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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.

Orientadora: Profª. Drª. Juliana dos Santos Vaz

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“O que importa na vida não é o ponto de partida, mas a caminhada. Caminhando e semeando, no fim terás o que colher.” (Cora Carolina)

Resumo

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. 147f. Dissertação (Mestrado em Nutrição e Alimentos) - Faculdade de Nutrição, Programa de Pós-Graduação em Nutrição e Alimentos, Universidade Federal de Pelotas, Pelotas, 2022.

As características comportamentais e as alterações sensoriais apresentadas por indivíduos com transtorno do espectro autista (TEA) podem resultar em dificuldades alimentares como a recusa alimentar e o repertório de alimentos limitado que acarretam prejuízos no estado nutricional. Entretanto, não há consenso na literatura sobre quais os métodos que devem ser aplicados na coleta e análises de dados de consumo alimentar no TEA. 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 realizada em outubro de 2020 e atualizada em dezembro de 2021. Foram incluídos estudos observacionais e clínicos com avaliação do consumo alimentar de pacientes com TEA (2-19 anos). A avaliação do relato metodológico 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 91 estudos, sendo a maioria de delineamento transversal (n=59). Os instrumentos dietéticos mais frequentes foram o registro alimentar (n=49) e o questionário de frequência alimentar (n=41). As variáveis dietéticas mais exploradas foram os micronutrientes (n=55) e a ingestão de energia (n=49). Quinze estudos avaliaram a seletividade alimentar. Outros estudos investigaram dificuldades alimentares, como variedade alimentar (n=15) e recusa alimentar (n=13). A pontuação média no STROBE-nut foi de 12.5 (5.5-17.5). Os itens referentes ao relato do protocolo de aplicação e validação dos instrumentos dietéticos não foram pontuados na maioria dos estudos (≥68%). A maioria dos estudos incluídos obteve baixa pontuação na avaliação do relato metodológico. Destaca-se a importância de aprimorar o protocolo de avaliação da dieta para avanços nas evidências científicas relacionadas a nutrição no TEA.

Palavras-chave: Transtorno do espectro autista. Inquéritos alimentares. Consumo alimentar. Dieta.

Abstract

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. 147f. Dissertation (Master's in Nutrition and Food) - Faculty of Nutrition, Graduate Program in Nutrition and Food, Federal University of Pelotas, Pelotas, 2022.

The behavioral characteristics and sensory changes presented by individuals with autism spectrum disorder (ASD) can lead to eating difficulties such as food refusal and limit food repertoire that can negatively affect nutritional status. However, there is no consensus in the literature on which methods should be applied in the collection and analysis of diet intake in ASD. This study aimed to review the literature to clarify how 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). Searches were conducted in the PubMed, PsycINFO, SciELO, and Web of Science databases. The search was conducted in October 2020 and updated in December 2021. Observational and clinical studies that evaluate food intake of patients with ASD (2-19 years of age) were included. The evaluation of the methodological reporting of the dietary assessment was carried out applying the Strengthening the Reporting of Observational Studies in Epidemiology - Nutritional Epidemiology (STROBE-nut) criteria. Ninety-one studies were included and most of them were cross-sectional (n=59). The most frequent dietary instruments were the food record (n=49) and the food frequency questionnaire (n=41). The dietary variables most explored were micronutrients (n=55) and energy intake (n=49). Fifteen studies evaluated food selectivity. Other studies investigated eating difficulties, such as food variety (n=15) and food refusal (n=13). The mean STROBE-nut score was 12.5 (5.5-17.5). The items related to the reporting of the application protocol and the validation of the dietary instruments were not scored in most studies (≥68%). Most of the included studies have low scores in the evaluation of the methodological report. The importance of improving the diet assessment protocol for advances in scientific evidence related to nutrition in ASD is highlighted.

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*
DD	*Other developmental disorders*
DSM	*Diagnostic and Statistical Manual of Mental Disorders*
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
ICD	*International Classification of Diseases*
MESH	*Medical Subject Headings*
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*
24HR	*24-hour food recall*

Lista de símbolos

> Maior

≥ Maior igual

< Menor

≤ Menor igual

= Igual

Sumário

Projeto de dissertação

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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 a recusa alimentar e o 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 métodos 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 (2 a 19 anos) e serão excluídos resumos, relatos de casos, literatura cinza e estudos fora do escopo. 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 métodos 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 methods 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 (2 to 19 years old) will be included, and abstracts, case reports, grey literature, and studies outside of the scope 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 methods 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 *International Classification of Diseases* (ICD) (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 ICD, 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 com 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 a 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, a 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, a 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).

Esta avaliação é de extrema importância durante a infância e adolescência, onde 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 alterações sensoriais, 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 os métodos têm sido aplicados em estudos clínicos e epidemiológicos, discutindo as limitações inerentes de cada instrumento aplicado, bem como a necessidade de melhorias no relato de protocolos de aplicação de instrumentos e análises dietéticas. A revisão poderá contribuir para nortear a definição adequada dos métodos para avaliar o consumo alimentar em futuras pesquisas desenvolvidas com esta população.

4. Objetivos

4.1. Objetivo geral

Investigar os métodos de avaliação dietética aplicados em estudos clínicos e epidemiológicos com crianças e adolescentes com TEA.

4.2. Objetivos específicos

I) Revisar a literatura e descrever os métodos 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;

IV) Avaliar a qualidade dos estudos quanto relato metodológico da avaliação do consumo alimentar.

5. Hipóteses

A presente revisão testará as seguintes hipóteses:

I) A maior parte dos estudos emprega 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 estudos realiza análises adaptadas para investigar as características alimentares do TEA;

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 os métodos de avaliação do consumo alimentar aplicados 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**)	Métodos de avaliação do consumo alimentar
Delineamento (**D**)	Transversais, longitudinais, casos controles, ensaios clínicos
Avaliação (**E**)	Qualidade dos métodos 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 (2 a 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 de caso, resumos, investigações fora do escopo da revisão e publicações 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**).

Estudos localizados em fontes secundárias serão avaliados quanto a elegibilidade de forma independente por dois revisores (ESS, GSL). Por fim, os estudos considerados elegíveis serão incluídos para extração de dados.

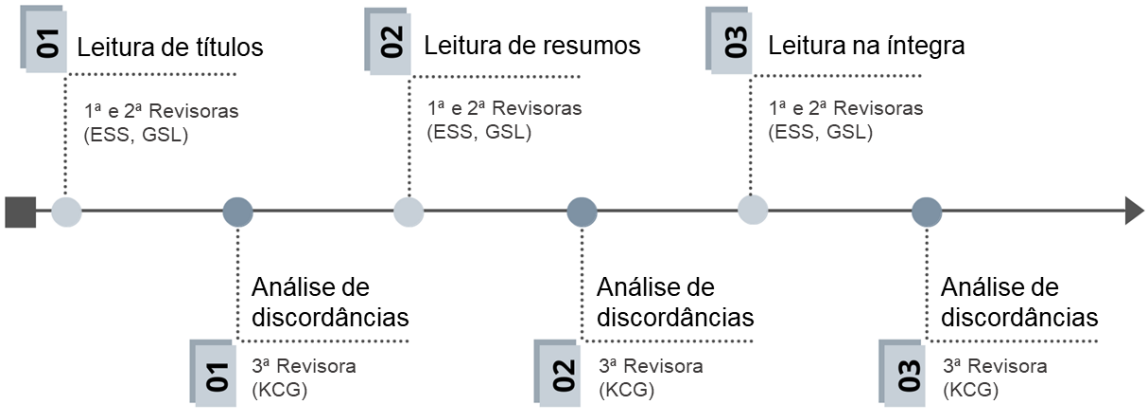

Figura 1. Fluxo representativo das etapas de seleção de estudos.

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)	7.110
Autism Research	A1 (Interdisciplinar)	5.216
Research in Autism Spectrum Disorder	A2 (Interdisciplinar)	2.881

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																							
Definição da questão de pesquisa e chaves de busca																							
Elaboração do protocolo da revisão																							
Registro do protocolo de revisão																							
Busca nas bases de dados																							
Seleção de estudos																							
Extração de dados																							
Síntese dos resultados																							
Redação inicial do manuscrito																							
Busca por estudos em fontes secundárias																							
Avaliação da qualidade dos estudos																							
Redação do projeto de dissertação																							
Qualificação do projeto de dissertação																							
Redação do manuscrito																							
Elaboração de materiais suplementares																							
Atualização da revisão																							
Formatação do manuscrito e materiais																							
Defesa da dissertação																							
Tradução e submissão do manuscrito																							
Atualização do protocolo do PROSPERO																							

Referências

AL-KINDI, N. M. et al. Food Selection and Preferences of Omani Autistic Children. **Advances in neurobiology**, v. 24, p. 505–523, 2020.

ALLEN, S. L. et al. Behavioral Pediatrics Feeding Assessment Scale in Young Children With Autism Spectrum Disorder: Psychometrics and Associations With Child and Parent Variables. **Journal of Pediatric Psychology**, v. 40, n. 6, p. 581–590, 2015.

AMERICAN PSYCHIATRIC ASSOCIATION (ED.). **Diagnostic and statistical manual of mental disorders: DSM-5**. 5th ed ed. Washington, D.C: American Psychiatric Association, 2013.

BAI, D. et al. Association of Genetic and Environmental Factors With Autism in a 5-Country Cohort. **JAMA Psychiatry**, v. 76, n. 10, p. 1035–1043,2019.

BANDINI, L. G. et al. Food selectivity in children with autism spectrum disorders and typically developing children. **The Journal of Pediatrics**, v. 157, n. 2, p. 259–264, 2010.

BÖLTE, S.; GIRDLER, S.; MARSCHIK, P. B. The contribution of environmental exposure to the etiology of autism spectrum disorder. **Cellular and molecular life sciences: CMLS**, v. 76, n. 7, p. 1275–1297, 2019.

BOOTH, A. et al. The nuts and bolts of PROSPERO: an international prospective register of systematic reviews. **Systematic Reviews**, v. 1, n. 1, p. 2, 2012.

BRASIL. LEI Nº 13.861. Lei nº 13.861, de 18 de julho de 2019.

CASTRO, K. et al. Feeding behavior and dietary intake of male children and adolescents with autism spectrum disorder: A case-control study. **International Journal of Developmental Neuroscience: The Official Journal of the International Society for Developmental Neuroscience**, v. 53, p. 68–74,2016.

CERMAK, S. A.; CURTIN, C.; BANDINI, L. G. Food selectivity and sensory sensitivity in children with autism spectrum disorders. **Journal of the American Dietetic Association**, v. 110, n. 2, p. 238–246, 2010.

COLVERT, E. et al. Heritability of Autism Spectrum Disorder in a UK Population-Based Twin Sample. **JAMA psychiatry**, v. 72, n. 5, p. 415–423, 2015.

CURTIN, C. et al. Food Selectivity, Mealtime Behavior Problems, Spousal Stress, and Family Food Choices in Children with and without Autism Spectrum Disorder. **Journal of autism and developmental disorders**, v. 45, n. 10, p. 3308–3315, 2015.

DE CASTRO, M. A. et al. Children's nutrient intake variability is affected by age and body weight status according to results from a Brazilian multicenter study. **Nutrition Research**, v. 34, n. 1, p. 74–84, 2014.

DOVE, D. et al. Medications for Adolescents and Young Adults With Autism Spectrum Disorders: A Systematic Review. **Pediatrics**, v. 130, n. 4, p. 717–726, 2012.

ESTEBAN-FIGUEROLA, P. et al. Differences in food consumption and nutritional intake between children with autism spectrum disorders and typically developing children: A meta-analysis. **Autism: The International Journal of Research and Practice**, v. 23, n. 5, p. 1079–1095, 2019.

EVANS, B. How autism became autism: The radical transformation of a central concept of child development in Britain. **History of the Human Sciences**, 2013.

GRABRUCKER, A. M. Environmental Factors in Autism. **Frontiers in Psychiatry**, v. 3, 2013.

HENRÍQUEZ-SÁNCHEZ, P. et al. Dietary assessment methods for micronutrient intake: a systematic review on vitamins. **British Journal of Nutrition**, v. 102, n. S1, p. S10–S37, 2009.

JOHNSON, C. P.; MYERS, S. M. Identification and Evaluation of Children With Autism Spectrum Disorders. **Pediatrics**, v. 120, n. 5, p. 1183–1215, 2007.

KING, M.; BEARMAN, P. Diagnostic change and the increased prevalence of autism. **International Journal of Epidemiology**, v. 38, n. 5, p. 1224–1234, 2009.

LA MAISON, C. et al. Prevalence and risk factors of psychiatric disorders in early adolescence: 2004 Pelotas (Brazil) birth cohort. **Social Psychiatry and Psychiatric Epidemiology**, v. 53, n. 7, p. 685–697, 2018.

LACHAT, C. et al. Strengthening the Reporting of Observational Studies in Epidemiology-Nutritional Epidemiology (STROBE-nut): An Extension of the STROBE Statement. **PLoS medicine**, v. 13, n. 6, p. e1002036, 2016.

