Systematic review of diet quality indices and their associations with health-related outcomes in children and adolescents

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Abstract

Background: Diet quality indices add an important dimension to dietary assessment. The aim of this systematic review was to: a) identify and describe the attributes and applications of diet quality indices developed for use or used in paediatric populations; b) describe associations between these diet quality indices and health-related variables in paediatric populations; and c) identify factors that are associated with diet quality in paediatric populations worldwide. *Methods*: Studies were identified by searching electronic databases for relevant papers from 1980 to October 2013 using keywords. Inclusion criteria were original studies that utilised a quantitative measure of diet quality in children and adolescents aged 0 to 18 years. *Results*: One hundred and nineteen studies met the inclusion criteria, from which 80 different diet quality indices were identified. The majority of studies had >1000 participants and were of acceptable quality. Of the 56 studies that investigated health-related outcomes, weight status was the most researched. Europe produced the most number of diet quality indices (n=27 indices). Of the 119 studies, seven intervention studies were identified. Paediatric diet quality indices were found to be associated with environmental, behavioural and maternal factors. *Conclusion*: The use of diet quality indices in paediatric populations is a rapidly expanding area of research in diverse populations internationally. In economically disadvantaged countries, diet quality indices may be predictive of child growth. However, prospective cohort, intervention and validation studies are required to draw stronger conclusions concerning risk of future disease in paediatric populations in general.

Introduction

Assessment of diet quality is concerned with both the quality and variety of the holistic diet, rather than individual nutrients, and allows for evaluation of how closely eating patterns align with dietary recommendations. In adults, diet quality has been used to quantify risk of chronic conditions, including cardiovascular disease, some cancers, and total and disease specific mortality (Kimokoti & Millen, 2011; Wirt & Collins, 2009). Diet quality indices, or scores, are tools that provide an overall rating on a numeric scale, of an individual's dietary intake in reference to nutrient and/or dietary recommendations (Wirt & Collins, 2009). The development and application of these tools is expanding rapidly, as is the exploration of relationships between indicators of health and disease (Kourlaba & Panagiotakos, 2009; Roman-Vinas et al., 2009). To date most adult indices have been developed for epidemiological purposes, although their clinical application has been encouraged (Wirt & Collins, 2009). Despite this, their utility in paediatric populations worldwide their utility is relatively under studied.

The assessment of paediatric diet quality is of high interest, as food habits and behaviours that develop in childhood can track over time and predict adult diet-related disease (Craigie, Lake, Kelly, Adamson, & Mathers, 2011; E. Patterson, Kearney, & Sjöström, 2009). A number of paediatric diet quality indices have emerged such as the North American Youth Healthy Eating Index (YHEI) (Feskanich, Rockett, & Colditz, 2004) and the Revised Children's Diet Quality Index (RC-DQI) (Kranz, Findeis, & Shrestha, 2008), the Australian Child and Adolescent Recommended Foods Score (ACARFS) (Marshall, Watson, Burrows, Guest, & Collins, 2012) and the Greek Preschool Diet-Lifestyle Index (PEL-Index) (Manios et al., 2010). However, the examination of all reported paediatric diet quality indices including those in both developed and developing nations, their association with health-related outcomes, and a thorough exploration of factors associated with diet quality in children is incomplete. Two recent reviews have explored diet quality measures in paediatric populations from developed countries only. The review by Smithers et al.(Smithers, Golley, Brazionis, & Lynch, 2011) concluded that the use and application of diet quality indices, especially in regards to weight status in developed nations, had not been fully explored. A review by Lazarou & Newby (Chrystalleni Lazarou & Newby, 2011) also concluded that further research was required to gain a better understanding of paediatric diet quality and health-related outcomes. The current paper expands on information presented in these reviews by incorporating populations from developing countries, additional studies published after 2010 and a more thorough summary of the diet quality indices' attributes and uses. This systematic review intends to be a complete summary and reference guide for all paediatric diet quality indices published up to October 2013. The specific aims of this review were to: a) identify and describe the attributes and applications of diet quality indices developed for use or used in paediatric populations; b) describe associations between these diet quality indices and health-related variables in paediatric populations; and c) identify factors that are associated with diet quality in paediatric populations worldwide.

Methods

A systematic literature review of current evidence was conducted in reference to the PRISMA statement for reporting systematic reviews (Liberati et al., 2009).

Search strategy

Published English-language studies were searched using the electronic databases PubMed and CINAHL (via Ebscohost) for publications from January 1980 to 31 October 2013. The search strategy was conducted using the keywords:

(*pediatric* OR *child** OR *paed**) AND (*diet quality* OR *diet variety* OR *food variety* OR *diet* diversity*)

The search strategy was complemented by a "snowball" search, where retrieved papers had their reference lists hand searched to ensure that all relevant studies were identified. Variables and factors of interest included 1) Type of index (food or nutrient based), 2) diet quality index country of origin, 3) dietary method used by diet quality index, 4) purpose of diet quality index, 5) method of scoring, 6) age group appropriate for diet quality index, 7) health-related outcomes associated with a diet quality index, and 8) non-health related factors found to impact upon diet quality.

Inclusion criteria for types of participants were children and/or adolescents aged 0 to 18 years in any setting. If adults were part of the sample population, the studies were included but only results for those aged ≤18y were investigated. If the age range was not reported, samples were included if the mean age was 18.0y or less. Inclusion criteria for types of studies were methodological studies, cohort studies, cross-sectional, case-control or experimental studies (e.g. randomised controlled trials, pre-post trials). Abstracts and full texts were considered and studies were included only if they described the development, validation, application or evaluation of an assessment tool to quantitatively measure diet quality and/or variety and/or diversity. Exclusion criteria for participants were adult populations (>18y) and animal studies. Exclusion criteria for types of studies included review studies, non-English language publications, and studies that did not apply or describe a dietary scoring system. No exclusions were made based on variables of interest, for example otherwise eligible papers that did not report association with a health-related variable were included, so that a diet quality index may still be identified and described.

Selection of studies and data synthesis

A two-step screening process was employed. In step 1, one author scanned the titles and abstracts of studies identified by the search for their eligibility and duplicates were removed. At step 2, full-text articles were screened by one author for eligibility and were confirmed by a second author if eligibility was unclear. Data were extracted from the published papers into standardised tables by two authors. The study design and population were reported in tables only for studies that reported results for health-related variables. Health-related variables and non-health related factors that may impact upon diet quality were considered significant at the $P<0.05$ level and no exclusions were made for type of statistical approach. All variables of interest were reported in tables, excepting non-health related factors, which were described in text.

Review of study quality

Study methodological quality was assessed using the standardised critical appraisal instrument from the Joanna Briggs Institute (Schultz & Florence, 2007). Nine quality questions were classified as ‘yes’, ‘no’ or ‘unclear’ in relation to: adequacy of the study sample description, use of objective outcome measures, adequacy of follow-up, appropriate statistical analysis and consideration of confounding factors. Quality data were extracted into standardised tables by one investigator and checked for completeness and accuracy by a second.

Results

Three hundred and twenty-four full-text studies were identified and retrieved for evaluation against the inclusion criteria, 119 of which were included (Figure 1). Major reasons for exclusion were no use of a diet quality index (n=131) and a non-paediatric population (n=54). Of the 119 included studies, 80 different diet quality indices were identified that had been designed for use, or had been used, in paediatric populations. The sample size across studies ranged from nine to 165,111 and the majority had >1000 participants. Food frequency questionnaires and 24hr recalls were the most common dietary method; however some indices required multiple dietary methods to be used to derive a score, for example 24hr recall and diet history. The age group appropriate for the indices was not always specified (Table 1). Studies were more likely to be published after 2005 (n=89 studies) with 44 published from January 2010 and none before 1995. Fifty-six of the 119 included studies investigated associations between a diet quality index and health-related variables, using 40 of the 80 paediatric diet quality indices (online supporting material 1).

The majority of included studies were rated as acceptable study quality and utilised appropriate statistical approaches (data not shown) (Schultz & Florence, 2007). Many of the studies utilised the same dataset, for example data from the US Department of Agriculture Continuing Survey of Food Intakes by Individuals was used in seven studies (Beydoun & Wang, 2009; Goodwin et al., 2006; Griel, Eissenstat, Juturu, Hsieh, & Kris-Etherton, 2004; E. T. Kennedy, Ohls, Carlson, & Fleming, 1995; Knol, Haughton, & Fitzhugh, 2005; Kranz, Hartman, Siega-Riz, & Herring, 2006; Kranz, Siega-Riz, & Herring, 2004). There were only seven intervention studies, one of which was a pilot study (Alexy, Sichert-Hellert, Kersting, Lausen, & Schoch, 1999; Dixon, Tershakovec, McKenzie, & Shannon, 2000; Gittelsohn et al., 2010; Laster et al., 2013; Rauber, Hoffman, & Vitolo, 2013; Spence et al., 2013; Vitolo, Rauber, Campagnolo, Feldens, & Hoffman, 2010). The majority of the observational studies reported results cross-sectionally (online supporting material 1).

Table 1 describes the diet quality indices (n=80 total) and includes tools developed in North America (n=15), Europe (n=27), Asia-Pacific (n=17), Latin America (n=8), Africa (n=12) and one of unknown origin. Although an index was developed for a specific population, many have been subsequently used in diverse populations, with or without modifications. For example, several unevaluated modifications to the Health Eating Index (HEI) sub-scales were made for culturally diverse populations specific geographical locations, including Brazil (de Andrade et al., 2009; Vitolo et al., 2010), Spain (Royo-Bordonada et al., 2003) and for Native Hawaiians in the USA (Gittelsohn et al., 2010). In addition, many of the indices are updated or reappropriated versions of an original, for example the Diet Quality Index-International (DQI-I) (Kim, Haines, Siega-Riz, & Popkin, 2003) and the Mediterranean DQI-I (Mariscal-Arcas et al., 2007) were adapted from the original Diet Quality Index (DQI) (R. E. Patterson, Haines, & Popkin, 1994); and the Revised Children's Diet Quality Index (RC-DQI) (Kranz et al., 2006) was updated from the Children's Diet Quality Index (C-DQI) (Kranz et al., 2004).

The majority of the paediatric diet quality indices were designed to assess the dietary intake of populations for epidemiological purposes. However, there were 11 indices that were described by their authors as being able to be applied to the assessment of an individual's dietary intake. These include the YHEI (Feskanich et al., 2004), Healthy Nutrition Score for Kids & Youth (HuSKY) (Kleiser, Mensink, Scheidt-Nave, & Kurth, 2009), Recommended Food Group Change Score (RFS), Total Food Group Change Score (TFS) and Nutrient Improvement Score (NIS) (Alexy et al., 1999), the PDL-Index (Manios et al., 2010), the E-KINDEX (D. B. Lazarou, Panagiotakos, & Matalas, 2008), the Foods E-KINDEX (C. Lazarou, Panagiotakos, & Matalas, 2009a), the Mediterranean Diet Quality Index for Children & Adolescents (KIDMED) (Serra-Majem et al., 2004), the ACARFS (Marshall et al., 2012), and the Adolescent Micronutrient Quality Index (AMQI) (Chiplonkar & Tupe, 2010).

