Association between obesity and dietary patterns in children of developing countries in Asia: A Systematic Review

Centre Conducting Review: The Australian Centre for Evidence Based Nutrition and Dietetics (ACEBAND), School of Health Sciences, Faculty of Health, The University of Newcastle, New South Wales, Australia; a collaborating centre of the Joanna Briggs Institute

Reviewers
Wai Yew Yang MMedSci (Human Nutrition) BSc (Dietetics) ¹
Lauren Williams PhD, BSc, Grad Dip Diet, Grad Dip Soc Sci, Grad Dip Hlth Prom, AdvAPD ²
Clare Collins, PhD, BSc, Dip Nutri& Diet, Dip Cli Epi, AdvAPD, FDAA ³
Chee WSS, PhD, MSc (Nutrition), BSc (Dietetics) ⁴

1. PhD Candidate, School of Health Sciences, Faculty of Health, University of Newcastle. Contact: Ph 603 27317579 Fax 603 86567229 waiyew.yang@uon.edu.au
2. Professor of Nutrition and Dietetics, Faculty of Health, University of Canberra. Contact: Lauren.Williams@canberra.edu.au
3. Professor in Nutrition and Dietetics, NHMRC CDA Research Fellow, School of Health Sciences, Faculty of Health, University of Newcastle. Contact: Ph 02 49215646 Fax 02 49217053 Clare.Collins@newcastle.edu.au
4. Associate Professor in Nutrition and Dietetics, Department of Nutrition and Dietetics, School of Pharmacy and Health Sciences, Faculty of Medicine and Health, International Medical University. Contact: Ph 603 27317305 Fax 603 86567229 winnie_chee@imu.edu.my

Review question
The review objective is to synthesise the best available evidence on the epidemiological association between the dietary patterns of children in the developing countries in Asia and their weight status in terms of obesity.

Background
At least 155 million children internationally are overweight, with up to 45 million classified as obese.¹² There is a growing concern about the rapid rise in prevalence of childhood obesity across the developing countries. These countries are undergoing rapid socio-economic and nutrition transitions with a shift from under- to over-nutrition problems, and are thus experiencing the double burden of malnutrition and obesity.²³

The widely used thresholds for classifying childhood overweight or obese are: 110% or 120% of ideal weight for height; weight-for-height Z scores of higher than 1 or higher than 2, and BMI at the 85th, 90th, 95th, and 97th percentiles (on the basis of international or country specific reference populations). The lack of standardisation in reference values used in data reporting worldwide makes it difficult to compare prevalence and we are therefore, unable to comprehensively estimate the true magnitude of this problem.²⁴⁵
Despite this inability to accurately quantify the problem, the available data indicates cause for concern. In 1995, the World Health Organisation (WHO) estimated that 2.9% of pre-school children were overweight, with the prevalence higher in Eastern Asia and South East Asia. A study published in the year 2000 reported 17.6 million overweight children under five years of age in developing countries, 61% of these in Asia. Popkin and Gordon-Larsen highlighted that in China, the prevalence of overweight in children increased from 6.4 in 1991 to 7.7% in 1997, with an annual rate increase of 0.2%. In some countries there is a more pronounced weight problem among children from higher income families; and urban areas. The International Obesity Task Force report of 2004 projected that one in four children in South East Asia was either overweight or obese. A recent systematic review by Kelishadi revealed that the highest prevalence of childhood overweight was found in Eastern Europe and Middle East, while developing countries in Asia like India and Sri Lanka had the lowest prevalence. The prevalence is lowest in Vietnam, Laos and the Philippines with less than one percent.

The consequences of childhood obesity are significant. Systematic reviews confirm the persistence of obesity from childhood into adulthood, and these children are predisposed to a higher chance of developing adult-type diseases like type II diabetes, hypertension and high cholesterol. Such medical conditions subsequently lead to cardiovascular disease and other weight-related health consequences increasing the risk of premature death. Psychological morbidity is the most widespread health impact among overweight and obese children.