LEVY, S. E. et al. Autism spectrum disorder and co-occurring developmental, psychiatric, and medical conditions among children in multiple populations of the United States. **Journal of developmental and behavioral pediatrics: JDBP**, v. 31, n. 4, p. 267–275, 2010.

LEVY, S. E.; MANDELL, D. S.; SCHULTZ, R. T. Autism. **The Lancet**, v. 374, n. 9701, p. 1627–1638, 2009.

LIVINGSTONE, M. B. E.; ROBSON, P. J.; WALLACE, J. M. W. Issues in dietary intake assessment of children and adolescents. **The British Journal of Nutrition**, v. 92 Suppl 2, p. S213-222, 2004.

LLEWELLYN, A. et al. Childhood obesity as a predictor of morbidity in adulthood: a systematic review and meta-analysis. **Obesity Reviews**, v. 17, n. 1, p. 56–67, 2016.

LUÇARDO, J. DA C. et al. Interest in food and triglyceride concentrations in children and adolescents with autistic spectrum disorder. **Jornal de pediatria**, 2020.

LUKENS, C. T.; LINSCHEID, T. R. Development and validation of an inventory to assess mealtime behavior problems in children with autism. **Journal of Autism and Developmental Disorders**, v. 38, n. 2, p. 342–352, 2008.

MAENNER, M. J. Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2016. **MMWR. Surveillance Summaries**, v. 69, 2020.

MAENNER, M. J. Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2018. **MMWR. Surveillance Summaries**, v. 70, 2021.

MAGAREY, A. et al. Assessing dietary intake in children and adolescents: Considerations and recommendations for obesity research. **International journal of pediatric obesity: IJPO: an official journal of the International Association for the Study of Obesity**, v. 6, n. 1, p. 2–11, 2011.

MALHI, P. et al. Feeding Problems and Nutrient Intake in Children with and without Autism: A Comparative Study. **Indian Journal of Pediatrics**, v. 84, n. 4, p. 283–288, 2017.

MANNO, C. J. et al. Early oral-motor interventions for pediatric feeding problems: What, when and how. **Journal of Early and Intensive Behavior Intervention**, v. 2, n. 3, p. 145–159, 2005.

MARÍ-BAUSET, S. et al. Food Selectivity in Autism Spectrum Disorders: A Systematic Review. **Journal of Child Neurology**, v. 29, n. 11, p. 1554–1561, 2014.

MARÍ-BAUSET, S. et al. Anthropometric measurements and nutritional assessment in autism spectrum disorders: A systematic review. **Research in Autism Spectrum Disorders**, v. 9, p. 130–143, 2015.

MCELHANON, B. O. et al. Gastrointestinal Symptoms in Autism Spectrum Disorder: A Meta-analysis. **Pediatrics**, v. 133, n. 5, p. 872–883, 2014.

MCPHERSON, R. S. et al. Dietary Assessment Methods among School-Aged Children: Validity and Reliability. **Preventive Medicine**, v. 31, n. 2, p. S11–S33, 1 2000.

MEGUID, N. A. et al. Dietary adequacy of Egyptian children with autism spectrum disorder compared to healthy developing children. **Metabolic brain disease**, v. 32, n. 2, p. 607–615, 2017.

METHLEY, A. M. et al. PICO, PICOS and SPIDER: a comparison study of specificity and sensitivity in three search tools for qualitative systematic reviews. **BMC Health Services Research**, v. 14, n. 1, p. 579, 2014.

NASKA, A.; LAGIOU, A.; LAGIOU, P. Dietary assessment methods in epidemiological research: current state of the art and future prospects. **F1000Research**, v. 6, 2017.

ORTIZ-ANDRELLUCCHI, A. et al. Dietary assessment methods for micronutrient intake in infants, children and adolescents: a systematic review. **British Journal of Nutrition**, v. 102, n. S1, p. S87–S117, 2009.

PAGE, M. J. et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. **PLOS Medicine**, v. 18, n. 3, p. e1003583, 2021.

PAULA, C. S. et al. Brief report: prevalence of pervasive developmental disorder in Brazil: a pilot study. **Journal of Autism and Developmental Disorders**, v. 41, n. 12, p. 1738–1742, 2011.

PENAGINI, F. et al. Dietary Intakes and Nutritional Issues in Neurologically Impaired Children. **Nutrients**, v. 7, n. 11, p. 9400–9415, 2015.

PEREIRA, A.; RIESGO, R. S.; WAGNER, M. B. Autismo infantil: tradução e validação da Childhood Autism Rating Scale para uso no Brasil. **Jornal de Pediatria**, v. 84, n. 6, p. 487–494, 2008.

PEREIRA, R. A.; SICHIERI, R. Métodos de Avaliação do Consumo de Alimentos. In: **Epidemiologia nutricional.** Rio de Janeiro: Editora FIOCRUZ/Atheneu, 2007. p. 181–200.

PÉREZ-RODRIGO, C. et al. Dietary assessment in children and adolescents: issues and recommendations. **Nutricion Hospitalaria**, v. 31 Suppl 3, p. 76–83, 2015.

POSEY, D. J. et al. Antipsychotics in the treatment of autism. **The Journal of Clinical Investigation**, v. 118, n. 1, p. 6–14, 2008.

RIBAS-BARBA, L. et al. Effects of dietary assessment methods on assessing risk of nutrient intake adequacy at the population level: from theory to practice. **British Journal of Nutrition**, v. 101, n. S2, p. S64–S72, 2009.

ROBINSON, S. J. Childhood epilepsy and autism spectrum disorders: psychiatric problems, phenotypic expression, and anticonvulsants. **Neuropsychology review**, v. 22, n. 3, p. 271-279, 2012.

ROGOL, A. D.; CLARK, P. A.; ROEMMICH, J. N. Growth and pubertal development in children and adolescents: effects of diet and physical activity. **The American Journal of Clinical Nutrition**, v. 72, n. 2, p. 521S-528S, 1 ago. 2000.

SCHRECK, K. A.; WILLIAMS, K.; SMITH, A. F. A comparison of eating behaviors between children with and without autism. **Journal of autism and developmental disorders**, v. 34, n. 4, p. 433–438, 2004.

SEIVERLING, L. et al. Prevalence of Feeding Problems in Young Children With and Without Autism Spectrum Disorder: A Chart Review Study. **Journal of Early Intervention**, v. 40, n. 4, p. 335–346, 2018.

SHARP, W. G. et al. Feeding Problems and Nutrient Intake in Children with Autism Spectrum Disorders: A Meta-analysis and Comprehensive Review of the Literature. **Journal of Autism and Developmental Disorders**, v. 43, n. 9, p. 2159–2173, 2013.

SHARP, W. G. et al. Dietary Intake, Nutrient Status, and Growth Parameters in Children with Autism Spectrum Disorder and Severe Food Selectivity: An Electronic Medical Record Review. **Journal of the Academy of Nutrition and Dietetics**, v. 118, n. 10, p. 1943–1950, 2018.

SHIM, J.-S.; OH, K.; KIM, H. C. Dietary assessment methods in epidemiologic studies. **Epidemiology and Health**, v. 36, 2014.

SIMONOFF, E. et al. Psychiatric Disorders in Children With Autism Spectrum Disorders: Prevalence, Comorbidity, and Associated Factors in a Population-Derived Sample. **Journal of the American Academy of Child & Adolescent Psychiatry**, v. 47, n. 8, p. 921–929, 2008.

TICK, B. et al. Heritability of autism spectrum disorders: a meta-analysis of twin studies. **Journal of Child Psychology and Psychiatry, and Allied Disciplines**, v. 57, n. 5, p. 585–595, 2016.

VERHOEFF, B. Autism in flux: a history of the concept from Leo Kanner to DSM-5. **History of Psychiatry**, v. 24, n. 4, p. 442–458, 2013.

VISSOKER, R. E.; LATZER, Y.; GAL, E. Eating and feeding problems and gastrointestinal dysfunction in Autism Spectrum Disorders. **Research in Autism Spectrum Disorders**, v. 12, p. 10–21, 2015.

VLLASALIU, L. et al. Diagnostic instruments for autism spectrum disorder (ASD). **Cochrane Database of Systematic Reviews**, n. 1, 2016.

WIŚNIOWIECKA-KOWALNIK, B.; NOWAKOWSKA, B. A. Genetics and epigenetics of autism spectrum disorder-current evidence in the field. **Journal of Applied Genetics**, v. 60, n. 1, p. 37–47, 2019.

WORD HEALTH ORGANIZATION. **International Classification of Diseases 10 version**. Disponível em: <https://icd.who.int/browse10/2019/en>. Acesso em: 21 abr. 2021.

WORD HEALTH ORGANIZATION. **International Classification of Diseases 11th Revision: The global standard for diagnostic health information.** Disponível em: <https://icd.who.int/en>. Acesso em: 14 abr.2021.

ZHANG, J. et al. The reporting quality of observational studies relevant to the STROBE-nut statement in journals of nutrition. **Asia Pacific Journal of Clinical Nutrition**, v. 30, n. 1, p. 174–183, 2021.

Manuscrito

Manuscrito redigido de acordo com as normas da *Nutrition Reviews*

Critical analysis of dietary assessments applied in clinical and epidemiological studies in patients with autism spectrum disorder: a systematic review

ABSTRACT

Context: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by heterogeneous symptoms that can influence nutritional status. Despite the growing number of studies investigating dietary intake in ASD, there are some criticisms of the adequacy of the diet methods applied in this group of patients.

Objective: Critical evaluation of dietary assessments used in the investigation of dietary intake in children and adolescents with ASD.

Data sources: The search was performed in October 2020 and updated in December 2021 in the electronic databases PsycINFO, PubMed, SciELO and Web of Science. Clinical and epidemiological studies investigating dietary intake in children and adolescents with ASD (2 to 19 years old) were selected, and abstracts, case reports, grey literature and studies outside of the scope were excluded.

Data extraction: Data on the dietary intake assessment methodologies and the dietary variables analysed were extracted. The data was presented in narrative synthesis and tables. The quality of reporting was assessed by the Strengthening the Reporting of Observational Studies in Epidemiology - Nutritional Epidemiology (STROBE-nut).

Results: Ninety-one studies were included, most of them cross-sectional (n=59). The most frequent dietary instruments were the food record (n=49) and the food frequency questionnaire (n=41). The dietary variables most explored were micronutrients (n=55) and energy intake (n=49). Fifteen studies evaluated food selectivity. Other studies investigated eating difficulties, such as food variety (n=15) and food refusal (n=13). The mean STROBE-

nut score was 12.5 (5.5-17.5). The items referring to the reporting of the application protocol and the validation of the dietary instruments were not scored in most studies (≥68%).

Conclusion: Most of the included studies have low scores in the evaluation of the methodological report. The importance of improving the diet assessment protocol for advances in scientific evidence related to nutrition in ASD is highlighted.

Protocol and financing: Protocol registered with PROSPERO (CRD42020190229). Support from the Coordination for the Improvement of Higher Education Personnel (CAPES) and the Brazilian National Research Council (CNPq).

Keywords: autism spectrum disorder; diet surveys; dietary intake; nutrition assessment.

INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by impairments in the domains of communication and social interaction, repetitive behaviors and restricted interests, and sensory processing difficulties.[1] These characteristics could interfere with dietary intake, reflecting at mealtimes and, consequently present an inadequate nutrient intake,[2,3] restricted and repetitive food repertoire[4,5] and food selectivity.[6–8] Such conditions are reported in the literature with prevalence between 33.3% and 66%[5,9] and have a negative impact on nutritional status, such as the risk of nutrient deficiencies and changes in body composition.[2,10]

The methodological quality of studies investigating nutritional aspects is essential considering that the results obtained from these studies support decisions related to clinical interventions.[11] Studies on dietary intake in children and adolescents with ASD are growing in the literature, as are proposals for dietary interventions.[3,8,12] However, there is no consensus about which nutritional aspects should be evaluated in these individuals. Sometimes it is still unclear in these studies what is the main objective of research related to dietary intake and

ASD, such as analysis of micronutrient deficiencies,[13,14] energy intake[15,16] and evaluation of food groups consumed.[17,18]

A variety of instruments can be used to assess dietary intake, regardless of the objective and design of the studies.[19] However, some issues must be considered when choosing the method to be applied. For example, the Food Frequency Questionnaire (FFQ) is a practical instrument to administer, but it overestimates the consumption of energy and micronutrients, while the food record (FR) and the 24-hour dietary recall (24HR) require replication of data collection and greater detail in the description of foods.[2,20] Furthermore, studies that investigate the dietary intake of children and adolescents must consider that the report will be carried out by parents or caregivers, which are susceptible to inaccuracies. Another important issue is about the temporality of the information on dietary intake: retrospective instruments, such as the FFQ and 24HR, depend on the interviewee's memory, while prospective instruments (such as the FR) require greater involvement of individuals in the food record.[21,22] In addition to these issues, the choice of dietary instrument in ASD should also consider the overload of activities for parents and caregivers, because it is a clinical condition in which individuals with ASD are regularly involved in therapeutic activities.[23,24]

Studies on dietary intake and ASD often used non-validated or food list's instruments.[13,16] Furthermore, many published studies have limited descriptions of the diet method protocols, such as the interval of days in repeated methods,[25,26] whether parents or caregivers received instructions to fill out the diet method.[15,26] Other studies on ASD do not provide details of how diet data were explored in the statistical analysis.[9,27,28] The assortment of methods applied in the collection and analysis of dietary data does not allow the comparability of results from being assured, even in homogeneous groups. Furthermore, it is

important to consider that patients with ASD can have cognitive impairments that compromise the application of diet methods in this population.[1,29]

The Strengthening the Reporting of Observational Studies in Epidemiology - nutritional epidemiology (STROBE-nut)[11] is a 24-item instrument that guides the definition of methods for research and analysis of nutritional data. Recently, this protocol has been used to assess the quality of the methodological reporting of manuscripts on nutritional investigations, identifying critical points to improve among studies.[30,31] To date, no studies have been published to evaluate the methodological quality of the instruments used in nutritional investigations of patients with ASD.