Diet quality indices in developing nations

With the exception of the Adolescent Micronutrient Quality Index (AQMI) and the Infant and Child Feeding Index (ICFI), paediatric diet quality in developing countries has been assessed using a range of dietary diversity scores or food variety scores (n=31 scores). As indices in developing nations have not been reviewed previously, a summary of their scoring and evaluation methodology has been detailed in table 2. These tools were generally not named nor developed to assess adherence to predetermined dietary recommendations, with the exception of the Cooking Pot Dietary Diversity Score (Enneman, Hernandez, Campos, Vossenaar, & Solomons, 2009). The scoring of these indices were based on the assumption that a diet with adequate variety of food groups or food items was more likely to be nutritionally adequate (Hatloy, Torheim, & Oshaug, 1998). A number of tools (Emond, Emmett, Steer, & Golding, 2010; Enneman et al., 2009; Mpontshane et al., 2008; Shatenstein, Abu-Shaaban, Pascual, & Kark, 1996) were designed or implemented with no assessment made of validity (Table 2). Food categories reported in these studies were often arbitrary, reflecting local judgement related to regional foods of importance (Mpontshane et al., 2008), and in some studies no explanation was given regarding food categorisation (Eckhardt, Suchindran, Gordon-Larsen, & Adair, 2005; Rah et al., 2010). Several diversity or variety scores (Cabalda, Rayco-Solon, & Solon, 2011; Daniels, Adair, Popkin, & Truong, 2009; G. L. Kennedy, Pedro, Seghieri, Nantel, & Brouwer, 2007; Steyn, Nel, Nantel, Kennedy, & Labadarios, 2006) were designed in reference to development guidelines

(Arimond, Cohen, Dewey, & Ruel, 2005; Dewey, Cohen, Arimond, & Ruel, 2006; G. Kennedy & Nantel, 2008).

Diet quality indices associated with health-related outcomes

Weight status was the most commonly measured health-related outcome (n=34 studies) in relation to a diet quality score (online supporting material 1), followed by height/length (n=17 studies). Serum biomarkers were examined in seven studies, pre-existing disease states in six, blood pressure in four and waist circumference in four. Diarrhoea and body composition were considered in three studies each; and infections were considered in two studies. Outcomes that were examined in only one study include dental caries, mental health, health-related quality of life, puberty and fever. No type of diet quality index or scoring approach was able to better predict or find a significant relationship with a health-related outcome. However, studies that utilised food based scores were more likely to test for associations with biomarkers and height/length, and food and nutrient based scores were more likely to test for associations with measures of adiposity.

Associations with weight status in populations at risk of over-nutrition were examined in 26 studies, with only eight finding a significant relationship (Chiplonkar & Tupe, 2010; Feskanich et al., 2004; R.K. Golley, Hendrie, & McNaughton, 2011; Jennings, Welch, van Sluijs, Griffin, & Cassidy, 2011; Kontogianni et al., 2010; Kranz et al., 2008; D. B. Lazarou et al., 2008; Manios et al., 2010; Mirmiran, Azadbakht, Esmaillzadeh, & Azizi, 2004; Vitolo et al., 2010). Generally, this relationship was inconsistent with studies finding negative and positive associations (online supporting material 1).

Poor diet quality was associated with earlier onset of puberty by 0.4y (*P*=0.02), an established risk factor for hormone-related cancers, all-cause mortality and insulin resistance (Cheng et al., 2010). Three studies found weak negative associations with diastolic blood pressure (R. K. Golley et al., 2013; C. Lazarou et al., 2009a; C. Lazarou, Panagiotakos, & Matalas, 2009b), however the study by Truthmann (Truthmann et al., 2012) found a weak positive association with diastolic blood pressure using the Indicator Food Index. Malnutrition (kwashiorkor/marasmus) was not associated with diet diversity (Lin et al., 2007; Sullivan, Ndekha, Maker, Hotz, & Manary, 2006). Cross-sectionally, the pre-existing disease state of human immunodeficiency virus infection had a negative association with diet quality, as did autism in two studies; however no association with autism or developmental delay was found in a later study (Emond et al., 2010; Graf-Myles et al., 2013; Mpontshane et al., 2008; Zimmer et al., 2012). No association with poor mental health (internalising disorder) was found in adolescents (McMartin, Kuhle, Colman, Kirk, & Veugelers, 2012).

In developing nations where risk of under-nutrition rather than over-nutrition was the major concern, diet quality indices were found to be positively associated with measures of child growth in 14 studies

(Arimond & Ruel, 2004; Benefice, Monroy, Jimenez, & Lopez, 2006; Bork, Cames, Barigou, Cournil, & Diallo, 2012; Chiplonkar & Tupe, 2010; Darapheak, Takano, Kizuki, Nakamura, & Seino, 2013; Eckhardt et al., 2005; G. L. Kennedy et al., 2007; Mirmiran et al., 2004; Moursi, Treche, Martin-Prevel, Maire, & Delpeuch, 2009; Rah et al., 2010; Ruel & Menon, 2002; Saibul et al., 2009; Sawadogo et al., 2006; Zhang, Shi, Wang, & Wang, 2009), though some studies reported no association. Furthermore, if the child experienced diarrhoea at the time of assessment they were more likely to report poor diet diversity (Rah et al., 2010; Zhang et al., 2009).

Factors associated with diet quality

Several demographic factors were found to be associated with diet quality, these included socio-economic status (SES) (de Andrade et al., 2009; R.K. Golley et al., 2011; Kleiser, Mensink, Neuhauser, Schenk, & Kurth, 2010; Kranz et al., 2008; Serra-Majem et al., 2004; Torheim et al., 2004), age (de Andrade et al., 2009; R.K. Golley et al., 2011; Kleiser et al., 2010; Kleiser et al., 2009; Kranz et al., 2008; Torheim et al., 2004), sex (Kleiser et al., 2010; Kleiser et al., 2009), ethnic or migration background (Kleiser et al., 2010; Kleiser et al., 2009; Kranz et al., 2008), geographical location (Darapheak et al., 2013; Serra-Majem et al., 2004; Simen-Kapeu, Kuhle, & Veugelers, 2010) and the degree of urbanisation (Kleiser et al., 2010; Serra-Majem et al., 2004).

Multiple behaviours were also found to impact upon diet quality in children and adolescents, including beverage patterns (LaRowe, Moeller, & Adams, 2007), portion sizes (Colapinto, Fitzgerald, Taper, & Veugelers, 2007), dieting due to weight concerns, the frequency of family dinners (Veugelers, Fitzgerald, & Johnston, 2005; Woodruff, Hanning, McGoldrick, & Brown, 2010), eating in front of the television as well as television viewing in general (Liang, Kuhle, & Veugelers, 2009; Simen-Kapeu et al., 2010; Sisson, Shay, Broyles, & Leyva, 2012; Veugelers et al., 2005), and meal skipping (Veugelers et al., 2005; Woodruff & Hanning, 2009; Woodruff, Hanning, Lambraki, Storey, & McCargar, 2008; Woodruff et al., 2010). Low diet quality was also found to be associated with increased likelihood of behavioural and emotional symptoms in children (Kohlboeck et al., 2012). Specific eating environments were found to impact adversely on diet quality, such as purchasing or consuming meals outside the home, rather than eating food prepared at home from grocery store ingredients (Veugelers et al., 2005; Woodruff & Hanning, 2009). Florence *et al.* (Florence, Asbridge, & Veugelers, 2008) and Golley *et al.* (R. K. Golley et al., 2013) identified that diet quality was a predictor of academic performance and intelligence, however the association was weakened when considering maternal intelligence as a confounder.

Maternal education and employment and parental diet quality was positively associated with the child's diet quality, and providing maternal education in regard to their children's dietary intake from birth significantly improved the child's diet quality at age 3-4y but not at 7-8y (Beydoun & Wang, 2009; Darapheak et al., 2013; Laster et al., 2013; Manios et al., 2009; Rauber et al., 2013; Vitolo et al., 2010). However, mothers were found to significantly overestimate child diet quality, and maternal healthy eating knowledge was not predictive of child diet quality, but rather the mothers' ability to translate that knowledge into behaviours such restricting sweet food intake (OR = 21.63, 95% CI 2.70, 173.30) or promoting fruit consumption (OR = 52.94, 95% CI 1.09, 7.95) (Crombie et al., 2009; Kourlaba, Kondaki, Grammatikaki, Roma-Giannikou, & Manios, 2009).

Discussion

This systematic review provides a comprehensive summary of the diet quality indices that have been developed internationally to assess the overall healthfulness of dietary intakes in children and adolescents. The use of diet quality indices in paediatric populations is increasing internationally in highly diverse populations.

Significant variation existed in how indices were calculated. Methods where a score could be directly calculated from the dietary assessment method, such as simple addition or awarding of points, have less participant and researcher burden. The low burden indices may be used within a clinical or fieldwork setting, where they are able provide immediate client feedback. Examples of these low burden scores include the KIDMED or ACARFS in developed nations, and all diet variety or diversity scores in developing nations. In contrast, indices that require intensive dietary assessment or additional analysis before a final score could be derived have a higher participant and researcher burden. In some cases, such as nutrient-derived scores, these analysis are complex, requiring multiple mathematical models, making these scores only applicable for group-level research, for example the HEI and Nutrient Rich Foods 9.3. Interestingly, the wide variation observed in scoring methodology and type of diet quality index did not impact upon an indices ability to predict health-related outcomes.

Continental trends were observed in the type of scoring method. Diet quality indices developed in Europe were predominantly food based, and include a number of simpler diet variety or diet diversity scores. Alternatively, North American derived diet quality indices were largely food and nutrient based scores requiring nutrient analysis for calculation. The dietary methods and scoring for diet quality indices in developing nations were found to be more simplistic when compared with developed nations overall. This may be because application in these countries needs to be less time and resource intensive due to the fieldwork setting, and applicable to populations where food is often shared communally (Hatloy et al., 1998). Overall, diet variety and diversity scores appear to predict positive child growth, and have previously been reported as sensitive indicators of food insecurity in developing countries, with an independent relationship between dietary diversity and dietary quality shown in some studies (Arimond & Ruel, 2004; Ruel, 2003).

Determining the association between diet quality indices and health-related outcomes in children and adolescents is an important method of evaluating the usefulness of a diet quality index for particular settings. The associations are principally cross-sectional in nature and therefore diet quality indices should not yet be used to determine risk of disease. The conflicting associations with weight status in developed nations may be due to poor study design, for example, only one study considered the confounding effect of physical activity (Lazarou *et al.*, 2010). Beyond body weight, the relationship between diet quality and health outcomes has not been extensively examined in the published literature, with studies often only evaluating a single health-related variable at one time-point. This may be due to paediatric diet quality indices being a new area of research, where many sample populations have been derived from ongoing larger studies and therefore not designed for the purpose of examining diet quality and health. Additionally, selecting appropriate health and disease outcomes is more challenging in paediatric populations compared to adults.

Limitations and recommendations for further research

This review may be limited by publication bias and relevant studies may have been missed if they did not report the examination of diet quality, diet variety, diet diversity or food variety in the title, abstract or keywords. Only two electronic databases were used, however the two selected are the most relevant to the nutrition sciences and were supported by a thorough snowball search of citations. The body of research identified in this review is limited by its observational and cross-sectional nature. Although several studies have used diet quality indices as outcome measures in intervention studies, no intervention studies have examined how paediatric diet quality indices may be used to improve the health of the paediatric populations, such as using self-assessment and feedback.