Childhood obesity has multi-factorial causation, divided into genetic and environmental factors. Genetics have been identified as a minor cause and obesity is predominantly related to the environment, as a result of energy intake in excess of energy output. Developing countries in the epidemiological transition experience a reduction in mortality from communicable diseases, but are being faced with significant increases in nutrition-related non-communicable diseases and diabetes and cardiovascular disease, related to the increasing prevalence of obesity. With economic globalisation, Asian countries have experienced improved motor vehicle transportation and higher television ownership resulting in a shift away from high energy activities of daily living, promoting a much more sedentary lifestyle. As Asian populations achieve affluence, the intake of energy dense foods, such as fats and sugars increase, while complex carbohydrates and fibre consumption decreases. Similarly, the rapid expansion of the fast food industry add another dimension to the change in the structure of Asian diet, increasing the amount of energy-dense, nutrient-poor food available. Children are particularly susceptible, as they are the target of marketers of energy-dense snacks for sweetened foods and beverages, and fried foods.

In order to tackle childhood obesity in developing countries, it is important to explore the main factors contributing to the emerging obesity epidemic in Asia. This review aims to establish an understanding of the associations between dietary pattern and children's weight status in Asian developing countries. This information could be used to derive effective and efficient interventions, for the prevention and treatment of childhood obesity.

The Joanna Briggs Institute Library of Systematic Reviews, the Cochrane Library and MEDLINE databases were searched to determine whether any systematic reviews already exist on this topic. The search revealed that no systematic reviews have been published on this topic.

Operational definitions:
For the purposes of this review, the followings are the definitions of keywords used:
Developing countries in Asia include: South East Asia, Malaysia, Indonesia, Cambodia, Philippines, Thailand, Laos, Myanmar, Vietnam, Brunei, India and China and are defined by the World Bank criteria and are physically located in Asia.\textsuperscript{19}

For dietary patterns, the different terms used are as follows:

- Macronutrients refer to chemical substances found in food that human consume in large quantity as a source of fuel to meet energy requirements of the body. These substances are also necessary for growth and tissue repair. Macronutrients include carbohydrate, protein and fats.\textsuperscript{18}

- Micronutrients like vitamins and minerals are essential nutrients required in small quantities for health maintenance and disease prevention.\textsuperscript{16}

- Core food groups comprise of five food groups i.e. grains and cereals, fruits and vegetables, meat and meat products, milk and milk products, and, fats, oil, sugar and salt. A food group puts together foods of similar nutrients content and function.\textsuperscript{17}

- Food pyramid is a food guide used by some countries to illustrate desired eating patterns. It is made up of levels that represent various food groups with the recommended number of servings per day from each group. From bottom to the top of the food pyramid, the size of each food group becomes smaller to indicate more foods are consumed at the base of the pyramid and less foods from the top of the pyramid.\textsuperscript{18a}

- Diet quality is used primarily to assess whether the food intake is supplying adequate protein and selected micronutrients for a given energy level. Its current usage has expanded to look into proportionality, moderation and variety of the diet while focusing on the risk of developing chronic disease and comparing and evaluating intake of nutrients and food groups to a standard.\textsuperscript{17}

- Diet patterns and food patterns refer to the habitual food and nutrient intakes for a period of time. The variability in consumption can be explored in terms of availability (geographic, trade and demand), cultural differences or time (secular trends).\textsuperscript{17}

- Diet variety refers to different types of food and beverages taken within a period of time. The variety is counted based on foods that contribute at least one-half of a serving in a food group and similar foods from the same food group will be only counted once. The purpose to promote variety is to ensure supply of all the nutrients needed by body.\textsuperscript{18a}

- Diet score is the points allocated for different indicators used when evaluating a person's diet. Usually scoring is given in a range, from minimum to maximum, with lower score reflecting less favourable result compared to higher score.