The objective of this systematic review was to critically evaluate the dietary assessment methods and variables used to investigate the dietary intake of children and adolescents with ASD in clinical and epidemiological studies, and to discuss the quality of the methodological reporting of the applied dietary instruments, identifying factors that can limit the quality of the studies.

METHODS

Research protocol

The review was conducted in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analyses.[32] The protocol was registered in The International Prospective Register of Systematic Reviews (registration number: CRD42020190229).

Search strategy

The search was performed in July 2020 and updated in December 2021. The electronic databases PubMed, PsycINFO, SciELO, and Web of Science were consulted with search keys composed of the combination of terms indexed in the Medical Subject Headings (MeSH), free terms, and the operators “OR” and “AND” (Supplementary table 1). Secondary sources

studies were identified by analyzing references cited in studies and reviews that addressed topics related to dietary intake and ASD.

Criteria for eligibility

The eligibility criteria were based on the acronym SPIDER (Sample, Phenomenon of Interest, Design, Evaluation, Research type) shown in Table 1. The selection included: i) original studies (excluding abstracts, case reports, grey literature, and studies outside of the scope; ii) studies that evaluated the dietary intake of children and adolescents (between 2 and 19 years old) diagnosed with ASD; iii) cross-sectional studies, case-control studies, clinical trials, cohort studies (follow-up), instrument validation studies. Studies with patients under 2 years of age were excluded due to possible overlap of breastfeeding with dietary intake. [21,33] No restrictions were applied to the language and year of 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 dietary intake assessment protocol (dietary instrument, number of applications, inclusion of weekend days, training, use of portion estimation guides, review after completion), the dietary variables analyzed and the statistical procedures applied. 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 methodological reporting

To evaluate the reporting of the studies, the STROBE-nut criteria were applied.[11] 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.[30] 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, 57 studies were eligible. Nineteen additional references were identified in the secondary search (Supplementary figure 1) and 15 in the review update (Figure 1). The final review included 91 articles published between 1982 and 2021, as described in Table 2. The study designs were cross-sectional (n=59),[2,4,5,9,14–16,18,20,25,26,34–81] case-control (n=23),[10,13,17,27,28,82–99] follow-up (n=5),[6,100–103] cross-sectional with instrument validation (n=2),[104,105] crossover clinical trial (n=1)[106] and controlled randomized clinical trial (n=1).[107] The studies were carried out in North America (49%), Asia (19%), Europe (18%), Eastern Europe & Central Asia (7%), Africa (4%), Oceania (2%) and South America (1%). Most studies included children and adolescents in their samples, with age ranging from 2 to 18 years.

Dietary intake assessment instruments

The FR was the instrument most frequently applied among studies (n=49),[2,4,6,10,15–17,25,26,36–39,42,43,46,50,52,53,55,57–60,62,65–67,69,71,73,74,78,79,82,83,85,87–90,92,98–100,102,103,105,107] with the 3-day record protocol being the most used (n=46).[2,4,6,10,15–17,25,26,36,38,39,42,43,46,50,52,53,55,57–

[60,62,66,67,69,71,73,74,79,82,83,85,87–90,92,98–100,102,103,105,107] Only one study used FR with food weighing method.[65]

The 24HR was applied in eight studies, using protocols of 1 (n=3)[41,96,104] and 3 days (n=5).[28,40,47,91,95] The interviews were conducted face-to-face in seven studies[28,40,41,47,91,95,96] and by telephone in one study.[104] Only one study reported interviews on non-consecutive days[47] and two studies reported the inclusion of 1 weekend day.[40,95] Four studies indicated the application of the instrument by trained interviewers or a nutritionist.[91,95,96,104]

The FFQ was applied in 41 studies.[4–6,13,14,20,27,40,41,44,48,49,51,54,56,61,63,64,66,67,70,71,74–76,81,83,86,93–95,97–101,104,106] Among those validated for the age group of children and adolescents, the Youth/Adolescent Questionnaire (YAQ) was used in 11 studies, with adaptations to the food list that ranged from 126 to 156 items.[4–6,48,61,63,66,67,86,100,104] While the 72-item Block Kids Questionnaire and the Harvard Semi Quantitative FFQ were applied in two separate studies.[51,54] One study applied a 56-item FFQ, previously developed for a cohort study.[44]

Other FFQs were developed and validated for application in American adults, such as the Women's Health Initiative FFQ (122 items),[20] the Short Dietary Questionnaire of Yarnell,[41] the FFQ to assess calcium and vitamin D consumption (22 items),[56] the FFQ to assess omega-3 consumption (152 items),[70] the Block Reduced Dietary Questionnaire (60 items)[13] and a modified version of the Block Reduced Dietary Questionnaire with Omani food (119 items).[94] One study applied versions of the Brief self-administered Dietary History Questionnaire (54-57 items), validated for Japanese adults[76] and another study applied a FFQ adapted of a previous study carried out with Spanish adults (137 items).[98]

Ten studies did not specify the FFQ applied.[14,27,40,64,71,75,83,93,95,99] Five studies used their own instruments without indicating validation.[49,74,81,101,106] Food frequency questions without validation were included in questionnaires used in three studies[18,68,80] and one study referred to the use of part of the Eating Habits Survey to investigate food frequency.[97]

Non-validated instruments such as the Food Preference Inventory/Questionnaire (60-123 items)[17,34,35,58,72,77,84] and Food Lists (70-139 items)[9,13,15,16,26,28,45,103] were applied in fifteen studies. Combinations of two dietary intake assessment instruments were used in 23 studies,[4,6,13,15–17,26,28,40,41,58,65–67,71,74,83,95,98–100,103,104] the most frequent use were FR and FFQ (n=10),[4,6,66,67,71,74,83,98–100] followed by FFQ and 24HR (n=4),[40,41,95,104] FR and food list (n=4).[15,16,26,103]

Analysis of energy and nutrient intake

Most studies investigated the consumption of micronutrients (n=55),[2,4,10,13–15,17,20,26,28,36,37,39–44,46,47,50–60,62,67,69–71,73,76,79,82,83,85,87–92,95,98–100,102,105,107] energy (n=49)[2,10,15–17,20,25–28,36–41,43,44,46,47,50,51,53,54,58–60,65,67,69–71,73,76,79,82,83,85,87–89,91,92,95,98–100,105,107] and macronutrients (n=42),[2,10,15,17,20,26–28,36,37,39,41–44,46,47,50,51,53–55,58–60,65,67,69–71,73,79,82,83,85,90–92,98,100,105,107] with FR (n=44) as the most frequently applied instrument.[2,4,10,15–17,25,26,36–39,42,43,46,50,52,53,55,57–60,62,65,67,69,71,73,79,82,83,85,87–90,92,98–100,102,105,107] The energy contribution of macronutrients was investigated in 24 studies.[10,15,25,38–40,46,50,51,55,59,67,69,76,79,83,87–89,91,95,99,100,107] Analyses of adequacy of estimated intake according to dietary reference recommendations were performed in 50 studies.[2,4,10,14,15,17,20,25,26,36–43,46,47,50,51,53–60,62,65,71,73,79,82,83,85,87–92,95,98–100,102,105,107] Details of the nutrients analysed by the studies can be accessed in the Supplementary table 2.

Analysis by food groups and dietary patterns

The frequency and average consumption of items and/or portions of food groups were investigated in 46 studies, and FFQ (n=28)[4,6,18,40,41,44,48,49,54,61,63,64,66–68,74,75,80,81,83,94,95,98–101,104,106] and FR (n=11) were the most applied instruments. [4,6,36–38,43,66,74,82,88,103] Six studies compared estimated consumption portions with dietary recommendations.[38,40,95,98,99,101] The preference for certain food items was investigated in five studies using FR (n=1)[2], food preference questionnaire (n=1)[77] and food list (n=3).[9,15,26]

Only three studies identified dietary patterns by principal component analyzes.[67,98,100] The Healthy Eating Index (n=6)[15,78,82,87–89] and the Chinese Children Dietary Index (n=1)[99] were used to assess food quality in seven studies.

Analysis of dietary intake according to ASD characteristics

The characteristics of dietary intake associated with eating difficulties in ASD were analyzed in 25 studies by investigating food variety (n=15),[2,16,26,40,44,45,54,66,74,82,87–89,99,103] food refusal of isolated items and by food groups (n=13),[2,4–6,28,35,61,63,64,66,86,93,95] food repertoire (n=3)[4,6,66] and the high frequency of consumption of a specific food items per day (n=2).[4,61] The FFQ was the most applied instrument to assess food refusal (n=11)[4–6,61,63,64,66,86,93,95,97] and the only one applied to assess high daily consumption of food items (n= 2).[4,61] Food variety was evaluated mainly by FR (n=7),[2,26,74,82,87–89] followed by FFQ (n=5).[44,54,66,74,99] To evaluate the food repertoire, FR was the only method used (n= 3).[4,6,66]

Food selectivity was analyzed in 15 studies[2,4–6,9,10,17,35,54,58,61,63,66,93,95] based on acceptance or refusal of food items or food groups, with the FFQ being the instrument most used for this purpose (n=8).[4–6,61,63,66,93,95] Although different criteria were defined for this evaluation. Two studies established cut-off points based on the variety of food items accepted by neurotypical children, with the application of FFQ[54] and the food preference inventory.[35] One study established the omission of one or more complete food groups or the consumption of five or fewer food items as criteria of selectivity, evaluated using FR.[2] Other studies were based on the count of consumed or refused food items, with data collected from FR (n=1),[10] food preference inventory (n=1)[58] and the food list (n=1),[9] however, only the study based on the food list defined a cut-off point for selectivity (consumption of up to 20 items).

Domains to evaluate food selectivity regarding food refusal and high daily consumption of food items, according to the application of FFQ, and the food repertoire, evaluated by filling in an FR, were defined in a cross-sectional study,[4] and replicated in two

other studies.[61,66] One study[5] used as a cut-off point the food refusal of 33% or more of the food items evaluated using FFQ, and this criterion was later replicated in three other studies in this review.[6,93,95]

Evaluation of the methodological reporting of the studies

The mean score of the studies in STROBE-nut was 12.5 (5.5-17.5). The highest percentage of inadequacy was observed in the items that refer to the report to assessment of bias in the dietary data (Nut-9) and to the reporting of the application protocol for the dietary intake assessment instrument (Nut-8.1), with 99% and 69% respectively. Whereas greater adequacy was observed in the items regarding the report on the relevance of results and discussion (Nut-20) and categorization of the dietary data (Nut-11), with percentages of 98% and 86% respectively (Supplementary table 3).

Regarding the other items, most studies (≥54%) presented satisfactory reports for the following items: inclusion of the instrument in the title and/or abstract (Nut-1), dietary or nutritional criteria considered in the selection of participants (Nut-5 and Nut-6) , investigated dietary variables (Nut-7.1 and 7.2), time of collection of non-dietary data (Nut-8.5), statistical methods applied to dietary data (Nut-12.1), participant characteristics (Nut-14), without inclusion of dietary supplement intake in data analysis (Nut-16) and instrument limitations and/or dietary analyses (Nut-19) and ethical approval (Nut-22.1). Meanwhile, 52% of the studies presented partial reporting of the references of nutritional composition tables used in dietary analyzes (Nut-8.2).

However, reports on dietary recommendations used for comparison with intake estimates (Nut-8.3), validation of dietary instruments (Nut-8.6), statistical adjustments to dietary data (Nut-12.2), exclusions of participants for missing or implausible data (Nut-13), and sensitivity analyses on dietary data (Nut-17), were not complied with for most studies (≥54%) (Supplementary figure 2) (Supplementary table 3).

DISCUSSION

This systematic review identified a variety of dietary assessment instruments applied in studies that evaluated the diet intake of children and adolescents with ASD. The STROBE-nut items referring to the methodology for data collection and analysis were not fully complied with in most studies. Also, instruments with closed questions and non-validated for the target population of the studies were frequently used.