The overall paediatric diet quality research is limited by very few indices being supported by validation studies or evaluation in regards to nutritional adequacy. Although the methodologies of many indices are based on sound principles, such as adherence to dietary guidelines, conclusions about their results should be interpreted with caution as scores may not correlate beneficially with nutrient intakes or health outcomes of interest. Indices that have been shown to be associated with nutrient intakes, nutrient biomarkers and with internal validity and/or reliability studies lend more confidence to their results. In addition, diet quality scores identified that were not developed specifically for children, such as the DQI, should also be interpreted with caution. Future diet quality studies in children and adolescents should utilise tools developed specifically for paediatric populations with consideration given to the purpose of the index. Importantly, these tools should be supported by validation studies.

Due to the limitations in the existing body of knowledge, key areas for future research have been identified. Cohort studies that evaluate the relationship between paediatric diet quality and risk factors for adult chronic conditions, such as blood pressure and plasma lipids, are needed. Clarity is required for association between diet quality indices and weight status in developed nations, where studies should employ several measures of anthropometry and use multivariate statistical models with all confounding variables considered. Examination between parent and child diet quality would complement research into chronic disease risk and provide evidence for more relevant recommendations and policies. Intervention studies in the clinical setting will extend paediatric diet quality index research beyond its established role in epidemiology.

Conclusion

The use of diet quality indices in paediatric populations is a rapidly expanding area of research in diverse populations internationally. Diet quality indices in paediatric populations have an established role in observational research and epidemiology and an emerging role in clinical application and intervention studies. Food behaviours and environmental and maternal influences impact upon a child or adolescents' diet quality, and therefore future disease risk. In economically disadvantaged countries, diet quality indices may be predictive of child growth. However, prospective cohort, intervention and validation studies are required to draw stronger conclusions concerning risk of future disease in paediatric populations in general.

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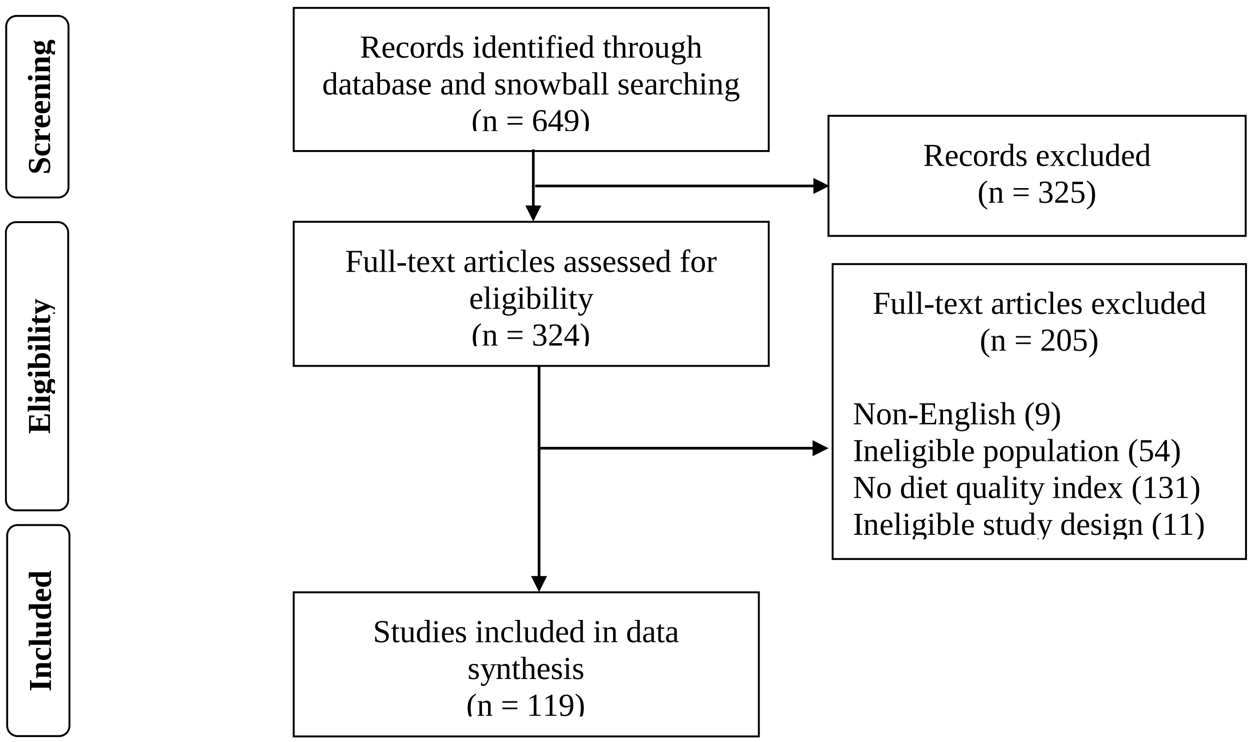

Figure 1: Study flow diagram for selection of studies

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Table 1: Description and purpose of diet quality indices which have been designed for use or used in paediatric populations (n=80 indices)

	Index & original author	Type of index	Country of origin	Dietary method	Purpose	Scoring	Age group
1	Healthy Eating Index (HEI); Kennedy *et al.* (1995)	Food & nutrient	USA	1) 24h recall & food diary/ record, 2) FFQ, 3) 24h recall, 4) Food diary/ record	Reflects adherence to the Dietary Guidelines for Americans & the USDA Food Guide Pyramid (1992)	10 components, scored 0 – 100, calculated by nutrient analysis	≥2y
2	Healthy Eating Index-2005 (HEI-2005); Britten *et al.* (2006), Guenther *et al*. (2008)	Food & nutrient	USA	1) 24h recall, 2) food diary/record	Reflects adherence to the 2005 MyPyramid Food Guidance System	12 components, scored 0 – 100, calculated by nutrient analysis	2 – 18y
3	Youth Healthy Eating Index (YHEI); Feskanich *et al.* (2004)	Food & behaviour	USA	1) FFQ	Reflects adherence to the Dietary Guidelines for Americans	13 components, scored 0 – 100, points awarded & summed	Not specified
4	Canadian Healthy Eating Index (HEI-C); Glanville *et al.* (2006)	Food & nutrient	Canada	1) 24h recall, 2) 24h recall & FFQ	Reflects adherence to the 1993 Canada's Good Guide to Healthy Eating & 1990 Canadian Nutrient Recommendations	9 components, scored 0 – 100, calculated by nutrient analysis & servings	≥3y
5	Canadian Health Eating Index-2009 (HEIC-2009); Woodruff *et al.* (2010a)	Food & nutrient	Canada	1) 24h recall & FFQ	Reflects adherence to the 2007 Eating Well with Canada's Food Guide	9 components, scored 0-100, calculated by nutrient analysis & servings	≥3y
6	Alternative Health Eating Index (AHEI); McCullough *et al*. (2002)	Food & nutrient	USA	1) FFQ	Reflects dietary patterns to lower risk of chronic disease	9 components, scored 2.5-87.5, calculated by nutrient analysis & servings	Designed for adults, used in children
7	Diet Quality Index (DQI); Patterson *et al.* (1994)	Food & nutrient	USA	1) 24h recall, 2) 24h recall & food diary/ record	Reflects adherence to the 1989 Recommended Dietary Allowances	8 components, scored 0 – 16, points awarded & summed	Designed for adults, used in children
8	Diet Quality Index-International (DQI-I); Kim *et al.* (2003)	Food & nutrient	Designed in USA to be of international use	1) FFQ, 2) 24h recall & FFQ	Reflects worldwide (WHO, USA & China) adherence to dietary food & nutrient recommendations	4 major components with sub-components, scored 0 – 100, calculated by nutrient analysis & servings	Not specified
9	Children's Diet Quality Index (C-DQI); Kranz *et al.* (2004)	Food & nutrient	USA	1) 24h recall	Reflects adherence to the 1998 Food Guide Pyramid for 2 – 6yr old for components relevant to public health	8 components, scored 0 – 70, calculated by nutrient analysis & servings	2 – 5y

10	Revised Children's Diet Quality Index (RC-DQI); Kranz *et al.* (2006)	Food, nutrient & behaviour	USA	1) 24h recall, 2) Food diary/record	Reflects adequacy of nutrients & food group intakes which are of a public health concern	13 components, scored 0 – 95, calculated by nutrient analysis & servings	2 – 18y
11	Food Variety Index for Toddlers (VIT); Cox *et al.* (1997)	Food	USA	1) 24h recall & food diary/record; 2) Food diary/record	Reflects meeting the minimum requirement of the 1992 Food Guide Pyramid food groups.	5 components considered, scored 0.00 – 1.00, food items summed & truncated at 33%	Toddlers
12	Grain, Fruit, Vegetables, Dairy & Mild (GFVDM) Variety Score; Falciglia *et al.* (2004)	Food	USA	1) 24h recall	Reflects adherence to the 1992 Food Guide Pyramid food groups	5 food categories, servings summed	Not specified
13	Grain, Fruit & Vegetable (GFV) Variety Score; Falciglia *et al.* (2004)	Food	USA	1) 24h recall	Reflects the 2000 Dietary Guidelines for variety	3 food categories, servings summed	Not specified
14	Nutrient Rich Foods (NRF) 9.3; Fulgoni *et al.* (2009)	Nutrient	USA	1) 24h recall	Reflects nutritional adequacy	12 nutrients, scored <0 to 100, calculated via nutrient analysis	4y - adult
15	Food Variety (FV) Score; Zimmer *et al.* (2011)	Food	USA	1) FFQ	Reflects food variety	174 food items, scored 0-175, serves summed	Children
16	Diet Quality Index for Preschool Children (DQI-CH); (Huybrechts *et al.* (2010)	Food & behaviour	Belgium	1) Food diary/record or FFQ	Reflects compliance with Flemish Food-Based Dietary Guidelines	4 components, scored -25 – 100%, calculated as percentage of food group intakes	2 – 6y
17	Excess Index; Sabbe *et al.* (2008)	Food	Belgium	1) FFQ, 2) FFQ & food diary/record	Reflects weekly consumption of sugar- &/or fat-containing products	Number of items not specified, scored 7 – 35, servings summed	Not specified
18	Daily Diversity Index (DDI); Sabbe *et al.* (2008)	Food	Belgium	1) FFQ	Reflects adherence to the 2000 American Food Guide Pyramid	5 components, scored 0 – 5, points awarded & summed	Not specified
19	Variety Index; Vereecken *et al.* (2008)	Food	Belgium & Italy	1) FFQ & food diary/record	Reflects consumption of various food items	7 components, scoring not specified	Not specified
20	Fruit & Vegetable Index (FV Index); Vereecken *et al.* (2008)	Food	Belgium & Italy	1) FFQ & food diary/record	Reflects consumption of fruit & vegetable intake	No components specified, scoring not specified	Not specified
21	Fiber Index; Vereecken *et al.* (2008)	Food	Belgium & Italy	1) FFQ & food diary/record	Reflects consumption of the fibre rich food groups fruit, vegetables & brown bread	No components specified, scoring not specified	Not specified
22	Calcium Index (Ca-Index); Vereecken *et al.* (2008)	Food	Belgium & Italy	1) FFQ & food diary/record	Reflects consumption of dairy items	4 components, scoring not specified	Not specified
23	Healthy Diet Indicator (HDI); Huijbregts *et al.* (1997)	Food & nutrient	Finland, Italy & Netherlands	1) Diet history, 2) food diary/record	Reflects WHO guidelines to prevent chronic disease	9 components, scored 0 – 9, points awarded & summed	Designed for adults,

