policy, and practice as appropriate.

Acknowledgements (after the Conclusion)

Funding and sponsorship (as part of the Acknowledgments)

Declaration of interest (as part of the Acknowledgments)

References (after the Acknowledgments).

List of any Supporting Information included (after the acknowledgements and before the reference list)

Table Legend and Figure Legend listing the tables and figures included in the manuscript (after the reference list)

Umbrella

Articles of this type should be presented as a systematic review of previous reviews. Thus, the sections are the same as a systematic review. Each manuscript should contain at a minimum the following sections in addition to the abstract:

A structured, concise abstract containing the following subheadings: Context, Objective, Data Sources, Data Extraction, Data Analysis, Conclusions.

Introduction that includes a sufficient amount of background information to justify the review, and the objectives for the review including the question(s) being addressed by the review.

Methods used to review and evaluate the literature using standardized procedures. This should include the databases used for the review, the key search terms, the criteria for excluding or including previous studies, and how the studies were evaluated and by whom. Finally, the methods should include how the data were analyzed including the statistical methods for any meta-analyses that were conducted.

PICOS criteria (participants, interventions, comparisons, outcomes, and study design) used to define the research question as Table 1 and cite the table at an appropriate place in the text.

A flow chart of the literature search process.

A completed MOOSE/PRISMA checklist as part of the Supporting Information.

Results to report what previous papers were identified, reviewed and included in study (number and types of articles). An analysis should include the methods used to determine the quality of the studies. Key characteristics of the studies used for the review should be included within a table (e.g. study designs, characteristics of subjects, sample size, risk of bias and outcomes). Meta-analyses need to include the results of the statistical analyses and should illustrate the results using appropriate graphic presentations.

Discussion that summarizes the main results of the review, compares the findings of the review to existing literature, and states limitations of the review. The discussion section also includes the author's interpretation of the results and their implications for policy, practice and future research.

Conclusion that summarizes the impact of the review and provides recommendations for studies, policy, and practice as appropriate.

Acknowledgements (after the Conclusion)

Funding and sponsorship (as part of the Acknowledgments)

Declaration of interest (as part of the Acknowledgments)

References (after the Acknowledgments).

List of any Supporting Information included (after the acknowledgements and before the reference list)

Table Legend and Figure Legend listing the tables and figures included in the manuscript (after the reference list)

Commentaries and Letters to the Editor

Commentaries and *Letters to the Editor* do not have a set format for submission. Submissions should use prose to convey their message. Tables and figures are not usually provided but may be acceptable and their applicability will be determined. References should be limited to less than 10 citations. Commentaries and Letters to the Editor must still include an abstract and key words.

Other Guidelines

Abbreviations and acronyms. Abbreviations and acronyms should not be used unless they are widely recognized and generally understood, e.g. BMI, FDA. These should only be used for terms used more than four times in the text. If that criterion is met, the term should be spelled out on first use followed by the abbreviation or acronym in parentheses. The abbreviated form should be used consistently thereafter, except in section headings, where it should continue to be spelled out.

References. The number of references cited should be tailored to the material being reviewed and be from reputable sources. As a general rule, should not include more than 200 references for reviews and not more than 10 references for commentaries and letters to the editor.

References should be numbered sequentially upon first appearance in text, tables, and figures. They should be typed as superscripts and placed after commas and periods but before colons and semicolons. When citing a series of consecutive numbers, provide the first and last with a dash between them (e.g., [5–7]). When referring to a group of authors in the text, the format "Smith et al.[23]" should be used. Reference numbers should not be surrounded by brackets or parentheses.

References cited only in figure or table legends should be numbered according to the first mention of the graphic in the text and should be cited immediately after the first reference to the table or figure in the text. Reference to unpublished work or personal communications should be avoided but, when essential, should be identified in the text as "unpublished data" or "personal communication from …", not in the reference list. To ensure long-term accessibility, internet citations should only be used if that is the sole source of the information.

The reference list should be formatted according to AMA (American Medical Association) style. For each citation, sufficient information must be provided to allow a reader to know in what medium the material appeared and to access the information. Please list all authors if there are six or fewer; for seven or more authors, list the first three followed by "et al." Examples of AMA style are as follows:

Journal article: Gordon KB, Papp KA, Hamilton TK, et al, for the Efalizumab Study Group. Efalizumab for patients with moderate to severe plaque psoriasis: a randomized controlled trial. JAMA. 2003;290:3073–3080.

Chapter in a book: Dybul M, Connors M, Fauci AS. Immunology of HIV infection. In: Paul WE, ed. Fundamental Immunology. 5th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2003:1285–1318.

Entire book: Gibson GR, Rastall RA. Prebiotics: Developments and Application. Hoboken, NJ: Wiley; 2006.

Government bulletin: Guidance on Labeling of Foods That Need Refrigeration by Consumers. College Park, MD: Office of Food Labeling, US Food and Drug Administration; 1997. Docket No. 96D-0513.

Internet citation: American College of Surgeons. National Trauma Data Bank Report 2006, Version 6.0. Chicago, USA. Available at: http://www.facs.org/trauma/ntdb/ntdbannualreport2006.pdf. Accessed on October 22, 2007.

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Tables and illustrations should be numbered in the sequence in which they appear in the text. They should appear in sequence after the reference list.

Tables. All tables should be included in the main manuscript file after the reference list. Each table should be constructed using the table functions of the word-processing program being used. Please avoid including Microsoft Excel files as tables. A title should appear at the top of each table. A column heading should appear in the top cell of each column. Within the table, each data set should appear in a single cell; the return key should not be used within any cell. Text should be justified to the left. Numerical data should be justified to the decimal point. Capitalization should be restricted to the first letter of the legend, the first letter in each cell, and applicable abbreviations or acronyms. Abbreviations used in the table should be spelled out in a footnote. When citing prior studies in tables please use the following format: Smith et al. (1998)[21].

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Where ethically feasible, *Nutrition Reviews* strongly encourages authors to make all data and software code on which the conclusions of the paper rely available to readers. We suggest that data be presented in the main manuscript or additional supporting files, or deposited in a public repository whenever possible. This includes the complete list of all papers identified for systematic reviews whether they are used or not used for evaluating the literature. For information on general repositories for all data types, and a list of recommended repositories by subject area, please see Choosing where to archive your data.

Data Citation

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[dataset]* Authors, Year, Title, Publisher (repository or archive name), Identifier

*The inclusion of the [dataset] tag at the beginning of the citation helps us to correctly identify and tag the citation. This tag will be removed from the citation published in the reference list.

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Procedures

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Authors' corrections to Supplementary Data are made only in exceptional circumstances (for example major errors that compromise the conclusion of the study). Because the Supplementary Data is part of the original paper and hence the published record, the information cannot be updated if new data have become available or interpretations have changed.

Compliance with funding bodies

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