The complete process of a diet assessment consists of a vary of steps, from the study design, the objective of the investigation, the choice of an instrument and its protocol needed for application, until data entry and statistical analysis. In this review, most studies did not score on STROBE-nut items referring to the reporting of the application protocol and validity of diet instruments (Nut-8.1 and Nut-8.6). The FR was the instrument most applied, especially in cross-sectional and case-control designs, which included the largest number of studies. This instrument, as well as the 24HR, allows us to collect information on the types and amounts of food consumed, in addition to investigating the method of preparation and presentation of foods, which are important characteristics in the study of food selectivity in patients with ASD.[6,7,22]

Most studies applied 3-day record or recall protocols. This protocol has been considered adequate to estimate energy intake in individuals.[22,108,109] In addition, protocols with fewer days combined with adjustment analyzes have been found to be sufficient for population dietary estimation.[110,111] Although less variability was observed in dietary intake during childhood, the number of days of record or recall needed to assess actual intake in children and adolescents varies among the studies and can be reduced using statistical models.[112–114]

Regarding the assessment of patients with ASD, the authors suggest that only 3 days may not be enough to measure real dietary intake, especially those of nutrients with great

variability.[4,19,25,43,66,115] Therefore, although 3-day protocols proved to be sufficient to estimate daily fiber consumption in children with ASD,[43] none of the studies aimed to assess the variability of dietary intake and determine the number of days needed to estimate the intake of nutrients in this population, limiting adjustments to dietary estimates without considering the severity level and the variety of characteristics of ASD.[50,82]

FFQ is one of the most widely applied instruments to assess dietary intake in epidemiological studies[21] and the second most frequently used in ASD studies. This instrument retrospectively evaluates habitual dietary intake in a given period, using a pre-defined list of foods or food groups, which the interviewee must fill out or indicate to the researcher the frequency of consumption of each item (per day, week, month, semester, or year).[22,116–118] However, it was observed that most of the FFQs used were not validated for the age groups studied. The use of this instrument without indication for the population has limitations, because it depends on a pre-defined food list that may not represent the habits of populations with divergent dietary patterns, in addition to not providing accurate and absolute measures of dietary intake.[22,117,118]

Closed instruments with food lists or questions developed by the authors were used to assess food acceptance and variety prospectively and retrospectively. Although some of these instruments were applied in previous studies[35,45] and allow adaptations to their lists[17,35,58] or questions,[34,35,84] none was previously validated, so it is not possible to guarantee the accuracy of the data obtained.

Regardless of the instruments chosen, all dietary methods are susceptible to under- or overestimation of dietary data. Meanwhile, retrospective assessments must consider the inherent inaccuracies of recall bias.[21,22,116] Different strategies can be applied to reduce bias during the application of instruments and data analysis; however, only one study in this

review reported strategies to verify and correct bias in dietary data (Nut-9), and most did not perform sensitivity analyzes to identify deviations in the data (Nut-17).

The quality of the collected data must be guaranteed from the moment when choosing the instrument, where the objective and design of the research must be considered.[21,22,116] Furthermore, the target population of the study is considered a crucial factor in choosing the instrument, why different age groups, cultural and socioeconomic aspects, as well as other characteristics, such as eating difficulties in ASD, can influence dietary intake.[21,119,120] It should also be considered that in research with children, the reporting of dietary intake is carried out mainly by a parent or the main caregiver.[21,108] Furthermore, patients with ASD, both in childhood and in adolescence, may present some degree of cognitive impairment that prevents them from contributing to the assessment.[1]

In this scenario, prospective instruments completed by parents or caregivers, such as weighed FR, can influence the food offered to children during the study and, when not reviewed after application, increase the risk that items are not recorded or reported inaccurately.[22,116,117] There is also difficulty in recording the food consumed during school and therapy hours.[20,25,42,69] Furthermore, because they require greater commitment from the interviewees, these instruments can contribute to a higher level of overload in the daily routine, resulting in a lower participation in the research.[117,118]

Alternatively, instruments with closed questions, such as FFQ and food lists, limit the evaluation to a list of pre-established foods and portions, preventing a broader analysis of characteristics that can influence the dietary intake of patients with ASD, such as the presentation and preparation of foods that allow the identification of acceptance of certain textures.[7,22,101]

Therefore, both FR and 24HR are good options for application in this population because they are open investigation instruments that allow the collection of detailed data on

the characteristics of dietary intake and do not require prior validation.[22,117] Moreover, 24HR does not represent an overload factor for interviewees during application.[22,117] While FFQ previously validated for the region and age group of participants may be the instrument of choice in studies whose sample sizes make it impossible to apply prospective methods, such as cohort studies, or when the purpose of the study includes analysis of food items or food groups.[21,22]

As applied in some studies in this review, it is possible to choose an application of two instruments for assessment of dietary intake, this protocol is indicated to reduce methodological biases and to correct limitations of a single instrument, which may be appropriate for evaluating more characteristics of ASD.[22,116]

A well-designed methodology, considering the choice of the right instrument, helps reduce bias and ensure the precision of data collection. Therefore, to ensure adequate methodological quality, it is essential to guarantee training for the person responsible for filling out the instrument to obtain a standard data collection. In addition, one can use visual guides and measurement instruments to estimate food portions in quantitative instruments and request labels and recipes for better accuracy of ingredients and composition used in analyses. Finally, the review of instruments completed by respondents should be carried out to identify and correct missing and incomplete data.[22,117,118]

Additionally, the use of non-validated instruments or with inadequate application protocols interferes with the analysis and interpretation of data on food characteristics in ASD, such as refusal, food variety and selectivity, constantly evaluated through closed instruments such as the FFQ.[5,6,61] These assessments, although replicated in different studies, do not have prior validation and do not consider the variety of behavioural and dietary characteristics of ASD, so that incorrect methodologies for choosing and applying the

instrument, as well as the definition of the analyses of the collected data, influence the observed data to be inconclusive for both scientific literature and clinical practice.

A variety of dietary analysis in ASD was observed, which makes it difficult to identify which are the directions to investigated dietary intake in patients with ASD, e.g., energy intake, isolated nutrients, food groups, and so on. In the current review, nutrient intake analyzes were frequent; however, few studies specified which composition table was used to estimate the intake of participants (Nut-8.2) or reported adjustments to data analyzes (Nut-12.2). When planning the collection of diet data, it is necessary to choose a software and a food table composition consistent with the population studied. Furthermore, to investigate the adequacy of dietary intake, reference to dietary recommendations must be appropriate for the age group and the country of study.[22,50,121] Furthermore, the use of dietary supplements should be investigated, and clearly state in methods the decision for inclusion or not of these data in the nutrient intake analyzes (Nut-16).[11,36,62]

Currently, no dietary instrument allows the investigation of behavioural characteristics, and only instruments with open questions, such as FR and 24HR, collect detailed data on of foods consumed to observe sensory characteristics, such as texture, colour and flavour. Therefore, studies that investigate dietary aspects in patients with ASD must add other instruments to this evaluation aimed at evaluating aspects related to this population[4,119] (sensory disorders,[7,66] gastrointestinal symptoms,[49,122] behavior during meals,[63,104] use of medications[123,124]).

This review is the first study to critically analyze the dietary instruments applied in patients with ASD and included a wide variety of studies in the field of nutrition and ASD. Through STROBE-nut, it was possible to evaluate the reporting of the dietary investigation methodology of the studies. The main limitation was the non-inclusion of studies from the

grey literature. Furthermore, data on the investigation of behavioural factors and sensory alterations were not explored.

CONCLUSION

In the studies included in this review, the choice of instruments used (e.g., non-validated) and the insufficient description on dietary assessment methods indicate the absence of criteria when choosing the method of investigating dietary intake in ASD. As a suggestion, from this review, studies that include the investigation of nutritional aspects in ASD must use validated dietary methods and follow good standards for their application and describe the rationality of the dietary analysis. Additionally, researchers must be critical of the methodological reporting of studies to ensure a better quality of scientific evidence related to nutritional problems in ASD. Considering this, studies that seek to analyze dietary intake in patients with ASD should consider the possibility of using the STROBE-nut as a support tool for the design of the methodology and writing. In addition, future investigations are suggested to develop validated or adapted instruments for patients with ASD that allow the crossing of dietary intake, behavioural, and sensory symptoms.

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Reference

1. American Psychiatric Association, ed. *Diagnostic and Statistical Manual of Mental Disorders: DSM-5*. 5th ed. American Psychiatric Association; 2013.

2. Sharp WG, Postorino V, McCracken CE, et al. Dietary Intake, Nutrient Status, and Growth Parameters in Children with Autism Spectrum Disorder and Severe Food Selectivity: An Electronic Medical Record Review. *J Acad Nutr Diet*. 2018;118(10):1943-1950. doi:10.1016/j.jand.2018.05.005

3. Esteban-Figuerola P, Canals J, Fernández-Cao JC, Arija Val V. Differences in food consumption and nutritional intake between children with autism spectrum disorders and typically developing children: A meta-analysis. *Autism*. 2019;23(5):1079-1095. doi:10.1177/1362361318794179

4. Bandini LG, Anderson SE, Curtin C, et al. Food selectivity in children with autism spectrum disorders and typically developing children. *J Pediatr*. 2010;157(2):259-264. doi:10.1016/j.jpeds.2010.02.013

5. Curtin C, Hubbard K, Anderson SE, Mick E, Must A, Bandini LG. Food Selectivity, Mealtime Behavior Problems, Spousal Stress, and Family Food Choices in Children with and without Autism Spectrum Disorder. *J Autism Dev Disord*. 2015;45(10):3308-3315. doi:10.1007/s10803-015-2490-x

6. Bandini LG, Curtin C, Phillips S, Anderson SE, Maslin M, Must A. Changes in Food Selectivity in Children with Autism Spectrum Disorder. *J Autism Dev Disord*. 2017;47(2):439-446. doi:10.1007/s10803-016-2963-6

7. Cermak SA, Curtin C, Bandini LG. Food selectivity and sensory sensitivity in children with autism spectrum disorders. *J Am Diet Assoc*. 2010;110(2):238-246. doi:10.1016/j.jada.2009.10.032

8. Marí-Bauset S, Zazpe I, Mari-Sanchis A, Llopis-González A, Morales-Suárez-Varela M. Food Selectivity in Autism Spectrum Disorders: A Systematic Review. *J Child Neurol*. 2014;29(11):1554-1561. doi:10.1177/0883073813498821

9. Suarez MA, Crinion KM. Food Choices of Children With Autism Spectrum Disorders. *Int J School Health*. 2015;2(3). doi:10.17795/intjsh-27502

10. Castro K, Faccioli LS, Baronio D, Gottfried C, Perry IS, Riesgo R. Feeding behavior and dietary intake of male children and adolescents with autism spectrum disorder: A case-control study. *Int J Dev Neurosci*. 2016;53:68-74. doi:10.1016/j.ijdevneu.2016.07.003

11. Lachat C, Hawwash D, Ocké MC, et al. Strengthening the Reporting of Observational Studies in Epidemiology-Nutritional Epidemiology (STROBE-nut): An Extension of the STROBE Statement. *PLoS Med*. 2016;13(6):e1002036. doi:10.1371/journal.pmed.1002036

12. Karhu E, Zukerman R, Eshraghi RS, et al. Nutritional interventions for autism spectrum disorder. *Nutrition Reviews*. 2020;78(7):515-531. doi:10.1093/nutrit/nuz092

13. Al-Farsi YM, Waly MI, Deth RC, et al. Low folate and vitamin B12 nourishment is common in Omani children with newly diagnosed autism. *Nutrition*. 2013;29(3):537-541. doi:10.1016/j.nut.2012.09.014

14. Fahmy SF, Sabri NA, El Hamamsy MH, El Sawi M, Zaki OK. VITAMIN D INTAKE AND SUN EXPOSURE IN AUTISTIC CHILDREN. *INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH*. 2016;7(3):1043-1049. doi:10.13040/IJPSR.0975-8232.7(3).1043-49

15. Zeybek S, Yurttagul M. Nutrient status, diet quality and growth parameters of children with autism spectrum disorder in Northern Cyprus. *PROGRESS IN NUTRITION*. 2020;22(3). doi:10.23751/pn.v22i3.8847

16. Marshall J, Hill RJ, Ware RS, Ziviani J, Dodrill P. Clinical Characteristics of 2 Groups of Children With Feeding Difficulties. *J Pediatr Gastroenterol Nutr*. 2016;62(1):161-168. doi:10.1097/MPG.0000000000000914

17. Malhi P, Venkatesh L, Bharti B, Singhi P. Feeding Problems and Nutrient Intake in Children with and without Autism: A Comparative Study. *Indian J Pediatr*. 2017;84(4):283-288. doi:10.1007/s12098-016-2285-x

18. Murshid EZ. Diet, oral hygiene practices and dental health in autistic children in Riyadh, Saudi Arabia. *Oral Health Dent Manag*. 2014;13(1):91-96.