							used in children
24	Food-Variety Score (FVS); Emond *et al.* (2010)	Food	England	1) FFQ	Reflects variety of foods consumed in a given FFQ	56 food items, scored 0 – 56, points awarded & summed	Not specified
25	Complementary Feeding Utility Index (CFUI); Golley *et al*. (2012)	Food & behaviour	England	1) FFQ & independent questionnaire	Reflects adherence to commentary feeding guidelines in Australia, NZ, USA and UK	14 components, scored 0-1, calculated by summing of probability functions	Infants & toddlers
26	Healthy Food Diversity (HFD) - Index; Drescher *et al*. (2007)	Food	Germany	1) FFQ, 2) diet history	Reflects diversity & adherence to the Dietary Guidelines for an OMD for Adults	18 categories, scored 0 – 1/1-n, calculated by summing health factors	Designed for adults, used in adolesce-ents
27	Healthy Nutrition Score for Kids & Youth (HuSKY); Kleiser *et al.* (2009)	Food	Germany	1) FFQ	Reflects adherence to the Dietary Guidelines for an OMD for Children & Adolescents	11 components, scored 0 – 100, calculated as ratio of food group intakes	3 – 17y
28	Indicator Food Index (IDI); Kleiser *et al.* (2007)ᶲ	Food	Germany	1) FFQ	Reflects adherence to the Dietary Guidelines for an OMD for Children & Adolescents	7 food groups, scored 0 – 14, points awarded & summed	Children & Adole-scents
29	Recommended Food Group Change Score (RFS); Alexy *et al.* (1999)	Food	Germany	1) Food diary/ record	Reflects average change in amounts of deviation from the OMD food groups based on individualised recommendations	Number of components change depending on individualised recommendations, scored as a negative or positive percentage of change, servings summed	Not specified
30	Total Food Group Change Score (TFS); Alexy *et al.* (1999)	Food	Germany	1) Food diary/ record	Reflects average change in amounts of deviation from all OMD food groups	11components, scored as a negative or positive percentage of change, servings summed	Not specified
31	Nutrient Improvement Score (NIS); Alexy *et al.* (1999)	Nutrient	Germany	1) Food diary/ record	Reflects average change in dietary intake of German reference values for nutrient intakes	16 components, scored as a '-' or '+' percentage of change, scored by nutrient analysis	Not specified
32	Nutrition Quality Index (NQI) Gedrich *et al.* (2001)*	Nutrient	Germany	1) Food diary/ record	Reflects adequacy as compared the 2002 German, Austrian & Swiss Dietary Reference Values	13 - 17 components, scored 0 – 100, calculated by nutrient analysis	Not specified
33	Diet Quality Score; Kohlboeck *et al*. (2012)	Food	Germany	1) FFQ	Reflects adherence to the OMD food groups based	11 components, scored 0-11, points awarded & summed	Children
34	Mediterranean Diet Score (MDS); Trichopoulou *et al*. 1995	Food & nutrient	Greece	1) FFQ, 2) food diary/record	Reflects adherence to the Mediterranean dietary pattern	8 components, scored 0 – 8, points awarded & summed	Designed for adults,

							used in children
35	Preschool Diet-Lifestyle Index (PDL-Index); Manios *et al.* (2010)	Food & behaviour	Greece	1) 24h recall & food diary/ record	Reflects adherence to American & Canadian diet & physical activity guidelines for pre-schoolers	11components, scored 0 – 44, points awarded & summed	2 – 5y
36	Unhealthy Food Choices Score (UFCS); Yannakoulia *et al.* (2004)	Food	Greece	1) FFQ	Reflects adherence to a number of Greek & international recommendations	9 categories, scored 9 – 45, negative & positive points awarded & summed	11 – 15y
37	E-KINDEX; Lazarou *et al.* (2008)	Food & behaviour	Greece	Unclear	Reflects risk of being overweight or obese.	Composed of 3 indices with a total of 30 components, scored 1 – 87	Not specified
38	Foods E-KINDEX; Lazarou *et al.* (2009a)	Food & behaviour	Cyprus	1) FFQ	Score is one index used in the calculation of the E-KINDEX	13 components, scored 0 – 37, unspecified scoring method	Not specified
39	Diet Quality Score; Crombie *et al.*,(2009)	Food	Scotland	Unclear	Reflects adherence to the Caroline Walker Trust recommendations for under 5s	5 components, dichotomous scoring for each component summed	2 – 5y
40	Diet Variety Index (DVI); Royo-Bordonada *et al.* (2003b)	Food	Spain	1) FFQ	Indicates diet variety	75food items, scored 0 – 75, servings summed	Not specified
41	Mediterranean Diet Quality Index International (Med DQI-I); Mariscal-Arcas *et al.* (2007)	Food & nutrient	Spain	1) 24h recall & FFQ	Reflects worldwide (WHO, USA & China) adherence to dietary food & nutrient recommendations with specific Mediterranean adaptations	4 major components each with sub-components, scored 0 – 100, calculated by nutrient analysis	Not specified
42	Mediterranean Diet Quality Index for children & adolescents (KIDMED); Serra-Majem *et al.* (2004)	Food & behaviour	Spain	1) 24h recall & FFQ, 2) independent questionnaire, 3) FFQ & independent questionnaire, 4) 24h recall	Reflects adherence to the Mediterranean Diet Model	16 components, scored 0 – 12, points awarded & summed	Not specified
43	Dietary Guideline Index for Children & Adolescents DGI-CA; Golley *et al.* (2011)	Food	Australia	1) 24h recall	Reflects adherence to the 2003 Australian Dietary Guidelines for Children & Adolescents & 1998 Australian Guide to Healthy Eating	11 components, scored 0 – 100, calculation by nutrient analysis	Not specified
44	Australian Child & Adolescent Recommended Food Score (ACARFS); Marshall *et al.* (2012)	Food	Australia	1) FFQ	Reflects adherence to the 2003 Australian Dietary Guidelines for Children & Adolescents	8 components, scored 0 – 73, points awarded & summed	6 – 14y
45	Diet Quality Index; Li *et al.* (2012)	Food & nutrient	Australia	1) FFQ	Reflects adherence to the Australian Guide to Healthy Eating and Nutrient Reference Values for Australia & NZ	12 components, scored 20-150,	Adolesc-ents

46	Core Food Variety Score (CFVS); Scott *et al.* (2012)	Food	Australia	1) 24h recall	Reflects adherence to the Australian Guide to Healthy Eating	6 food groups, scored 0-34, points awarded & summed	Toddlers
47	Fruit and Vegetable Variety Score (FVVS); Scott *et al.* (2012)	Food	Australia	1) 24h recall	Reflects adherence to the Australian Guide to Healthy Eating	6 food groups, scored 0-16, points awarded & summed	Toddlers
48	Obesity Protective Dietary Index (OPDI); Spence *et al.* (2013)	Food	Australia	1) 24h recall	Reflects adherence to a non-obesogenic diet	3 food groups, scored 0 – 30, unspecified scoring method	Infants
49	Adolescent Micronutrient Quality Index (AMQI); Chiplonkar *et al.* (2010)	Food	India	1) 24h recall	Reflects adherence to the 2005 Dietary Guidelines for Indians & the 2005 Dietary Guidelines for Americans	13 components, scored 0 – 100, points awarded & summed, unspecified scoring method	Adolesc-ents
50	Diet Variety Score (DV Score) Mendez (2000)†	Food	Philippines	1) Independent questionnaire	Indicates diet variety	8 components, scored 0 – 8, servings summed	Not specified
51	Dietary Diversity Score (DDS); Kennedy *et al.* (2007)	Food	Philippians	1) 24h recall, 2) FFQ	Indicates diet diversity in adherence with development & analysis guidelines for developing countries (Arimond *et al.*, 2005; Kennedy & Nantel 2006)	10 components, scored 1 – 9, servings summed	Non-breastfed infants
52	Dietary Diversity Score 10g (DDS 10g); Kennedy *et al.* (2007)	Food	Philippians	1) 24h recall, 2) FFQ	Indicates diet diversity in adherence with development & analysis guidelines for developing countries Arimond *et al.*, 2005; Kennedy & Nantel 2006)	10 components, scored 1 – 9, servings summed	Non-breastfed infants
53	Food Variety Score (FVS); Saibul *et al.* (2009)	Food	Malaysia	1) 24h recall	Indicates diet variety	69 food items, scored 0 – 69, servings summed	Not specified
54	Food Variety Score (FVS); Darapheak *et al.* (2013)	Food	Cambodia	1) 24h recall	Indicates diet diversity	7 components, scored 0-9, servings summed	Infants & toddlers
55	Dietary Diversity Score (DDS); Rah *et al.* (2010)	Food	Bangladesh	1) FFQ	Indicates diet diversity	9 components, scored 0 – 63, servings summed	<5y
56	Dietary Diversity Score (DDS); Rani *et al.* (2010)	Food	India	1) 24h recall	Indicates diet diversity	13 components, scored 0 – 13, servings summed	Designed for adults, used in children
57	Food Variety Score (FVS) (Rani *et al.*, 2010) 2010	Food	India	1) 24h recall	Indicates diet diversity	13 components, scored 0 – 78, servings summed	Designed for adults, used in children

58	Dietary Diversity Score (DDS); Mirmiran *et al.* (2004)	Food	Iran	1) 24r recall	Indicates diet diversity	5 components with 27 sub-components, scored 0 – 10, points awarded & summed	≥10y
59	Dietary Diversity Score (DDS); Shatenstein *et al.* (1996)	Food	Gaza Strip	1) FFQ	Indicates diet diversity	4 components, scored 0 – 4, points awarded & summed	12 – 17y
60	Infant & Child Feeding Index (ICFI); Ruel *et al.* (2002)	Food & behaviour	Designed in the USA for use in Latin America	1) 24h recall & FFQ, 2) 24h recall, 3) 7d recall	Reflects adequacy of the 1998 WHO & the 1999 Academy of Educational Development complementary feeding recommendations	5 components, scored 0 – 12, points awarded & summed	6 – 36m
61	Dietary Diversity Indicator; Arimond *et al.* (2004)	Food	Designed in the USA for use in Southeast Asia, Latin America & Africa	1) 7d recall, 2) FFQ	Indicates diet diversity	7 components, scored 0 – 7, points awarded & summed	Infants
62	Food Diversity Index (FDI); Benefice *et al.* (2006)	Food	Bolivia	1) 24h recall & FFQ	Indicates diet diversity	4 components, scored 0 – 19, servings summed	Paediatrics & adults
63	Traditional Food Diversity Score (TFDS); Roche *et al.* (2008)	Food	Peru	1) 24h recall	Indicates diet diversity	No components specified, no scoring limit, servings summed	Paediatrics & adults
64	1 & 3day Food Variety Score (FVS); Enneman *et al.* (2009)	Food	Guatemala	1) 24h recall	Indicates diet diversity	No components specified, no scoring limit, servings summed	Infants
65	USAID Dietary Diversity Score (DDS); Enneman *et al.* (2009)	Food	Guatemala	1) 24h recall	Indicates diet diversity in adherence with USAID guidelines (Dewey *et al.*, 2006)	8 components, scored 0 – 8, servings summed	Infants
66	Cooking Pot Dietary Diversity Score (DDS); Enneman *et al.* (2009)	Food	Guatemala	1) 24h recall	Indicates diet diversity in adherence with the Guatemalan dietary guide translated	6 components, scored 0 – 6, servings summed	Infants
67	INCAP Papers Dietary Diversity Score (DDS); Enneman *et al.* (2009)	Food	Guatemala	1) 24h recall	Indicates diet diversity in adherence with INCAP protocol (Bermudez *et al.*, 2008)	25 components, scored 0 – 25, servings summed	Infants
68	Dietary Diversity Score (DDS8); Moursi *et al.* (2008a)	Food	Madagascar	1) 24h recall	Indicates diet diversity in adherence with development & analysis guidelines for developing countries (Arimond *et al.*, 2005)	8 components, scored 0 – 8, points awarded & summed	Infants aged ≥6m