- Diet index is an instrument used to assess the overall diet of groups and to evaluate the risk for chronic disease related to dietary pattern based on certain indicators. Diet Quality Index and Healthy Eating Index are two examples of diet index.\textsuperscript{18a}

Body weight status includes BMI-for-age, BMI percentiles, BMI z-score, percentage overweight, percentage body fat and lean body mass as described briefly as follow:
• Body mass index is the ratio weight (in kg)/recumbent length or standing height (in m²). It is a reliable indicator of body fatness. Although BMI does not measure body fat directly, but research has shown that BMI correlates to direct measures of body fat, such as underwater weighing and dual energy x-ray absorptiometry.

• Percentiles are the most commonly used indicator to assess the size and growth patterns of individual children. The percentile indicates the relative position of the child's BMI number among children of the same sex and age. After BMI is calculated, the BMI number is plotted on the gender-specific BMI-for-age growth charts to obtain a percentile ranking.

• BMI z-score measures relative weight adjusted for child age and sex. Z-scores or standard deviation (SD) scores have been used to present child nutritional status. This classification system has been recommended by WHO for its capability to describe nutritional status including at the extreme ends of the distribution and allow derivation of summary statistics, i.e. means and SDs of z-scores.

• Percentage body fat refers to the amount of fat in terms of weight in reference to the total body weight. A higher percentage of body fat predisposes a person to greater metabolic risk, especially those with excess fatness distributed at the central region. The desirable level of body fatness level varies based on gender, age and physical activity level.

• Lean body mass comprises of muscle, which is almost similar to fat free mass, except that lean body mass includes a small amount of lipid that the human body must have. The density of the lean body mass compartment is affected by several factors like age, gender, degree of fitness and body hydration status.

Inclusion criteria

Types of participants
This review will consider publications that include children under 18 years old, who live in developing countries in Asia.

Phenomena of interest
The focus of the review is the epidemiological association between dietary patterns as exposure and weight status as outcomes for children in developing Asian countries.

The measurement of dietary patterns is carried out using dietary assessment tools. These common tools include food frequency questionnaire, 24-hour dietary recall, estimated food record, weighed food record and dietary history. Each method has its own advantages and limitations, and therefore, the selection of the right tool for each research study depends on a few factors. A brief description of the tools:

• A limited checklist of foods and beverages (usually less than 150 food items) with frequency of intake stated in how many times a day, week, month or year and sometimes with inclusion of portion sizes. The tool might be supplemented by open ended questions. A food frequency questionnaire resemble a reporting period greater than 24 hours (e.g. week/s, month/s, year/s).

• 24-hour dietary recall involves a trained interviewer to get subjects to recall exact or detail all food and drinks intake during the previous 24 hour period. Food models or household measures are typically used to increase accuracy of recall. Interviewer records this information for later coding and analysis.
• Estimated food record method is used when the respondent records all foods and beverages (including snacks) eaten for a specified period (usually 1 to 7 days).\textsuperscript{18b}

• In weighed food record, all food and leftovers are weighed using food scales and recorded in a booklet or computerized techniques using household measures supplied by researchers for a specified period (usually 3, 5 or 7 days).\textsuperscript{18b, 22}

• Diet history is a combination method of interview, record and questionnaire. It usually begins with a face-to-face interview, followed by questionnaire and finally, completing the 3 day food record.\textsuperscript{18b, 22}

The weight status of children is described by using BMI-for-age, BMI percentiles, BMI z-score, percentage overweight, percentage body fat and lean body mass. The operational definition and description of each term is outlined above.

**Types of studies**
This review of epidemiological association will consider any analytical observational studies (case-control studies, cohort studies and analytical cross-sectional studies).

**Search strategy**

The search strategy aims to find both published and unpublished studies. A three-step search strategy will be utilised in this review. An initial limited search of MEDLINE, CINAHL and EMBASE (Excerpta Medica Database), will be undertaken; followed by analysis of the text words contained in the title and abstract, and the index terms used to describe the article. A second search using all identified keywords and index terms will then be undertaken across all included databases. Thirdly, the reference list of all identified reports and articles will be searched for additional studies. Search will be inclusive of all languages; however, only studies in English language will be included for assessment. The search of the databases will be from the inception of databases until the current date.