19. Marí-Bauset S, Zazpe I, Marí-Sanchis A, Llopis-González A, Suárez-Varela MM. Anthropometric measurements and nutritional assessment in autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders*. 2015;9:130-143. doi:10.1016/j.rasd.2014.08.012

20. Lindsay RL, Arnold LE, Aman MG, et al. Dietary status and impact of risperidone on nutritional balance in children with autism: A pilot study. *Journal of Intellectual and Developmental Disability*. 2006;31(4):204-209. doi:10.1080/13668250601006924

21. Ortiz-Andrellucchi A, Henríquez-Sánchez P, Sánchez-Villegas A, Peña-Quintana L, Mendez M, Serra-Majem L. Dietary assessment methods for micronutrient intake in infants, children and adolescents: a systematic review. *British Journal of Nutrition*. 2009;102(S1):S87-S117. doi:10.1017/S0007114509993163

22. Willett W. *Nutritional Epidemiology*. Third Edition, New to this Edition: Oxford University Press; 2012.

23. Bonis S. Stress and Parents of Children with Autism: A Review of Literature. *Issues in Mental Health Nursing*. 2016;37(3):153-163. doi:10.3109/01612840.2015.1116030

24. Goin-Kochel RP, Myers BJ, Mackintosh VH. Parental reports on the use of treatments and therapies for children with autism spectrum disorders. *Research in Autism Spectrum Disorders*. 2007;1(3):195-209. doi:10.1016/j.rasd.2006.08.006

25. Levy SE, Souders MC, Ittenbach RF, Giarelli E, Mulberg AE, Pinto-Martin JA. Relationship of dietary intake to gastrointestinal symptoms in children with autistic spectrum disorders. *Biol Psychiatry*. 2007;61(4):492-497. doi:10.1016/j.biopsych.2006.07.013

26. Schmitt L, Heiss C, Campbell E. A Comparison of Nutrient Intake and Eating Behaviors of Boys With and Without Autism. *Topics in Clinical Nutrition*. 2008;23(1):23-31. doi:10.1097/01.TIN.0000312077.45953.6c

27. Wang L, Christophersen CT, Sorich MJ, Gerber JP, Angley MT, Conlon MA. Elevated fecal short chain fatty acid and ammonia concentrations in children with autism spectrum disorder. *Dig Dis Sci*. 2012;57(8):2096-2102. doi:10.1007/s10620-012-2167-7

28. Malhi P, Saini S, Bharti B, Attri S, Sankhyan N. Sensory Processing Dysfunction and Mealtime Behavior Problems in Children With Autism. *Indian Pediatr*. 2021;58(9):842-845.

29. Perry A, Flanagan HE, Dunn Geier J, Freeman NL. Brief Report: The Vineland Adaptive Behavior Scales in Young Children with Autism Spectrum Disorders at Different Cognitive Levels. *J Autism Dev Disord*. 2009;39(7):1066-1078. doi:10.1007/s10803-009-0704-9

30. Zhang J, Zhou X, Li B, Zhou J, Chen Y. The reporting quality of observational studies relevant to the STROBE-nut statement in journals of nutrition. *Asia Pac J Clin Nutr*. 2021;30(1):174-183. doi:10.6133/apjcn.202103_30(1).0020

31. Xu Y, Le Sayec M, Roberts C, Hein S, Rodriguez-Mateos A, Gibson R. Dietary Assessment Methods to Estimate (Poly)phenol Intake in Epidemiological Studies: A Systematic Review. *Adv Nutr*. 2021;12(5):1781-1801. doi:10.1093/advances/nmab017

32. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6(7):e1000097. doi:10.1371/journal.pmed.1000097

33. Lanigan JA, Wells JCK, Lawson MS, Cole TJ, Lucas A. Number of days needed to assess energy and nutrient intake in infants and young children between 6 months and 2 years of age. *Eur J Clin Nutr*. 2004;58(5):745-750. doi:10.1038/sj.ejcn.1601872

34. Schreck KA, Williams K. Food preferences and factors influencing food selectivity for children with autism spectrum disorders. *Res Dev Disabil*. 2006;27(4):353-363. doi:10.1016/j.ridd.2005.03.005

35. Riccio MP, Franco C, Negri R, et al. Is food refusal in autistic children related to TAS2R38 genotype? *Autism Research*. 2018;11(3):531-538. doi:10.1002/aur.1912

36. Shearer TR, Larson K, Neuschwander J, Gedney B. Minerals in the hair and nutrient intake of autistic children. *J Autism Dev Disord*. 1982;12(1):25-34. doi:10.1007/BF01531671

37. Raiten DJ, Massaro T. Perspectives on the nutritional ecology of autistic children. *Journal of Autism and Developmental Disorders*. 1986;16(2):133-143. doi:10.1007/BF01531725

38. Ho HH, Eaves LC, Peabody D. Nutrient Intake and Obesity in Children with Autism. *Focus Autism Other Dev Disabl*. 1997;12(3):187-192. doi:10.1177/108835769701200308

39. Cornish E. Gluten and casein free diets in autism: a study of the effects on food choice and nutrition. *J Hum Nutr Diet*. 2002;15(4):261-269. doi:10.1046/j.1365-277x.2002.00372.x

40. Cornish E. A balanced approach towards healthy eating in autism. *Journal of Human Nutrition and Dietetics*. 1998;11(6):501-509. doi:https://doi.org/10.1046/j.1365-277X.1998.00132.x

41. Johnson CR, Handen BL, Mayer-Costa M, Sacco K. Eating habits and dietary status in young children with autism. *Journal of Developmental and Physical Disabilities*. 2008;20(5):437-448. doi:10.1007/s10882-008-9111-y

42. Lockner DW, Crowe TK, Skipper BJ. Dietary intake and parents' perception of mealtime behaviors in preschool-age children with autism spectrum disorder and in

typically developing children. *J Am Diet Assoc*. 2008;108(8):1360-1363. doi:10.1016/j.jada.2008.05.003

43. Herndon AC, DiGuiseppi C, Johnson SL, Leiferman J, Reynolds A. Does nutritional intake differ between children with autism spectrum disorders and children with typical development? *J Autism Dev Disord*. 2009;39(2):212-222. doi:10.1007/s10803-008-0606-2

44. Emond A, Emmett P, Steer C, Golding J. Feeding symptoms, dietary patterns, and growth in young children with autism spectrum disorders. *Pediatrics*. 2010;126(2):e337-342. doi:10.1542/peds.2009-2391

45. Hendy HM, Williams KE, Riegel K, Paul C. Parent mealtime actions that mediate associations between children's fussy-eating and their weight and diet. *Appetite*. 2010;54(1):191-195. doi:10.1016/j.appet.2009.10.006

46. Xia W, Zhou Y, Sun C, Wang J, Wu L. A preliminary study on nutritional status and intake in Chinese children with autism. *Eur J Pediatr*. 2010;169(10):1201-1206. doi:10.1007/s00431-010-1203-x

47. Sadowska J, Cierebiej M. Evaluation of the nutrition manner and nutritional status of children with autism. Preliminary investigations. *Pediatria Wspolczesna*. 2011;13:155-160.

48. Evans EW, Must A, Anderson SE, et al. Dietary Patterns and Body Mass Index in Children with Autism and Typically Developing Children. *Res Autism Spectr Disord*. 2012;6(1):399-405. doi:10.1016/j.rasd.2011.06.014

49. Harris C, Card B. A pilot study to evaluate nutritional influences on gastrointestinal symptoms and behavior patterns in children with Autism Spectrum Disorder. *Complement Ther Med*. 2012;20(6):437-440. doi:10.1016/j.ctim.2012.08.004

50. Hyman SL, Stewart PA, Schmidt B, et al. Nutrient intake from food in children with autism. *Pediatrics*. 2012;130 Suppl 2(Suppl 2):S145-153. doi:10.1542/peds.2012-0900L

51. Moore E. Nutrient Intake among Children with Autism. *J Nutr Disorders Ther*. 2012;02(03). doi:10.4172/2161-0509.1000115

52. Reynolds A, Krebs NF, Stewart PA, et al. Iron status in children with autism spectrum disorder. *Pediatrics*. 2012;130(Suppl 2):S154-S159. doi:10.1542/peds.2012-0900M

53. Soden SE, Garrison CB, Egan AM, Beckwith AM. Nutrition, physical activity, and bone mineral density in youth with autistic spectrum disorders. *J Dev Behav Pediatr*. 2012;33(8):618-624. doi:10.1097/DBP.0b013e318260943c

54. Zimmer MH, Hart LC, Manning-Courtney P, Murray DS, Bing NM, Summer S. Food variety as a predictor of nutritional status among children with autism. *J Autism Dev Disord*. 2012;42(4):549-556. doi:10.1007/s10803-011-1268-z

55. Bicer AH, Alsaffar AA. Body mass index, dietary intake and feeding problems of Turkish children with autism spectrum disorder (ASD). *Res Dev Disabil*. 2013;34(11):3978-3987. doi:10.1016/j.ridd.2013.08.024

56. Williams-Hooker R, George EO, Levy M, Morgan C, Smith TL, Bittle JB. Calcium and Vitamin D Intake of Boys Who Have Autism. *ICAN: Infant, Child, & Adolescent Nutrition*. 2013;5(2):113-117. doi:10.1177/1941406413478167

57. Lane AE, Geraghty ME, Young GS, Rostorfer JL. Problem Eating Behaviors in Autism Spectrum Disorder Are Associated With Suboptimal Daily Nutrient Intake and Taste/Smell Sensitivity. *ICAN: Infant, Child, & Adolescent Nutrition*. 2014;6(3):172-180. doi:10.1177/1941406414523981

58. Attlee A, Kassem H, Hashim M, Obaid RS. Physical Status and Feeding Behavior of Children with Autism. *Indian J Pediatr*. 2015;82(8):682-687. doi:10.1007/s12098-015-1696-4

59. Bicer A, Alsaffar A. Dietary intake of adolescents with Autism Spectrum Disorder (ASD) and normal to High Body Mass Index (BMI). *Integr Food Nutr Metab*. 2015;2(4). doi:10.15761/IFNM.1000135

60. Meguid N, Anwar M, Zaki S, Kandeel W, Ahmed N, Tewfik I. Dietary Patterns of Children with Autism Spectrum Disorder: A Study Based in Egypt. *Open Access Maced J Med Sci*. 2015;3(2):262-267. doi:10.3889/oamjms.2015.051

61. Postorino V, Sanges V, Giovagnoli G, et al. Clinical differences in children with autism spectrum disorder with and without food selectivity. *APPETITE*. 2015;92:126-132. doi:10.1016/j.appet.2015.05.016

62. Stewart PA, Hyman SL, Schmidt BL, et al. Dietary Supplementation in Children with Autism Spectrum Disorders: Common, Insufficient, and Excessive. *J Acad Nutr Diet*. 2015;115(8):1237-1248. doi:10.1016/j.jand.2015.03.026

63. Tanner K, Case-Smith J, Nahikian-Nelms M, Ratliff-Schaub K, Spees C, Darragh AR. Behavioral and Physiological Factors Associated With Selective Eating in Children With Autism Spectrum Disorder. *Am J Occup Ther*. 2015;69(6):6906180030p1-8. doi:10.5014/ajot.2015.019273

64. Aponte CA, Romanczyk RG. Assessment of feeding problems in children with autism spectrum disorder. *RESEARCH IN AUTISM SPECTRUM DISORDERS*. 2016;21:61-72. doi:10.1016/j.rasd.2015.09.007

65. Liu X, Liu J, Xiong X, et al. Correlation between Nutrition and Symptoms: Nutritional Survey of Children with Autism Spectrum Disorder in Chongqing, China. *Nutrients*. 2016;8(5). doi:10.3390/nu8050294

66. Chistol LT, Bandini LG, Must A, Phillips S, Cermak SA, Curtin C. Sensory Sensitivity and Food Selectivity in Children with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*. 2017;48(2):583-591. doi:10.1007/s10803-017-3340-9

67. Berding K, Donovan SM. Diet Can Impact Microbiota Composition in Children With Autism Spectrum Disorder. *Front Neurosci*. 2018;12:515. doi:10.3389/fnins.2018.00515

68. Kotha SB, AlFaraj NSM, Ramdan TH, Alsalam MA, Al Ameer MJ, Almuzin ZM. Associations between Diet, Dietary and Oral Hygiene Habits with Caries Occurrence and Severity in Children with Autism at Dammam City, Saudi Arabia. *Open Access Maced J Med Sci*. 2018;6(6):1104-1110. doi:10.3889/oamjms.2018.245

69. Neumeyer AM, Cano Sokoloff N, McDonnell EI, et al. Nutrition and Bone Density in Boys with Autism Spectrum Disorder. *J Acad Nutr Diet*. 2018;118(5):865-877. doi:10.1016/j.jand.2017.11.006

70. Ferguson BJ, Dovgan K, Severns D, et al. Lack of Associations Between Dietary Intake and Gastrointestinal Symptoms in Autism Spectrum Disorder. *Front Psychiatry*. 2019;10:528. doi:10.3389/fpsyt.2019.00528

71. Siddiqi S, Urooj A, D'Souza MJ. Dietary Patterns and Anthropometric Measures of Indian Children with Autism Spectrum Disorder. *J Autism Dev Disord*. 2019;49(4):1586-1598. doi:10.1007/s10803-018-3850-0

72. Smith B, Rogers SL, Blissett J, Ludlow AK. The relationship between sensory sensitivity, food fussiness and food preferences in children with neurodevelopmental disorders. *Appetite*. 2020;150. doi:10.1016/j.appet.2020.104643