69	Dietary Diversity Score (DDS8-R); Moursi *et al.* (2008a)	Food	Madagascar	1) 24h recall	Indicates diet diversity in adherence with development & analysis guidelines for developing countries (Arimond *et al.*, 2005)	8 components, scored 0 – 8, points awarded & summed	Infants aged ≥6m
70	Dietary Diversity Score (DDS7); Moursi *et al.* (2008a)	Food	Madagascar	1) 24h recall	Indicates diet diversity in adherence with development & analysis guidelines for developing countries (Arimond *et al.*, 2005)	7 components, scored 0 – 7, points awarded & summed	Infants aged ≥6m
71	Dietary Diversity Score (DDS7-R); Moursi *et al.* (2008a)	Food	Madagascar	1) 24h recall	Indicates diet diversity in adherence with development & analysis guidelines for developing countries (Arimond *et al.*, 2005)	7 components, scored 0 – 7, points awarded & summed	Infants aged ≥6m
72	Diet Diversity Score (DDS); Mpontshane *et al.* (2008)	Food	South Africa	1) Diet history & food diary/ record	Indicates diet diversity	8 components, scored 0 – 100%, scored as a percentage of servings	Infants aged ≥6m
73	Dietary Diversity Score (DDS); Hatloy *et al.* (1998)	Food	Designed in Norway to be of use in economically poor countries, such as Mali	1) Food diary/ record	Indicates diet diversity	8 components, scored 0 – 8, points awarded & summed	13 – 58m
74	Food Variety Score (FVS); Hatloy *et al.* (1998)	Food	Designed in Norway, used in economically poor countries	1) Food diary/ record, 2) FFQ	Indicates diet diversity	No components specified, no scoring limit, servings summed	≥13m to adults
75	Dietary Diversity Score (DDS); Torheim *et al.* (2004)	Food	Designed in Norway, used in economically poor countries	1) FFQ	Indicates diet diversity	10 components, scored 0 – 10, points awarded & summed	≥15y to adults
76	Dietary Diversity Score (DDS); Steyn *et al.* (2006)	Food	South Africa	1) 24h recall	Indicates diet diversity	9 components, scored 0 – 9, points awarded & summed	1 – 8y
77	Food Variety Score (FVS); Steyn *et al.* (2006)	Food	South Africa	1) 24h recall	Indicates diet diversity	No components specified, scored 0 – 45, servings summed	1 – 8y
78	Dietary Adequacy Score (DAS); Guthrie *et al.* (1981)‡	Food	Unknown	1) 24h recall; 2) FFQ	Reflects adequacy of Recommended Dietary Allowances for an unknown population	4 components, scored 0 – 16, points awarded & summed	Not specified
79	Dietary Diversity Index (DDI); Bork *et al.* (2013)	Food	Senegal	1) 24h recall	Indicates diet diversity	7 components, scored 0-7, points awarded & summed	Infants & toddlers

80	Food Variety Index (FVI); Bork *et al.* (2013)	Food	Senegal	1) 24h recall	Indicates food variety	20 components, scored 0-21, servings summed	Infants & toddlers

d, day; FFQ, food frequency questionnaire; g, gram; h, hour; INCAP, Institute of Nutrition of Central America & Panama; m, month; OMD, optimised mixed diet; NZ, New Zealand; UK, United Kingdom; USA, United States of America; USAID, United States Agency for International Development; USDA, United States Department of Agriculture; WHO, World Health Organisation; y, year.

ɸ Kleiser *et al*. (2007) are cited as the original authors of the IFI by Truthmann *et al.* (2012) however the paper was not available in English.

* Gedrich & Karg (2001) are cited as the original authors of the NQI by Libuda et al. (2009) & Cheng et al. (2010) however the paper was not available for review.

†Mendez (2000) is cited as the original author of the DV Score by Eckhardt et al (2005) however the thesis was not available for review.

‡ Guthrie & Scheer (1981) are cited as the original authors for the DAS by Shatenstein et al. (1996) however the paper was not available for review.

Table 2: Scoring methodology and evaluation method of diet diversity scores (DDS) and food variety scores (FVS) which have been used in paediatric populations of developing countries (n=31 indices)

Index & author	Scoring method	Evaluation
Diet Variety Score (DV score); Mendez (2000)	Scored 0 – 8.One point awarded for consuming one food from each of eight food categories: fish, animal sourced foods, staple cereals, other starches, vegetables, fruit, beans & nuts, dairy.	Nutrient adequacy
Diet Diversity Score (DDS); Kennedy *et al.* (2007)*	Scored 0 - 10. One point awarded for consuming at least one food from each of 10 food categories: cereals & tubers; meat, poultry & fish; dairy; eggs; pulses & nuts; vitamin A rich fruit & vegetables; other fruit; other vegetables; & oils & fats; & other.	Nutrient adequacy
Diet Diversity Score 10g (DDS 10g); Kennedy *et al.* (2007)	Scored 1 - 10. One point awarded for consuming at least 10g of food from each of 10 food categories: cereals & tubers; meat, poultry & fish; dairy; eggs; pulses & nuts; vitamin A rich fruit & vegetables; other fruit; other vegetables; oils & fats (10g minimum not applied); & other.	Nutrient adequacy
Food Variety Score (FVS); Saibul *et al.* (2009)	Scored 0 – 69. One point awarded for consuming each of 69 food items.	Energy adequacy
Food Variety Score (FVS); Emond *et al.* (2010)	Scored 0 – 56. One point awarded for never consuming each of 56 food items.	Nil
Diet Diversity Score (DDS); Rah *et al.* (2010)	Scored 0 – 63. One point awarded for consuming, over a week, a food from nine food groups: rice, lentils, green leafy vegetables, yellow/orange fruit, eggs, fish, chicken, meat & milk.	Growth
Dietary Diversity Score (DDS); Rani *et al.* (2010)	Scored 0 – 13. One point awarded for consuming a food from each 13 food categories: starchy staples, legumes & nuts, dairy, other fruit & vegetables, vitamin C rich fruit, vitamin C rich vegetables, vitamin A rich dark green leafy vegetables, vitamin A rich deep yellow, orange & red vegetables, organ meats, eggs, small fish eaten whole with bones, other flesh foods & miscellaneous animal protein.	Nutrient adequacy
Food Variety Score (FVS); Rani *et al* (2010)	Scored 0 – 78. One point awarded for consuming each food item from each 13 food categories: starchy staples, legumes & nuts, dairy, other fruit & vegetables, vitamin C rich fruit, vitamin C rich vegetables, vitamin A rich dark green leafy vegetables, vitamin A rich deep yellow, orange & red vegetables, organ meats, eggs, small fish eaten whole with bones, other flesh foods & miscellaneous animal protein.	Nutrient adequacy
Dietary Diversity indicator; Arimond *et al.* (2004)	Scored 0 – 7.One point awarded for consuming an item ≥3d in a week from seven foods categories: starchy staples, legumes, dairy, meat, poultry & fish or eggs, vitamin A rich fruit & vegetables, other fruit & vegetables, foods made with oil or butter.	Height-for-age z-score
Food Diversity Index (FDI); Benefice *et al.* (2006)	Scored 0 – 19. One to four points awarded for consuming an item from four food groups: fish, meat & milk; cereals; fruits; tubers & plantains.	Height-for-age z-score
Traditional Food Diversity Score (TFDS); Roche *et al.* (2008)	Unlimited scoring. One point awarded for each unique traditional (to the Peruvian Amazon) food consumed.	Nutrient adequacy
1 & 3day Food Variety Score; Enneman *et al.* (2009)	Unlimited scoring. One point awarded for each item consumed in one & three days.	Nil
USAID Dietary Diversity Score (DDS); Enneman *et al.* (2009)	Scored 0 – 8. One point awarded for consuming an item from each of eight food categories: grains, roots, & tubers; legumes & nuts; dairy; flesh foods; eggs; vitamin A rich fruit & vegetables; other fruit & vegetables; fats & oils.	Nil
Cooking Pot Dietary Diversity Score (DDS); Enneman *et al.* (2009)	Scored 0 – 6. One point awarded for consuming an item from each of six food categories: grains (legumes), cereals & potatoes; herbs & vegetables; fruits; meat; milk & milk products; sugar & fats.	Nil

INCAP Papers Dietary Diversity Score (DDS); Enneman *et al.* (2009)	Scored 0 – 25. One point awarded for consuming an item from each of 25 food categories: corn, corn tortilla & corn gruel; corn tamales; beans; rice; bread; breakfast cereals; other cereals; milk, dairy products & eggs; meat, beef & pork; game meat; chicken & turkey; fish & shellfish; green leaves; green & yellow vegetables; other vegetables; potatoes, root crops & plantain; fruit; fats & oils; sugar; beverages; snacks; desserts; soups; other mixed dishes with meat; & miscellaneous	Nil
Dietary Diversity Score (DDS8); Moursi *et al.* (2008a)	Scored 0 – 8. One point awarded for consuming ≥1g from each of 8 food categories: grains, roots & tubers; legumes & nuts; dairy products; flesh foods; eggs; vitamin A rich fruit & vegetables; other fruit & vegetables; fats & oils.	Nutrient adequacy
Dietary Diversity Score (DDS8-R); Moursi *et al.* (2008a)	Scored 0 – 8. One point awarded for consuming ≥10g from each of 7 food categories: grains, roots & tubers; legumes & nuts; dairy products; flesh foods; eggs; vitamin A rich fruit & vegetables; other fruit & vegetables; & consuming ≥1g from fats & oils food category.	Nutrient adequacy
Dietary Diversity Score (DDS7); Moursi *et al.* (2008a)	Scored 0 – 7. One point awarded for consuming ≥1g from each of 7 food categories: grains, roots & tubers; legumes & nuts; dairy products; flesh foods; eggs; vitamin A rich fruit & vegetables; other fruit & vegetables.	Nutrient adequacy
Dietary Diversity Score (DDS7-R); Moursi *et al.* (2008a)	Scored 0 – 7. One point awarded for consuming ≥10g from each of 7 food categories: grains, roots & tubers; legumes & nuts; dairy products; flesh foods; eggs; vitamin A rich fruit & vegetables; other fruit & vegetables.	Nutrient adequacy
Dietary Diversity Score (DDS); Mpontshane *et al.* (2008)	Scored 0 – 100. Scored as a percentage of 8 food categories consumed each day in a week: breast milk; formula milk; dairy products; vegetable protein; non-milk animal protein; snacks & sweet beverages; fruit & vegetables; complex carbohydrates.	Nil
Dietary Diversity Score (DDS); Hatloy *et al.* (1998)	Scored 0 – 8. One point awarded for consuming each of 8 food groups over three days: staples; vegetables; milk; meat; fish; egg; fruits; green leaves.	Nutrient adequacy
Food Variety Score (FVS); Hatloy *et al.* (1998)	Unlimited scoring. One point awarded for each item consumed in one & three days.	Nutrient adequacy
Dietary Diversity Score (DDS); Steyn *et al.* (2005)	Scored 0 – 9. One point awarded for consuming one food from nine food groups over 24h: cereals, roots & tubers; vitamin A rich fruits & vegetables; other fruits; other vegetables; legumes & nuts; meat, poultry & fish; fats & oils; dairy; eggs.	Nutrient adequacy
Food Variety Score (FVS); Steyn *et al.* (2005)	Unlimited scoring. One point awarded for consuming each food item from recommended food groups over 24h: cereals, roots & tubers; vitamin A rich fruits & vegetables; other fruits; other vegetables; legumes & nuts; meat, poultry & fish; fats & oils; dairy; eggs.	Nutrient adequacy
Dietary Diversity Score (DDS); Torheim *et al.* (2004)	Scored 0 – 10. One point awarded for consuming each food group over 7d: cereals; legumes; oil & sugar; fruit; vegetables; meat; milk; fish; eggs; green leaves; other.	Nutrient adequacy
Dietary Diversity Score (DDS); Mirmiran *et al.* (2004)	Scored 0 – 10. Two points awarded for consuming ≥0.5 serve from each of five food categories: grains; vegetables; fruit; meat; dairy.	Nutrient adequacy
Dietary Diversity Score (DDS); Shatenstein, *et al.* (1995)	Scored 0 – 4. One point awarded for consuming one serve from each of four food categories: grains; dairy; protein (excluding dairy); fruit & vegetables.	Nil
Dietary Adequacy Score (DAS); Guthrie & Scheen (1981)	Scored 0 – 16. One point awarded for consuming a serve from two food categories: grains; fruit & vegetables; & two points awarded for consuming a serve from two food categories: protein (excluding dairy) & dairy; with each food category capped at four points.	Nutrient adequacy
Dietary Diversity Index (DDI); Bork *et al.* (2013)	Scored 0 – 7. One point awarded for consuming a serve from seven food categories: animal milk products, animal-based foods, cereals and tubers, pulses and nuts, fruit and vegetables, vitamin A–rich foods, and food with fat added.	Height-for-age z-score
Food Variety Index (FVI); Bork *et al.* (2013	Scored 0 – 21. One point for consuming a serve from 20 food items: fresh milk, powered milk, sour milk, fresh fish, dried or smoked fish, eggs, meat, groundnuts, other legumes, vegetables/leaves, fruit, vitamin A–containing food, tubers/roots, millet gruel, milk-based millet gruel, millet couscous, millet porridge, rice, fat-containing foods, and bread/ biscuits), together with a category "other foods".	Height-for-age z-score