73. Barnhill K, Gutierrez A. Analysis of Dietary Intake and Nutritional Status in Children with Autism Spectrum Disorder. *Autism Open Access*. 2015;05(03). doi:10.4172/2165-7890.1000154

74. Williams KE, Gibbons BG, Schreck KA. Comparing Selective Eaters with and Without Developmental Disabilities. *J Dev Phys Disabil*. 2005;17(3):299-309. doi:10.1007/s10882-005-4387-7

75. Gok S, Ozturk S, Karaca R, Ilbars S, Nogay N. Evaluation of sleep disturbances, gastrointestinal problems and eating behaviors in Turkish children with autistic disorder and PDD-NOS. *ADVANCES IN AUTISM*. 2021;7(2):101-113. doi:10.1108/AIA-12-2019-0049

76. Tsujiguchi H, Miyagi S, Nguyen T, et al. Relationship between Autistic Traits and Nutrient Intake among Japanese Children and Adolescents. *NUTRIENTS*. 2020;12(8). doi:10.3390/nu12082258

77. Adams S, Verachia R, Coutts K. Mealtime challenges and food selectivity in children with autism spectrum disorder in South Africa. *SOUTH AFRICAN JOURNAL OF CLINICAL NUTRITION*. doi:10.1080/16070658.2021.1954794

78. Buro AW, Gray HL, Kirby RS, Berkman K, Agazzi H, Shaffer-Hudkins E. Diet quality in an ethnically diverse sample of children and adolescents with autism spectrum disorder compared with nationally representative data. *Disabil Health J*. 2021;14(1):100981. doi:10.1016/j.dhjo.2020.100981

79. Eow S, Gan W, Awang H. Body weight status and dietary intake of Malaysian children with Autism Spectrum Disorder. *RESEARCH IN AUTISM SPECTRUM DISORDERS*. 2021;84. doi:10.1016/j.rasd.2021.101768

80. Panjwani AA, Bailey RL, Kelleher BL. COVID-19 and Food-Related Outcomes in Children with Autism Spectrum Disorder: Disparities by Income and Food Security Status. *Curr Dev Nutr*. 2021;5(9):nzab112. doi:10.1093/cdn/nzab112

81. Şengüzel S, Cebeci AN, Ekici B, Gönen İ, Tatlı B. Impact of eating habits and nutritional status on children with autism spectrum disorder. *J Taibah Univ Med Sci*. 2021;16(3):413-421. doi:10.1016/j.jtumed.2020.11.010

82. Marí-Bauset S, Llopis-González A, Zazpe I, Marí-Sanchis A, Morales Suárez-Varela M. Comparison of nutritional status between children with autism spectrum disorder and typically developing children in the Mediterranean Region (Valencia, Spain). *Autism*. 2016;21(3):310-322. doi:10.1177/1362361316636976

83. Meguid NA, Anwar M, Bjørklund G, et al. Dietary adequacy of Egyptian children with autism spectrum disorder compared to healthy developing children. *Metab Brain Dis*. 2017;32(2):607-615. doi:10.1007/s11011-016-9948-1

84. Schreck KA, Williams K, Smith AF. A comparison of eating behaviors between children with and without autism. *J Autism Dev Disord*. 2004;34(4):433-438. doi:10.1023/b:jadd.0000037419.78531.86

85. Sun C, Xia W, Zhao Y, Li N, Zhao D, Wu L. Nutritional status survey of children with autism and typically developing children aged 4–6 years in Heilongjiang Province, China. *J Nutr Sci*. 2013;2. doi:10.1017/jns.2013.9

86. Hubbard KL, Anderson SE, Curtin C, Must A, Bandini LG. A comparison of food refusal related to characteristics of food in children with autism spectrum disorder and typically developing children. *J Acad Nutr Diet*. 2014;114(12):1981-1987. doi:10.1016/j.jand.2014.04.017

87. Marí-Bauset S, Llopis-González A, Zazpe-García I, Marí-Sanchis A, Morales-Suárez-Varela M. Nutritional status of children with autism spectrum disorders (ASDs): a case-control study. *J Autism Dev Disord*. 2014;45(1):203-212. doi:10.1007/s10803-014-2205-8

88. Marí-Bauset S, Llopis-González A, Zazpe I, Marí-Sanchis A, Suárez-Varela MM. Nutritional Impact of a Gluten-Free Casein-Free Diet in Children with Autism Spectrum Disorder. *J Autism Dev Disord*. 2015;46(2):673-684. doi:10.1007/s10803-015-2582-7

89. Marí-Bauset S, Llopis-González A, Zazpe I, Marí-Sanchis A, Suárez-Varela MM. Fat intake in children with autism spectrum disorder in the Mediterranean region (Valencia, Spain). *Nutr Neurosci*. 2015;19(9):377-386. doi:10.1179/1476830515Y.0000000029

90. Shmaya Y, Eilat-Adar S, Leitner Y, Reif S, Gabis L. Nutritional deficiencies and overweight prevalence among children with autism spectrum disorder. *Res Dev Disabil*. 2015;38:1-6. doi:10.1016/j.ridd.2014.11.020

91. Bicer AH, Alsaffar AA. Dietary intake and physical activity levels of male adolescents with autism spectrum disorder (ASD) and normal to high body mass index (BMI) - A

case series study. *RESEARCH IN AUTISM SPECTRUM DISORDERS*. 2016;31:1-10. doi:10.1016/j.rasd.2016.07.002

92. Barnhill K, Gutierrez A, Ghossainy M, et al. Dietary status and nutrient intake of children with autism spectrum disorder: A case-control study. *RESEARCH IN AUTISM SPECTRUM DISORDERS*. 2018;50:51-59. doi:10.1016/j.rasd.2018.03.002

93. Leiva-García B, Planells E, Planells Del Pozo P, Molina-López J. Association Between Feeding Problems and Oral Health Status in Children with Autism Spectrum Disorder. *J Autism Dev Disord*. 2019;49(12):4997-5008. doi:10.1007/s10803-019-04211-w

94. Al-Kindi NM, Al-Farsi YM, Al-Bulushi B, Ali A, Rizvi SGA, Essa MM. Food Selection and Preferences of Omani Autistic Children. *Adv Neurobiol*. 2020;24:505-523. doi:10.1007/978-3-030-30402-7_16

95. Molina-López J, Leiva-García B, Planells E, Planells P. Food selectivity, nutritional inadequacies, and mealtime behavioral problems in children with autism spectrum disorder compared to neurotypical children. *Int J Eat Disord*. Published online October 27, 2021. doi:10.1002/eat.23631

96. Moorthy L, Dixit UB, Kole RC, Gajre MP. Dietary Sugar Exposure and Oral Health Status in Children with Autism Spectrum Disorder: A Case-control Study. *J Autism Dev Disord*. Published online July 4, 2021. doi:10.1007/s10803-021-05151-0

97. Nadeau MV, Richard E, Wallace GL. The Combination of Food Approach and Food Avoidant Behaviors in Children with Autism Spectrum Disorder: “Selective Overeating”. *J Autism Dev Disord*. Published online April 12, 2021. doi:10.1007/s10803-021-04945-6

98. Plaza-Diaz J, Flores-Rojas K, Torre-Aguilar MJ de la, et al. Dietary Patterns, Eating Behavior, and Nutrient Intakes of Spanish Preschool Children with Autism Spectrum Disorders. *Nutrients*. 2021;13(10). doi:10.3390/nu13103551

99. Yeung SSY, Chan R, Li L, Chan D, Leung J, Leung TF. Eating Behaviors and Diet Quality in Chinese Preschoolers with and without Autism Spectrum Disorder: A Case-Control Study. *J Pediatr*. 2021;237:258-266.e5. doi:10.1016/j.jpeds.2021.06.017

100. Berding K, Donovan SM. Dietary Patterns Impact Temporal Dynamics of Fecal Microbiota Composition in Children With Autism Spectrum Disorder. *Front Nutr*. 2020;6:193. doi:10.3389/fnut.2019.00193

101. Diolordi L, del Balzo V, Bernabei P, Vitiello V, Donini LM. Eating habits and dietary patterns in children with autism. *Eat Weight Disord*. 2014;19(3):295-301. doi:10.1007/s40519-014-0137-0

102. Kim SY, Chung KM, Jung S. Effects of repeated food exposure on increasing vegetable consumption in preschool children with autism spectrum disorder. *Research in Autism Spectrum Disorders*. 2018;47:26-35. doi:10.1016/j.rasd.2018.01.003

103. Sharp WG, Jaquess DL, Morton JF, Miles AG. A Retrospective Chart Review of Dietary Diversity and Feeding Behavior of Children With Autism Spectrum Disorder Before and After Admission to a Day-Treatment Program. *Focus on Autism and Other Developmental Disabilities*. 2011;26(1):37-48. doi:10.1177/1088357609349245

104. Lukens CT, Linscheid TR. Development and validation of an inventory to assess mealtime behavior problems in children with autism. *Journal of Autism and Developmental Disorders*. 2008;38(2):342-352. doi:10.1007/s10803-007-0401-5

105. Withrow NA, Alvidrez L. The development of the Sensory Processing, Aberrant Mealtime Behavior, Motor Inventory for Eating (SAMIE) in children with an ASD. *ADVANCES IN AUTISM*. 2019;5(4):268-281. doi:10.1108/AIA-08-2018-0025

106. Gonzalez Domenech PJ, Diaz Atienza F, Garcia Pablos C, et al. Influence of a Gluten-free, Casein-free Diet on Behavioral Disturbances in Children and Adolescents Diagnosed with Autism Spectrum Disorder: A 3-month Follow-up Pilot Study. *Journal of Mental Health Research in Intellectual Disabilities*. 2019;12(3-4):256-272. doi:10.1080/19315864.2019.1654574

107. Nogay NH, Walton J, Roberts KM, Nahikian-Nelms M, Witwer AN. The Effect of the Low FODMAP Diet on Gastrointestinal Symptoms, Behavioral Problems and Nutrient Intake in Children with Autism Spectrum Disorder: A Randomized Controlled Pilot Trial. *J Autism Dev Disord*. 2021;51(8):2800-2811. doi:10.1007/s10803-020-04717-8

108. Burrows TL, Martin RJ, Collins CE. A Systematic Review of the Validity of Dietary Assessment Methods in Children when Compared with the Method of Doubly Labeled Water. *Journal of the American Dietetic Association*. 2010;110(10):1501-1510. doi:10.1016/j.jada.2010.07.008

109. Cheng G, Hilbig A, Drossard C, Alexy U, Kersting M. Relative validity of a 3 d estimated food record in German toddlers. *Public Health Nutr*. 2013;16(4):645-652. doi:10.1017/S1368980012003230

110. French CD, Arsenault JE, Arnold CD, et al. Within-Person Variation in Nutrient Intakes across Populations and Settings: Implications for the Use of External Estimates in Modeling Usual Nutrient Intake Distributions. *Advances in Nutrition*. 2021;12(2):429-451. doi:10.1093/advances/nmaa114

111. Rossato SL, Fuchs SC. Diet Data Collected Using 48-h Dietary Recall: Within—and Between-Person Variation. *Frontiers in Nutrition*. 2021;8. Accessed March 9, 2022. https://www.frontiersin.org/article/10.3389/fnut.2021.667031

112. Ollberding NJ, Couch SC, Woo JG, Kalkwarf HJ. Within- and between-individual variation in nutrient intake in children and adolescents. *J Acad Nutr Diet*. 2014;114(11):1749-1758.e5. doi:10.1016/j.jand.2014.03.016

113. Erkkola M, Kyttälä P, Takkinen HM, et al. Nutrient intake variability and number of days needed to assess intake in preschool children. *British Journal of Nutrition*. 2011;106(1):130-140. doi:10.1017/S0007114510005167

114. de Castro MA, Verly- E, Fisberg M, Fisberg RM. Children's nutrient intake variability is affected by age and body weight status according to results from a Brazilian multicenter study. *Nutrition Research*. 2014;34(1):74-84. doi:10.1016/j.nutres.2013.09.006

115. Graf-Myles J, Farmer C, Thurm A, et al. Dietary adequacy of children with autism compared with controls and the impact of restricted diet. *J Dev Behav Pediatr*. 2013;34(7):449-459. doi:10.1097/DBP.0b013e3182a00d17

116. Naska A, Lagiou A, Lagiou P. Dietary assessment methods in epidemiological research: current state of the art and future prospects. *F1000Res*. 2017;6. doi:10.12688/f1000research.10703.1

117. Shim JS, Oh K, Kim HC. Dietary assessment methods in epidemiologic studies. *Epidemiol Health*. 2014;36. doi:10.4178/epih/e2014009

118. Tucker KL. Assessment of usual dietary intake in population studies of gene–diet interaction. *Nutrition, Metabolism and Cardiovascular Diseases*. 2007;17(2):74-81. doi:10.1016/j.numecd.2006.07.010

119. Sharp WG, Berry RC, McCracken C, et al. Feeding Problems and Nutrient Intake in Children with Autism Spectrum Disorders: A Meta-analysis and Comprehensive Review of the Literature. *J Autism Dev Disord*. 2013;43(9):2159-2173. doi:10.1007/s10803-013-1771-5

120. McPherson RS, Hoelscher DM, Alexander M, Scanlon KS, Serdula MK. Dietary Assessment Methods among School-Aged Children: Validity and Reliability. *Preventive Medicine*. 2000;31(2):S11-S33. doi:10.1006/pmed.2000.0631

121. Pennington JAT. Applications of food composition data: Data sources and considerations for use. *Journal of Food Composition and Analysis*. 2008;21:S3-S12. doi:10.1016/j.jfca.2007.02.005

122. Vissoker RE, Latzer Y, Gal E. Eating and feeding problems and gastrointestinal dysfunction in Autism Spectrum Disorders. *Research in Autism Spectrum Disorders*. 2015;12:10-21. doi:10.1016/j.rasd.2014.12.010

123. Dove D, Warren Z, McPheeters ML, Taylor JL, Sathe NA, Veenstra-VanderWeele J. Medications for Adolescents and Young Adults With Autism Spectrum Disorders: A Systematic Review. *PEDIATRICS*. 2012;130(4):717-726. doi:10.1542/peds.2012-0683

124. Scahill L, Jeon S, Boorin SJ, et al. Weight Gain and Metabolic Consequences of Risperidone in Young Children With Autism Spectrum Disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2016;55(5):415-423. doi:10.1016/j.jaac.2016.02.016

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	Dietary assessment methodology
Design	Cross-sectional, longitudinal, case-control, clinical trials and instrument validation
Evaluation	Quality of methodology reporting
Research type	Quantitative and mixed studies

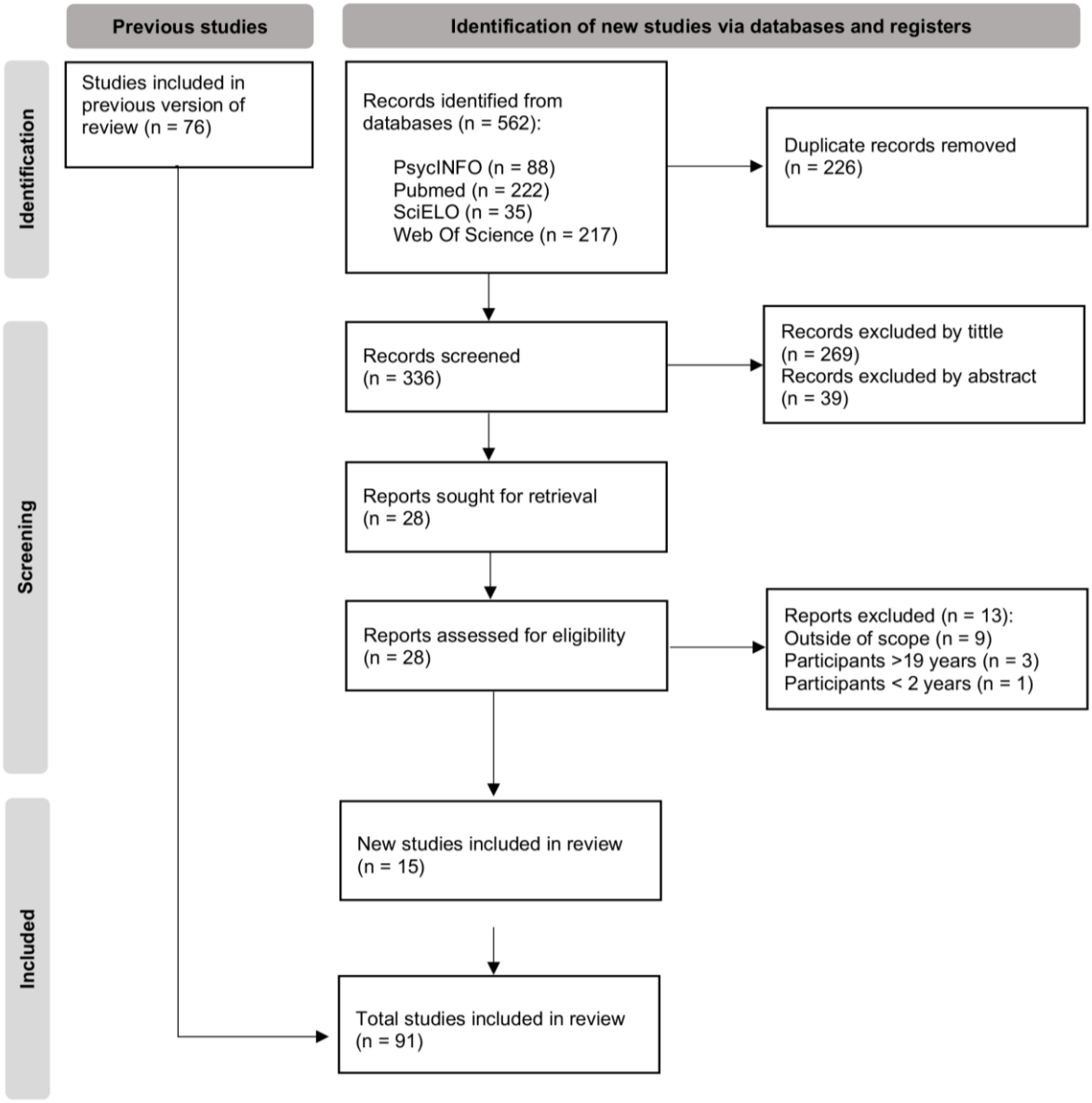


Figure 1. Preferred reporting items for systematic reviews and meta-analyses flow diagram of updated search process and literature screening.

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

Author, year (country)	Design	Sample	Instrument application protocol details	Dietary outcomes*	STROBE-nut
FOOD RECORD (n=49)					
Shearer et al., 1982[36] (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	Energy, macronutrients, micronutrients, daily servings of food groups, daily sugar consumption, and caloric contribution from sugar	5.5
Raiten; Massaro, 1986[37] (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	Energy, macronutrients, micronutrients, frequency and average of food group items	10.0
Ho et al., 1997[38] (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	Energy, calorie contribution of macronutrients and daily servings of food groups	8.0
Cornish, 2002[39] (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	Energy, 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=91).

Williams et al., 2005[74] (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[25] (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: 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[42] (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[26] (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	Energy, 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=91).

Herndon et al., 2009[43] (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	Energy, 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[46] (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	Energy, macronutrients, micronutrients and calorie contribution of macronutrients	11.5
Sharp et al., 2011[103] (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=91).

Hyman et al., 2012[50] (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	Energy, macronutrients, micronutrients and calorie contribution of macronutrients	14.5
Reynolds et al., 2012[52] (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[53] (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	Energy, macronutrients and micronutrients	12.5
Bicer; Alfassar, 2013[55] (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=91).

Sun et al., 2013[85] (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	Energy, macronutrients and micronutrients	12.5
Lane et al., 2014[57] (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[87] (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	Energy, micronutrients, calorie contribution of macronutrients , HEI and score of food variety (HEI component)	16.0
Attle et al., 2015[58] (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	Energy, macronutrients and micronutrients	11.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

Barnhill et al. 2015[73] (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	Energy, macronutrients and micronutrients	12.0
Bicer; Alfassar, 2015[59] (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	Energy, macronutrients, micronutrients and calorie contribution of macronutrients	11.5
Marí-Bauset et al., 2015[88] (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	Energy, 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[89] (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	Energy, micronutrients, calorie contribution of macronutrients , HEI and score of food variety (HEI component)	16.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

Meguid et al., 2015[60] (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	Energy, macronutrients and micronutrients	9.5
Shmaya et al., 2015[90] (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[62] (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

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

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	Energy, macronutrients, micronutrients, calorie contribution of macronutrients and total food items consumed (food selectivity)	11.0
Liu et al., 2016[65] (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: 7 consecutive days Responsible for filling out: Parents (weekend days) and researchers (FR with food weighing on weekdays) 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[82] (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	Energy, 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

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

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
Chistol et al., 2017[66] (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	Energy, macronutrients, and micronutrients	10.5
Meguid et al., 2017[83] (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	Energy, macronutrients, micronutrients, and calorie contribution from macronutrients	11.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

Barnhill et al. 2018[92] (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	Energy, macronutrients, andmicronutrients	12.0
Berding; Donovan, 2018[67] (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	Energy, macronutrients, micronutrients, and calorie contribution of macronutrients	9.0
Kim et al., 2018[102] (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[69] (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	Energy, macronutrients, micronutrients, and calorie contribution of macronutrients	12.0

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

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	Energy, macronutrients, micronutrients, preferred food items and omission of food groups (Food variety and criterion for food selectivity)	13.0
Siddiqi et al., 2019[71] (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	Energy, macronutrients, and micronutrients	11.0
Withrow; Alvidrez, 2019[105] (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	Energy, macronutrients, and micronutrients	13.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

Berding; Donovan, 2020[100] (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	Energy, macronutrients, micronutrients, and calorie contribution of macronutrients	9.0
Nogay et al., 2020[107] (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	Energy, 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	Energy, macronutrients, micronutrients, calorie contribution of macronutrients and HEI	9.0
Buro et al., 2021[78] (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[79] (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	Energy, macronutrients, micronutrients, and calorie contribution of macronutrients	14.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

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	Energy, macronutrients, and micronutrients	11.5
Yeung et al., 2021[99] (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.	Energy, micronutrients, calorie contribution of macronutrients and Chinese Children Dietary Index	10.0
24-HOUR FOOD RECALL (n=8)					
Cornish, 1998[40] (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	Energy, micronutrients, calorie contribution of macronutrients , servings of food groups and food items consumed (Food variety)	6.0
Johnson et al., 2008[41] (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	Energy, macronutrients and micronutrients	8.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

Lukens; Linscheid, 2008[104] (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[47] (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	Energy, macronutrients, micronutrients, percentage of food groups per meal and average number of food group items	5.5
Bicer; Alfassar, 2016[91] (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	Energy, macronutrients, micronutrients, and calorie contribution of macronutrients	10.5
Malhi et al., 2021[28] (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	Energy, macronutrients, and micronutrients	8.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

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	Energy, 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=41)					
Cornish, 1998[40] (England)	#	#	Instrument name not reported Food items: Not reported Responsible for filling out: Not reported Food groups: Not reportedRecall period: Not reported	Energy, micronutrients, calorie contribution of macronutrients and servings of food groups and food items consumed (Food variety)	#
Williams et al., 2005[74] (United States)	#	#	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)	#
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	Energy, macronutrients and micronutrients	12.5

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

Johnson et al., 2008[41] (United States)	#	#	Short Dietary Questionnaire of Yarnell Food items:: Not reported Responsible for filling out: Parents Food groups: Not reported Recall period: Not reported	Energy, macronutrients, micronutrients and consumption of water, fruits and vegetables	#
Lukens; Linscheid, 2008[104] (United States)	#	#	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.	#
Bandini et al., 2010[4] (United States)	#	#	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)	#
Emond et al., 2010[44] (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	Energy, macronutrients, micronutrients, items consumed from food groups and food items never consumed (Score of food variety)	10.5
Evans et al., 2012[48] (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=91).

Harris; Card, 2012[49] (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[51] (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	Energy, macronutrients, micronutrients, and calorie contribution of macronutrients	9.5
Wang et al., 2012[27] (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[54] (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	Energy, 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=91).

Al-Farsi et al., 2013[13] (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[56] (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[101] (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[86] (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=91).

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[61] (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=91).

Tanner et al., 2015[63] (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[64] (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[14] (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=91).

Bandini et al., 2017[6] (United States)	#	#	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)	#
Chistol et al., 2017[66] (United States)	#	#	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	#
Meguid et al., 2017[83] (Egypt)	#	#	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.	#
Berding; Donovan, 2018[67] (United States)	#	#	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	#
Kotha et al., 2018[68] (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=91).

Ferguson et al., 2019[70] (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	Energy, macronutrients, and micronutrients	13.5
Gonzalez-Domenech et al., 2019[106] (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[93] (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[71] (India)	#	#	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	#

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

Al-Kindi et al., 2020[94] (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[100] (United States)	#	#	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	#
Gok et al., 2020[75] (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=91).

Tsujiguchi et al., 2020[76] (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	Energy, micronutrients, and calorie contribution of macronutrients	14.0
Molina-López et al., 2021[95] (Spain)	#	#	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)	#
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[80] (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=91).

Plaza-Diaz et al., 2021[98] (Spain)	#	#	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	#
Şengüzel et al., 2021[81] (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[99] (China)	#	#	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	#
FOOD LIST (n=8)					
Schmitt et al., 2008[26] (United States)	#	#	Type: 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	#
Hendy et al., 2010[45] (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

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

Sharp et al., 2011[103] (United States)	#	#	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)	#
Al-Farsi et al., 2013[13] (Sultanate of Oman)	#	#	Food Diary Type: Free list Responsible for filling out: Mothers Food groups: Not applicable Recall period: 12 months	Not detail	#
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)	#	#	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)	#
Zeybek; Yurttagul, 2020[15] (Turkey)	#	#	Type: Checklist Food items: Not reported Responsible for filling out: Parents Recall period: Current	Preferred food items	#
Malhi et al., 2021[28] (India)	#	#	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.	#

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

FOOD PREFERENCE INVENTORY/QUESTIONNAIRE (n=7)					
Schreck et al., 2004[84] (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[34] (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
Attle et al., 2015[58] (United Arab Emirates)	#	#	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)	#
Malhi et al., 2017[17] (India)	#	#	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)	#

Table 2. Description of studies that investigate dietary intake in children and adolescents with ASD (n=91).