Food Variety Score (FVS); Darapheak *et al*. (2013)	Scored 0-9. One point awarded for consuming a serve from 7 food categories, capped at 9 serves: staple foods, animal foods, milk products, green leafy/orange colour vegetables, pulses, oils/fats, seeds	Growth

d, day; g, gram; h, hour.

†Not original author. Original paper not available.

Online supporting material 1: Characteristics and results of studies examining associations between diet quality indices and health-related outcomes in paediatric populations (n=56 of 119 studies).

Citation	Study design	Population	Health-related results
1. Healthy Eating Index (HEI)			
Studies using this index but did not investigate a health-related outcome include Kennedy *et al.* (1995)†, Rodriguez-Argalejo *et al.* (2003), Royo-Bordonada *et al.* (2003a), Griel *et al.* (2004), Knol *et al.* (2005), Mirmiran *et al*. (2005), LaRowe *et al.* (2007), Florence *et al.* (2008), De Andrade *et al.* (2009), Gittelsohn *et al.* (2010), Wang *et al.* (2010), Rauber *et al*. (2013a), Rauber *et al.* (2013b)			
Feskanich *et al.* (2004)	Data collected 1996, multistage stratified sampling, cross-sectional	USA, nationally representative, ages 9 – 14y, n=16,452	BMI negatively associated (r= -0.08)
Goodwin *et al.* (2006)	Data collected 1994 – 6, multistage stratified cluster sampling‡, cross-sectional	USA, nationally representative, ages 11 – 18y, n=1504	Self-rated health (NS)
Angelopoulos *et al.* (2009)	Data collected 2005 – 6, random multistage sampling, cross-sectional	Crete, Greece, ages 10 – 12y, n=481	BMI category (NS)
Kourlaba *et al.* (2009)	Data collected 2003 – 4, random cluster samplingᶲ, cross-sectional	Greece, nationally representative, ages 2 – 5y, n=2287	BMI category (NS)
Nunn *et al.* (2009)	Data collected 1988 – 94, stratified multistage sampling§, cross-sectional	USA, nationally representative, ages 2 – 5y, n=3912	Severe early childhood dental caries negatively associated (OR= 0.56, 95% CI: 0.37, 0.87), simple and maxillary early childhood dental caries (NS)
Hurley *et al.* (2009)	Data collected 1997 – 2004, purposive sampling, cross-sectional	USA, urban, ages 11 – 19y, n=317	Percent body fat negatively associated (r= -0.17), percent abdominal fat negatively associated (r= -0.19) Risk of overweight and overweight (NS)
Manios *et al.* (2009)	Data collected 2003 – 4, randomised cluster samplingᶲ, cross-sectional	Greece, nationally representative, ages 2 – 5y, n=2287	BMI category (NS)
Vitolo *et al.* (2010)	Data collected 2004 – 5, method of sampling not reported, RCT	Rio Grande do Sul, Brazil, ages 3 – 4y & mothers, n=1000	Overweight negatively associated (RR= 1.75, 95% CI: 1.05, 2.93)
2. Healthy Eating Index-2005 (HEI-2005):			
Studies using this index but did not investigate a health-related outcome include Guenther *et al.* (2008)†, Beydoun & Wang (2009), Kranz & McCabe (2013), Leung *et al.* (2013), McGill *et al.* (2013), Fulgoni *et al*. (2009), Sisson *et al*. (2012)			
Graf-Myles *et al.* (2013)	Year of data collection and method of sampling not reported, prospective cohort	USA, ages 1-6y, n=120	Cross-sectionally: autism (NS), cross-sectionally: Non-Autism Spectrum Disorder developmental delay (NS)
Nansel *et al*. (2012)	Data collected 2008 – 2009, convenience sampling, cross-sectional	Boston, USA, ages 8 – 18y, n=252	HbA1c (NS), BMI (NS)
Laster *et al*. (2013)	Data collected 2007 – 2009, method of sampling not reported, RCT	North Carolina, USA, ages 2-5y, n=177 child-parent dyads	BMI category (NS)
3. Youth Healthy Eating Index (YHEI)			
Feskanich *et al.* (2004)†	Reported in HEI	Reported in HEI	BMI negatively associated (r= -0.12)* *No p-value stated
Hurley *et al.* (2009)	Reported in HEI	Reported in HEI	Risk of overweight (NS), overweight (NS), precent body fat(NS), percent abdominal fat (NS)
4. Canadian Healthy Eating Index (HEI-C)			

Studies using this index but did not investigate a health-related outcome include Glanville & McIntyre (2006)†, Woodruff *et al.* (2008), Woodruff & Hanning (2009), Woodruff & Hanning (2010a)			
Woodruff *et al.* (2010b)	Data collected 2005 – 6, cluster sampling, cross-sectional	Ontario, Canada, ages 10 – 14y, n=1288	BMI category (NS)
5. Canadian Healthy Eating Index 2009 (HEIC-2009), 6. Alternative Healthy Eating Index (AHEI)			
No studies reported association with health related variables. Studies using this index but did not investigate a health-related outcome include Woodruff & Hanning (2010a)†, Leung *et al.* (2013)			
7. Diet Quality Index (DQI)			
Dixon *et al.* (2000)	Data collected 1991 onwards, convenience sampling, prospective RCT	Philadelphia, USA, ages 4 – 10y, n=303	Change in serum total cholesterol serum (NS), serum triglyceride (NS), serum HDL-C (NS), change in BMI (NS)
Jennings *et al.* (2011)	Data collected 2007, method of sampling not reported, cross-sectional	Norfolk, England, ages 9-10y, n=1700	Waist circumference negatively associated (-3.0%), Waist:height ratio negatively associated (-2.4%), percentage body fat negatively associated (-5.1%), weight negatively associated (-9.5%), BMI negatively associated (-4.2%), BMI z-score negatively associated (-44.6%) Height (NS)
8. Diet Quality Index – International (DQI-I)			
Studies using this index but did not investigate a health-related outcome include Veugelers *et al.* (2005), Tur *et al.* (2005), Colapinto *et al.* (2007), Florence *et al.* (2008), Liang *et al.* (2009), Simen-Kapeu *et al.* (2010)			
Kuhle *et al.* (2010)	Data collected 2003, cluster sampling[‖], cross-sectional	Nova Scotia, Canada, ages 10 – 11y, n=4966	Overweight (NS)
McMartin *et al.* (2012)	Data collected 2003 – 2006, cluster sampling[‖], cross-sectional	Nova Scotia, Canada, ages 10 – 14y, n=3757	Internalising disorder (NS)
Wu *et al.* (2012)	Data collected 2008, cluster randomised sampling, cross-sectional	Alberta, Canada, ages 10 – 11y, n3421	Health-related quality of life (EQ-5D-Y) visual analogue scale positively associated (β=2.76) and pain & discomfort dimension negatively associated (μ=49.2, 43.6 & 45.6)
9. Children's Diet Quality Index (C-DQI)			
No studies reported association with health related variables. Studies using this index but did not investigate a health-related outcome include Kranz *et al.* (2004)†			
10. Revised Children's Diet Quality Index (RC-DQI)			
Studies using this index but did not investigate a health-related outcome include Kranz *et al.* (2006)†, Kranz & McCabe (2013)			
Kranz *et al.* (2008)	Data collected 1999 – 2002, stratified multistage sampling[§], cross-sectional	USA, nationally representative, ages 2 – 5y, n=1521	Risk of overweight negatively associated*, overweight negatively associated* *Statistics not stated
Cheng *et al.* (2010)	Data collected 1985 onwards, convenience sampling, prospective cohort	Dortmund, Germany, mean age 7.4y, n=222	BMI z-scores (NS), fat mass/height^2 z-score (NS), fat-free mass/height^2 z-score (NS), timing of puberty (NS)
11. Food Variety Index for Toddlers (VIT), 12. Grain, Fruit, Vegetables, Dairy & Mild (GFVDM) Variety Score, 13. Grain, Fruit &Vegetable (GFV) Variety Score,			
No studies reported association with health related variables. Studies using these indices but did not investigate a health-related outcome include Cox *et al.* (1997)†, Powers *et al.* (2004), Falciglia *et al.* (2004)†			
14. Nutrient Rich Foods (NRF) 9.3			