Riccio et al., 2018[35] (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[72] (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
Adams et al., 2021[77] (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

*Calories and/ou nutrients, indexes, food groups. #Study applied two instruments to evaluate food consumption, information described previously (n=22). 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.

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=91). (Available as an Excel spreadsheet)

Supplementary table 3. Assessment of reporting quality with STROBE-nut items (n=91)*.

Item	Description	Yes n (%)	Not applicable 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.	59 (64.8)	0	0	32 (35.2)
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.	69 (75.8)	0	7 (7.7)	15 (16.5)
nut-6	Report particular dietary, physiological, or nutritional characteristics that were considered when selecting the target population.	69 (64.8)	0	1 (1.1)	21 (23.1)
Methods - Variables					
nut-7.1	Clearly define foods, food groups, nutrients, or other food components.	53 (58.2)	0	24 (26.4)	14 (15.4)
nut-7.2	When using dietary patterns or indices, describe the methods to obtain them and their nutritional properties.	8 (8.8)	58 (63.7)	24 (26.4)	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.	3 (3.3)	0	26 (28.6)	62 (68.1)
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.	3 (3.3)	31 (34.1)	47 (51.6)	10 (11)
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.	2 (2.2)	34 (37.4)	1 (1.1)	54 (59.3)

Supplementary table 3. Assessment of reporting quality with STROBE-nut items (n=91).

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.	49 (53.8)	0	2 (2.2)	40 (44)
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.	13 (14.3)	0	0	78 (85.7)
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	90 (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.	32 (35.2)	46 (50.5)	4 (4.4)	9 (9.9)
Methods - Statistical analysis					
nut-12.1	Describe any statistical method used to combine dietary or nutritional data, if applicable.	74 (81.3)	0	11 (12.1)	6 (6.6)
nut-12.2	Describe and justify the method for energy adjustments, intake modeling, and use of weighting factors, if applicable.	6 (6.6)	31 (34.1)	0	54 (59.3)
Results					
nut-13	Report the number of individuals excluded based on missing, incomplete, or implausible dietary/nutritional data.	27 (29.8)	0	15 (16.5)	49 (53.8)
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.	75 (82.4)	0	0	16 (17.6)
nut-16	Specify if nutrient intakes are reported with or without inclusion of dietary supplement intake, if applicable.	27 (29.7)	31 (34.1)	0	33 (36.3)
nut-17	Report any sensitivity analysis (e.g., exclusion of misreporters or outliers) and data imputation, if applicable.	5 (5.5)	31 (34.1)	0	55 (60.4)

Supplementary table 3. Assessment of reporting quality with STROBE-nut items (n=91).

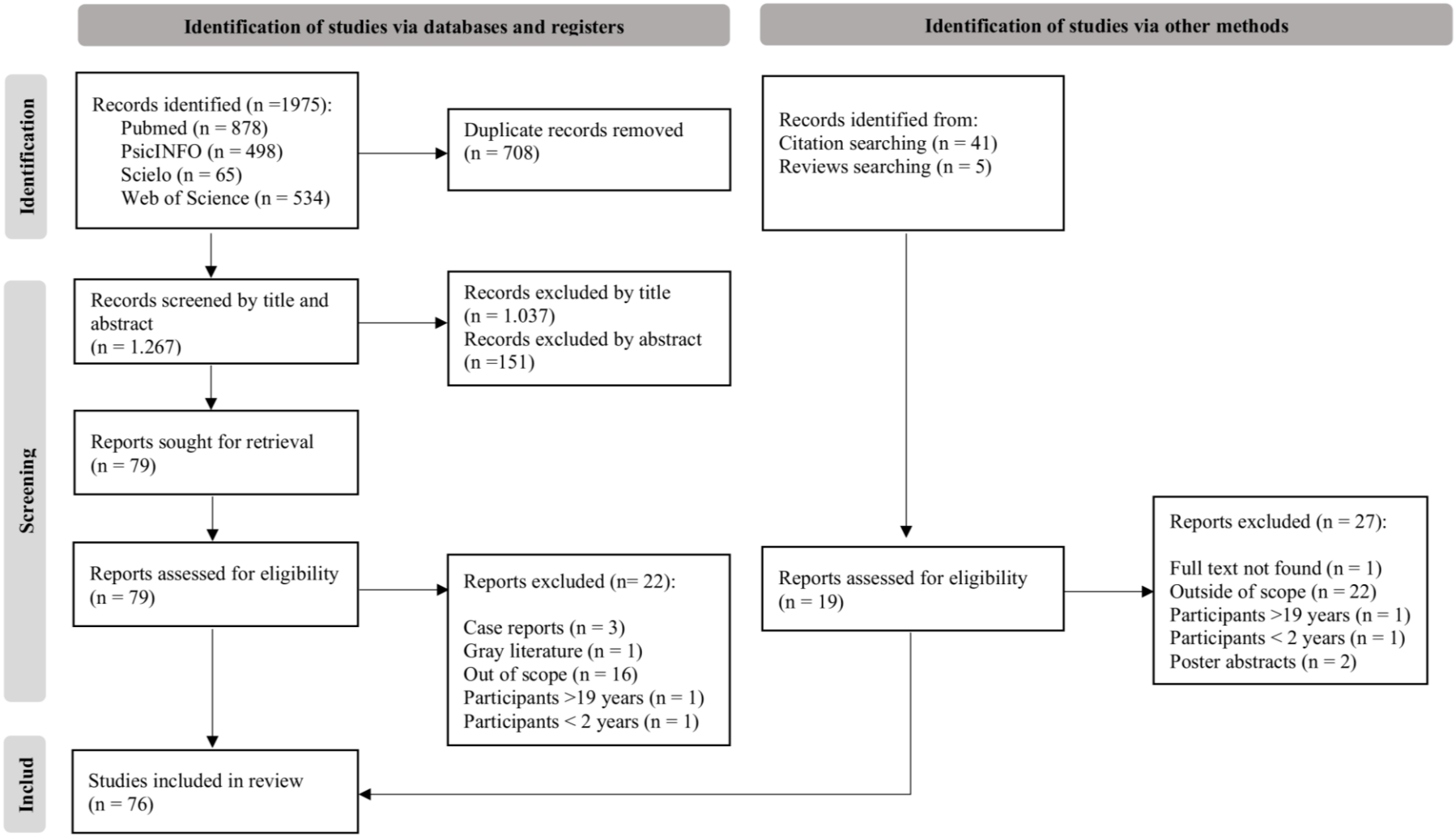
Discussion					
nut-19	Describe the main limitations of the data sources and assessment methods used and implications for the interpretation of the findings.	53 (58.2)	0	0	38 (41.8)
nut-20	Report the nutritional relevance of the findings, given the complexity of diet or nutrition as an exposure.	89 (97.8)	0	0	2 (2.2)
Other information					
nut-22.1	Describe the procedure for consent and study approval from ethics committee(s).	75 (82.4)	0	0	16 (17.6)
Total score[#]			12.5 (5.5-17.5)		
Total score without not applicable[#]			10.1 (3.5-16.5)		

*The studies were not assessed for nut-8.4, nut-12.3 and nut-22.2. Scores assigned: 1.0 (Yes and Not applicable), 0.5 (Partially yes) and 0 (No), more information can be found in Lachat et al.[1]

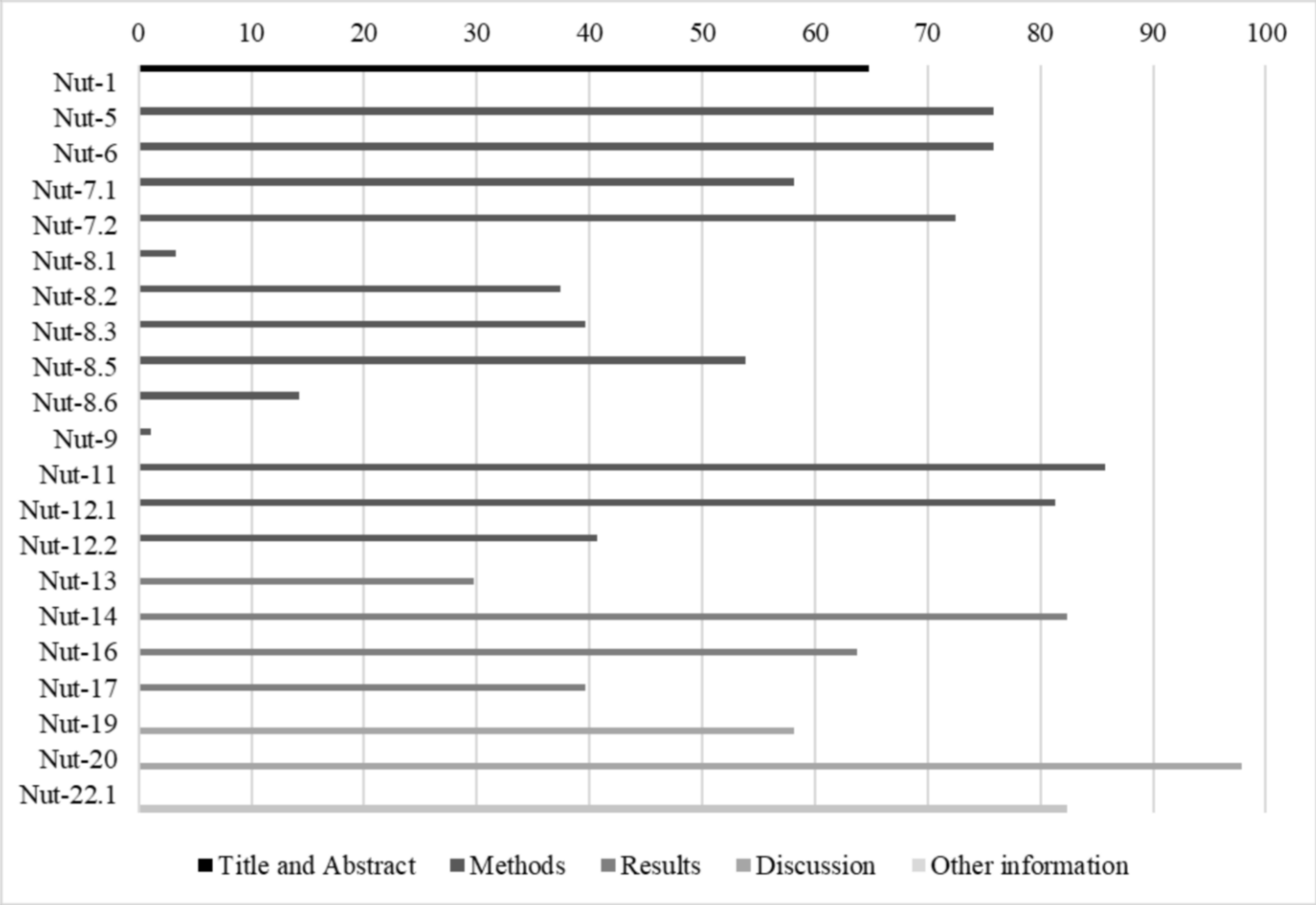
[#]Average (Minimum-Maximum).

References

1. Lachat C, Hawwash D, Ocké MC, et al. Strengthening the Reporting of Observational Studies in Epidemiology—Nutritional Epidemiology (STROBE-nut): An Extension of the STROBE Statement. *PLoS Med*. 2016;13(6). doi:10.1371/journal.pmed.1002036



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=91).

Apêndices

Apêndice A- Protocolo de registro no PROSPERO

PROSPERO
International prospective register of systematic reviews

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 5-32
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Line 44-51; 67-75
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Line 83-87
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Line 103-107
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 95-100
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Line 95-98
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 111-114
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 115-121

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 115-118
	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 115-119
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 120-121
	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 132-135
	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 248-252
	23b	Discuss any limitations of the evidence included in the review.	NA
	23c	Discuss any limitations of the review processes used.	Line 368-370
	23d	Discuss implications of the results for practice, policy, and future research.	Line 373-384
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 92-93
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	NA
	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 389-391
Competing interests	26	Declare any competing interests of review authors.	Line 392

Section and Topic	Item #	Checklist item	Location where item is reported
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Supplementary 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 (b) Describe any methods used to examine subgroups and interactions. (c) Explain how missing data were addressed. (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.	**nut-12.1** Describe any statistical method used to combine dietary or nutritional data, if applicable. **nut-12.2** Describe and justify the method for energy adjustments, intake modeling, and use of weighting factors, if applicable. **nut-12.3** Report any adjustments for measurement error, i.e,. from a validity or calibration study.	

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.	