Studies using this index but did not investigate a health-related outcome include Fulgoni *et al.* (2009)			
Nansel *et al*. (2012)	Reported in HEI-2005	Reported in HEI-2005	HbA1c (NS), BMI (NS)
15. Food Variety (FV) Score			
Zimmer *et al*. (2013)	Year of data collection and method of sampling not reported, cross-sectional	Ohio, USA, μ8.15y, n=44	Autism negatively associated (μ score 33.5 versus 54.5)
16. Diet Quality Index for Preschool Children (DQI-CH), 17. Excess Index, 18. Daily Diversity Index (DDI), 19. Variety Index, 20. Fruit & Vegetable Index (FV Index), 21. Fiber Index, 22. Calcium Index (Ca-Index)			
No studies reported association with health related variables. Studies using these indices but did not investigate a health-related outcome include Huybrechts *et al.* (2010)†, Sabbe *et al.* (2008)†, Vereecken *et al.* (2008)			
23. Healthy Diet Indicator (HDI)			
Jennings *et al*. (2011)	Data collected 2007, method of sampling not reported, cross-sectional	Norfolk, England, ages 9-10y, n=1700	Waist circumference negatively associated (-2.5%), Waist:height ratio negatively associated (-3.2%), percentage body fat negatively associated (-4.9%) Weight (NS), BMI (NS), BMI z-score (NS), height (NS)
24. Food-Variety Score (FVS)			
Emond *et al.* (2010)†	Data collected 1991 – 9, whole of population sample**, prospective cohort	Avon, England, ages 38m, n=12980	Classical autism positively associated (OR= 2.25) were more likely to have a higher score (poor diet quality) than other forms of Autism (OR= 1.84)
25. Complementary Feeding Utility Score (CFUI)			
Studies using this index but did not investigate a health-related outcome include Golley *et al. (2012)*			
Golley *et al. (2013)*	Data collected 1991 – 9, whole of population sample**, prospective cohort	Avon, England, ages 6m – 8y, n=6065	Waist circumference negatively associated (β= -0.15), diastolic blood pressure (β= -0.24) BMI score (NS), systolic blood pressure (NS), serum total cholesterol (NS), serum LDL-C (NS), serum HDL-C (NS)
26. Healthy Food Diversity (HFD) - Index			
Truthmann *et al*. (2012)	Data collected 2005 – 2007, two-stage clustered & stratified sampling, cross-sectional	Germany, nationally representative, ages 12 – 17y, n5198	Serum folate positively associated in boys & girls (β= 10.26 & β=9.86), serum homocysteine negatively associated in boys &girls (β= -0.16 & β= -0.07), serum uric acid negatively associated in boys (β= -0.07) Serum C-reactive protein (NS), serum total cholesterol (NS), serum HDL-C (NS), serum ferritin (NS), serum vitamin B12 (NS), serum uric acid in girls only (NS), systolic blood pressure (NS), diastolic blood pressure (NS), HbA1c (NS)
27. Healthy Nutrition Score for Kids & Youth (HuSKY)			
Studies using these indices but did not investigate a health-related outcome include Kleiser *et al.* (2010)			
Kleiser *et al.* (2009)†	Data collected 2003 – 6, two-stage clustered & stratified sampling, cross-sectional	Germany, nationally representative, ages 3 – 11y, n14,105	Serum folate (r= 0.068 & r =0.065), Serum homocysteine (r = -0.068) Serum ferritin (NS), serum calcium (NS), serum magnesium (NS), serum 25-hydroxyvitamin D (NS)

Truthmann *et al*. (2012)	Reported in HFD-Index	Reported in HFD-Index	Serum folate positively associated in boys & girls (β=13.29 & β=6.80), serum homocysteine negatively associated in boys & girls (β= -0.15 & β= -0.11), serum C-reactive protein negatively associated in boys (β= -8.21) Serum uric acid (NS), serum C-reactive protein in girls (NS), serum total cholesterol (NS), serum HDL-C (NS), serum ferritin (NS), , serum vitamin B12 (NS), systolic blood pressure (NS), diastolic blood pressure (NS), HbA1c (NS)
28. Indicator Food Index (IDI)			
Truthmann *et al*. (2012)	Reported in HFD-Index	Reported in HFD-Index	Serum vitamin B12 positively associated in girls (β=10.87), HbA1c negatively associated in boys (β= -0.01), serum folate positively associated in boys (β= -0.25 & β=27.67), serum homocysteine negatively associated in boys & girls (β= -0.10), serum C-reactive protein negatively associated in girls (β= -14.01), diastolic blood pressure positively associated in girls (β=0.33), serum uric acid negatively associated in boys (β= -0.06) Serum total cholesterol (NS), serum HDL-C (NS), serum ferritin (NS), serum folate in boys (NS), serum vitamin B12 in boys (NS), HbA1c in girls (NS), serum C-reactive protein in boys (NS), systolic blood pressure (NS), diastolic blood pressure in boys (NS)
29. Recommended Food Group Change Score (RFS), 30. Total Food Group Change Score (TFS), 31. Nutrient Improvement Score (NIS)			
No studies reported association with health related variables. Studies using these indices but did not investigate a health-related outcome include Alexy *et al.* (1999)†			
32. Nutrition Quality Index (NQI)			
Studies using these indices but did not investigate a health-related outcome include Libuda *et al.* (2009)			
Cheng *et al.* (2010)	Reported in RC-DQI Reported in RC-DQI		Fat-free mass/height^2 z-score positively associated (LMS: -0.02, 0.1, 0.2), timing of puberty positively associated (LMS: 9.2, 9.4, 9.6) BMI z-scores, fat mass/height^2 z-score (NS)
33. Diet Quality Score			
No studies reported association with health related variables. Studies using these indices but did not investigate a health-related outcome include Kohlboeck *et al.* (2012)			
34. Mediterranean Diet Score (MDS)			
Jennings *et al*. (2011)	Data collected 2007, method of sampling not reported, cross-sectional	Norfolk, England, ages 9-10y, n=1700	Waist circumference (NS), Waist:height ratio (NS), percentage body fat (NS), weight (NS), BMI (NS), BMI z-score (NS), height (NS)
35. Preschoolers Diet-Lifestyle Index (PDL-Index)			
Manios *et al.* (2010)†	Data collected 2003 – 4, random cluster sampling[ϕ], cross-sectional	Greece, nationally representative, ages 2 – 5y, n=2287	Overweight /obesity negatively associated (OR= 0.98, 95% CI: 0.95. 1.00), obesity negatively associated (OR= 0.95, 95% CI: 0.92, 0.99)
36. Unhealthy Food Choices Score (UFCS)			
Yannakoulia *et al.* (2004)†	Data collected 1997 – 8, multistage stratified cluster sampling, cross-sectional	Greece, nationally representative, ages 11 – 15y, n=4211	BMI Category (NS)
37. E-KINDEX			

Lazarou *et al.* (2008)†	Data collection period and sampling method not reported, cross-sectional	Greece, nationally representative, mean age 11.7y, n=634	Obesity or overweight (OR= 0.19, 95% CI:0.08. 0.49), waist circumference ≥75% percentile (OR= 0.20, 95% CI: 0.07. 0.54), each 8-point increase in score associated with a decrease of 1.12 units in BMI, 1.69% body fat & 2.7cm in waist circumference
38. Foods E-KINDEX			
Lazarou *et al.* (2009c)†	Data collected 2004 – 5, stratified multistage sampling‡‡, cross-sectional	Cyprus, nationally representative, ages 10 - 13y, n=622	Overall blood pressure (r= -0.104; OR= 0.43, 95% CI: 0.19, 0.98), diastolic blood pressure (r= -0.099), systolic blood pressure (r= -0.127; OR= 0.43, 95% CI: 0.19, 0.97)
39. Diet Quality Score			
No studies reported association with health related variables. Studies using these indices but did not investigate a health-related outcome include Crombie *et al.* (2009)†			
40. Diet Variety Index (DVI)			
Royo-Bordonada *et al.* (2003b)†	Data collected 1998 – 9, random cluster sampling, cross-sectional	Cadiz, Murcia, Orense & Madrid, Spain, ages 6 – 7y, n=1112	Serum α-carotene (r= 0.09), serum β-carotene (r= 0.14), serum carotenes (r= 0.13), serum lycopene (r= 0.27), serum retinol (r= 0.08), serum α-tocopherol (r= 0.10), serum vitamin E (r= 0.10) BMI (NS), Overweight percentage (NS), Obesity percentage (NS), Height (NS), Weight (NS), serum γ-tocopherol (NS), serum total cholesterol (NS), serum triglycerides (NS), serum HDL-C (NS), serum LDL-C (NS), serum glucose (NS)
41. Mediterranean Diet Quality Index – International (Med DQI-I)			
Studies using these indices but did not investigate a health-related outcome include Tur *et al.* (2005)†			
Mariscal-Arcas *et al.* (2007)	Data collected 2002 – 5, method of sampling not reported, cross-sectional	Granada Provence, Spain, ages 6 – 18y, n=288	BMI category (NS)
42. Mediterranean Diet Quality Index for children & adolescents (KIDMED)			
Studies using these indices but did not investigate a health-related outcome include Serra-Majem *et al.* (2004)†, Serra-Majem *et al.* (2003), Lazarou *et al.* (2009a), Lazarou *et al.* (2009c), Mariscal-Arcas *et al.* (2009)			
Lazarou *et al.* (2009b)	Data collected 2004 – 5, stratified multistage sampling‡‡, cross-sectional	Cyprus, nationally representative, ages 10 - 13y, n=622	Diastolic blood pressure (r= -0.102, OR = 0.25, 95% CI: 0.08, 0.76 for 80mm Hg cut-off & OR= 0.40, 95% CI: 0.22, 0.75 for 90th percentile cut-off) Blood pressure (NS), Systolic blood pressure (NS),
Lazarou *et al.* (2010)	Data collected 2004 – 5, stratified multistage sampling‡‡, cross-sectional	Cyprus, nationally representative, ages 10 – 13y, n=1140	Overweight(NS), obesity (NS)
Kontogianni *et al.* (2010)	Data collected 2007, multistage, stratified & randomised sample, cross-sectional	Greece, nationally representative, ages 3 – 18y, n=1305	BMI (r= -0.15; b= -0.10; b= -0.07)
Farajian *et al.* (2011)	Data collected 2009, stratified sampling, cross-sectional	Greece, nationally representative, ages 10 – 12y, n=4786	Overweight (NS), obesity (NS)
43. Dietary Guideline Index for Children & Adolescents (DGI-CA)			

Golley *et al.* (2011)†	Data collected 2007, stratified sampling, cross-sectional	Australia, nationally representative, ages 4 – 16y, n=3416	4 – 7y: BMI z-score (b= 0.005, 95% CI: 0.000, 0.009), waist circumference z-score (b= 0.007, 95% CI: 0.002, 0.011); 12 – 16y; BMI z-score (b= 0.004, 95% CI: 0.001, 0.008), waist circumference z-score (b= 0.006, 95% CI: 0.002, 0.010) In children aged 8 – 11y; BMI z-score (NS), waist circumference (NS)
44. Australian Child & Adolescent Recommended Food Score (ACARFS)			
Marshall *et al.* (2012)†	Data collected 2005, cluster randomised sampling, cross-sectional	Hunter Region, Australia, ages 9 – 12y, n=691	BMI z-scores (NS)
45. Diet Quality Index, 46. Core Food Variety Score (CFVS), 47. Fruit and Vegetable Variety Score (FVVS), 48. Obesity Protective Dietary Index (OPDI)			
No studies reported association with health related variables. Studies using these indices but did not investigate a health-related outcome include Li *et al*. (2012), Scott *et al.* (2013), Spence *et al.* (2013)			
49. Adolescent Micronutrient Quality Index (AMQI)			
Chiplonkar & Tupe, (2010)†	Data collected 2006 – 7, method of sampling not reported, cross-sectional	Pune City, India, ages 10 – 16y, n=630	BMI percentile (r= 0.12), serum vitamin C (r= 0.26), serum β-carotene (r= 0.34), serum zinc (r= 0.12)
50. Diet Variety Score (DV score)			
Eckhardt *et al.* (2005)	Data collected 1983 – 2002, cluster sampling, prospective cohort	Metro Cebu, Philippines, ages 0 – 18y, n=2029	Boys: Height positively associated (b= 0.33±0.06) Girls: Height (NS)
51. Dietart\y Diversity Score (DDS)			
Studies using these indices but did not investigate a health-related outcome include Daniels *et al.* (2009), Cabalda *et al.* (2011)			
Kennedy *et al.* (2007)†	Data collected 1993, stratified multistage sampling, cross-sectional	Philippines, nationally representative, ages 24 – 71m, n=2805	Weight positively associated (b= 0.0104, b= 0.0093) Height (NS)
52. Dietary Diversity Score 10g (DDS 10g)			
Studies using these indices but did not investigate a health-related outcome include Daniels *et al.* (2009)			
Kennedy *et al.* (2007)†	Reported in DDS (#37)	Reported in DDS (#37)	Weight (NS), height (NS)
53. Food Variety Score (FVS)			
Saibul *et al.* (2009)†	Data collected 2002 – 5, purposeful sampling, cross-sectional	Selangor, Malaysia, ages 2 – 9y & mothers, n=466	Underweight negatively associated (OR: 0.71. 95% CI: 0.51, 0.95) when child has overweight mother
54. Food Variety Score (FVS)			
Darapheak *et al*. (2013)	Data collected 2005, multistage stratified sampling, cross-sectional	Cambodia, nationally representative, ages 12-59m, n=4249	Height-for-age positively associated (OR 0.95, 95%CI 0.91-0.99) Weight-for-age (NS), weight-for-height (NS), diarrhoea (NS)
55. Dietary Diversity Score (DDS)			
Rah *et al.* (2010)†	Data collected 2003 – 5, stratified, multistage cluster sampling, cross-sectional	Rural Bangladesh, ages 6 – 59m, n=165,111	Stunting negatively associated (OR= 0.85, 95% CI: 0.76, 0.94 in 6-11m; OR=0.74, 95% CI: 0.69, 0.79 in 12-23m; OR=0.69, 95% CI:0.66, 0.73 in 24-59m), diarrhoea in last week negatively associated (OR= 1.14, 95% CI: 1.04, 1.25 in 6-11m; OR= 1.34, 95% CI: 1.25, 1.44 in 12-23m; OR= 1.13, 95% CI: 1.07, 1.19 in 24-59m)

56. Dietary Diversity Score (DDS), 57. Food Variety Score (FVS)			
No studies reported association with health related variables. Studies using these indices but did not investigate a health-related outcome include Rani *et al.* (2010)†			
58. Dietary Diversity Score (DDS)			
Mirmiran *et al.* (2004)†	Data collected 1999 – 2001, method of sampling not reported, cross-sectional	Tehran, Iran, ages 10 – 18y, n=30	BMI positively associated (μ19.81kg/m^2 with DDS score >6 versus μ18.95kg/m^2 with DDS score <6)
59. Dietary Diversity Score (DDS)			
No studies reported association with health related variables. Studies using these indices but did not investigate a health-related outcome include Shatenstein *et al.* (1996)†			
60. Infant & Child Feeding Index (ICFI)			
Ruel & Menon (2002)†	Data collected 199 4 – 9, method of sampling not reported, cross-sectional	Bolivia, Colombia, Guatemala, Nicaragua, Peru, all nationally representative, ages 6 – 36m, n=2506	6 – 9m: Height-for-age z-score in Peru only*; 9 – 12m: Height-for-age z-score in Guatemala (1995), Nicaragua & Peru only*; 12 – 36m: Height-for-age z-score associated in all seven datasets*; 12 – 36m height-for-age z-score positively associated in Colombia, two Guatemala datasets, Nicaragua & Peru* *Statistics not stated
Ntab *et al.* (2005)	Data collected 2003, method of sampling not reported, cross-sectional	Central Senegal, ages 12 – 42m, n=500	Height-for-age z-score (NS), linear growth (NS)
Sawadogo *et al.* (2006)	Data collected 2002, random sampling, cross-sectional	Gnagna, Burkina Faso, ages 6 – 23m, n=2466	6-11m: Weight-for-height z-score (μ= -0.9, -1.19, -1.15), height-for-age z-score (μ= -1.67, -1.53, -1.21); 12 – 23m: Height-for-age z-score (μ= -2.54, -2.24, -2.11), weight-for-height z-score (μ= -1.39, -1.33, -1.20); 24 – 35m: Height-for-age z-score negatively associated (μ= -2.18, -2.20, -2.45) 24-35m height-for-height z-score (NS)
Zhang *et al.* (2009)	Data collected 2006 – 7, method of sampling not reported, cross-sectional	Laishui, China, ages 6 – 11m, n=501	Diarrhoea in the last two weeks negatively associated (μ= 6.74±2.49); weight-for-length z-score positively associated (μ= 0.47, 0.74, 0.79) Fever (NS), cough/runny nose (NS), length-for-age z-score (NS), height-for-age z-score (NS)
Moursi *et al.* (2008b)	Data collected 2004, purposeful, total population sampling, prospective cohort	Fianarantsoa, Madagascar, ages 6 – 17m, n=363	Longitudinal ICFI: Length-for-age z-score (difference in μ= 0.5), Weight-for-length z-score (NS) Cross-sectional ICFI: Length-for-age z-score (NS), weight-for-length z-score (NS)
Moursi *et al.* (2009)	Data collected 2004, purposeful, total population sampling, cross-sectional	Fianarantsoa, Madagascar, ages 6 – 23m, n=1589	6 – 8m: Length-for-age z-score positively associated (μ= -1.74, -1.35, -1.09); 9 – 11m, 2 – 23m, 6 – 23m: Length-for-age z-score (NS)* *Became significant when breastfeeding was removed from the score & included as a confounder

Bork *et al.* *(*2013)	Data collected 2009, random cluster sampling, prospective cohort	Sine region, Senegal, ages 6-36m, n=1329	18-24m: longitudinal length/height increments positively associated (μ= 3.6, 4.1, 4.4); 6-12m: cross-sectional height-for-length z-score positively associated (μ=-1.04, -0.66, -0.07); 6-18m and 24-36m longitudinal length/height increments (NS), 12-36m: cross-sectional height-for-length z-score (NS)
61. Diet Diversity Indicator			
Arimond & Ruel (2004)†	Data collected 1984 – 2002, method of sampling not reported, cross-sectional	Benin, Cambodia, Colombia, Ethiopia, Haiti, Malawi, Mali, Nepal, Peru, Rwanda, Zimbabwe, ages 6 – 23m, n=22,065	Height-for-age z-score positively associated in Ethiopia, Mali, Rwanda, Zimbabwe, Cambodia, Nepal & Colombia (difference in μ= 0.24 – 0.59)
Ntab *et al.* (2005)	Reported in ICFI	Reported in ICFI	Height-for-age z-score (NS), linear growth (NS)
Lin *et al.* (2007)	Data collected 2004, method of sampling not reported, prospective cohort	Machiega, Malawi, ages 1 – 3y, n=1651	Kwashiorkor (NS)
Sullivan *et al.* (2006)	Data collected 2001, purposeful sampling, cross-sectional case-control	Blantyre, Malawi, mean age 31m, n=239	Kwashiorkor versus marasmus (NS)
Chua *et al.* (2012)	Data collected 2009, convenience sampling, cross-sectional	Pahang, Malaysia, ages 1 – 6y, n=216	Height-for-age z-score positively associated (β=0.12) Weight-for-age z-score positively associated (β=0.20)
62. Food Diversity Index (FDI)			
Benefice *et al,* (2006)†	Year of data collection and method of sampling not reported, cross-sectional	Bene River, Bolivia, ages 0 - 15y & mothers, n=631	0-5y: Height-for-age positively associated (t= 3.20; b= 0.07); clinical status* positively associated (b= 0.43); 5-1010y: Height-for-age positively associated (t= 2.54); 10-15y: Height-for-age positively associated (t= -2.41) 0-5y amd 10-15y helminth infection (NS), 5-15y clinical status* (NS) *Term not defined
63. Traditional Food Diversity Score (TFDS), 64. 1 & 3day Food Variety Score (FVS), 65. USAID Dietary Diversity Score (DDS), 66. Cooking Pot Dietary Diversity Score (DDS), 67. INCAP Papers Dietary Diversity Score (DDS), 68. Dietary Diversity Score (DDS8), 69. Dietary Diversity Score (DDS8-R), 70. Dietary Diversity Score (DDS7), 71. Dietary Diversity Score (DDS7-R)			
No studies reported association with health related variables. Studies using these indices but did not investigate a health-related outcome include Roche *et al.* (2008)†, Enneman *et al.* (2009)†, Moursi *et al.* (2008a)†			
72. Dietary Diversity Score (DDS)			
Mpontshane *et al.* (2008)†	Year of data collection not reported, cluster sampling, cross-sectional	KwaZulu-Natal Province, South Africa, ages 6 – 24m, n=381	HIV status negatively associated (OR= 1.76, 95% CI: 1.06, 2.94); diarrhoea that week negatively associated (OR= 1.18, 95% CI: 1.02, 1.34); respiratory infection that week negatively associated (OR= 0.86, 95% CI: 0.77, 0.94)
73. Dietary Diversity Score (DDS), 74. Food Variety Score (FVS), 75. Dietary Diversity Score (DDS), 76. Dietary Diversity Score (DDS), 77. Food Variety Score (FVS), 78. Dietary Adequacy Score (DAS)			

No studies reported association with health related variables. Studies using these indices but did not investigate a health-related outcome include Hatloy *et al.* (1998)†, Torheim *et al.* (2004), Steyn *et al.* (2006)†, Shatenstein *et al.* (1996)			
79. Dietary Diversity Index (DDI)			
Bork *et al.* (2013)	Reported in ICFI	Reported in ICFI	18-24m: longitudinal length/height increments positively associated (μ= 3.6, 4.1, 4.4); 6-24m: cross-sectional height-for-length z-score positively associated (6-12m μ=-1.18, -0.74, 0.09; 12-18m μ=-1.41, -1.19, -0.84; 18-24m μ=-1.54, -1.37, -1.09) 6-36m longitudinal length/height increments (NS), 12-36m: cross-sectional height-for-length z-score (NS)
80. Food Variety Index (FVI)			
Bork *et al.* (2013)	Reported in ICFI	Reported in ICFI	6-24m: cross-sectional height-for-length z-score positively associated (6-12m μ=-1.22, -0.52, -0.15; 12-18m μ=-1.30, -1.24, -0.95; 18-24m μ=-1.48, -1.3, 1.03) 6-36m longitudinal length/height increments (NS), 12-36m: cross-sectional height-for-length z-score (NS)

BMI, body mass index; CI, confidence interval; HIV, human immunodeficiency virus; LMS, least mean square; M, months; NS, not significant; OR, odds ratio, RCT, randomised controlled trial; RR, risk ratio; y, years

†Indicates original author of diet quality index

‡Data collected as part of the US Department of Agriculture Continuing Survey of Food Intakes by Individuals (CSFII).

* Information relating to statistical approach included in table

§ Data collected as part of the National Health and Examination Survey (NHANES)

‖ Data collected as part of the 2003 Children's Lifestyle and School Performance Study (CLASS) in Nova Scotia, Canada.

ɸ Data collected as part of the GENESIS Study

** Data collected as part of the Avon Longitudinal Study of Parents and Children (ALSPAC).

‡‡ Data collected as part of the CYprus KIDS (CYKIDS) study conducted in the Republic of Cyprus.

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