Additional electronic database to be searched include: ProQuest, Web of Science, and Scopus. The search for unpublished studies includes ProQuest (for theses and dissertations), MEDNAR, conference abstracts, Government Reports and Dissertation Abstracts.

The initial keywords to be used will be divided into 4 key areas:

1) Diet, diet pattern, diet intake, diet habit, diet quality, diet index, diet variety, diet score, food pattern, food consumption, food choices, food selection, food intake, eating pattern, eating selection, eating choices

2) South East Asia, Malaysia, Indonesia, Cambodia, Philippines, Thailand, Laos, Myanmar, Vietnam, Brunei India and China

3) Obesity, overweight, body mass index, BMI, body weight, weight status

4) Children ≤18 years of age.

All studies identified during the database search will be assessed for relevance to the review based on the information contained in the title, abstract and description/MESH heading by two independent reviewers. If the reviewers are uncertain of study inclusion, a third reviewer will be consulted until consensus is reached. For all studies that appear to meet inclusion criteria the full article will be retrieved. If it is unclear from the title, abstract and description/MESH heading whether the study meets inclusion
criteria the full article will be retrieved for clarification. A detailed report will be provided for all studies which meet the inclusion criteria.

Assessment of methodological quality

All papers selected for retrieval will be assessed independently by two reviewers for methodological quality prior to inclusion in the review using standardised critical appraisal instruments from the Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instruments (JBI-MAStARI)(see Appendix I). If there is no agreement, a third reviewer will be consulted to resolve any disagreements. The quality of the papers will be taken into consideration when determining reporting outcomes and drawing conclusions.

Data collection

Data will be extracted by two reviewers independently from papers included in this review using the standardised JBI data extraction form (see Appendix II). If there is any disagreement occurs between reviewers, a third reviewer will be consulted.

Data synthesis

The analytical observational studies will be pooled in statistical meta-analysis using the Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI). For studies that are sufficiently similar, results will be pooled in a meta-analysis to give a numeric estimate of the overall effect size, as estimated by risk ratios (odds, hazard or risk ratios), using the Mantel-Haenszel method. Both fixed-effects and random effects models will be used based on heterogeneity of included studies. Testing for heterogeneity will be performed using the Breslow*Day method with the p-value threshold for heterogeneity set at p < 0.1. If there is no heterogeneity, a fixed effects model will be used to pool data; otherwise a random effects model will be used. Study size (publication) bias will be assessed using Egger’s test.

Conflicts of interest
None to declare

Acknowledgements
This systematic review forms part of Reviewer 1’s postgraduate studies.

References


**Appendix I JBI Critical Appraisal Tools**
JBI Critical Appraisal Checklist for Experimental Studies

Reviewer ________________  Date __________

Author ________________  Year __________  Record Number ______

Yes  No  Unclear

1. Was the assignment to treatment groups truly random?

2. Were participants blinded to treatment allocation?

3. Was allocation to treatment groups concealed from the allocator?

4. Were the outcomes of people who withdrew described and included in the analysis?

5. Were those assessing outcomes blind to the treatment allocation?

6. Were the control and treatment groups comparable at entry?

7. Were groups treated identically other than for the named interventions?

8. Were outcomes measured in the same way for all groups?

9. Were outcomes measured in a reliable way?

10. Was appropriate statistical analysis used?

Overall appraisal:  Include □  Exclude □  Seek further info. □

Comments (Including reasons for exclusion)
JBI Critical Appraisal Checklist for Comparable Cohort/Case Control

Reviewer ___________________ Date __________
Author _____________________ Year __________ Record Number ______

---

Yes  No  Unclear

1. Is sample representative of patients in the population as a whole?

2. Are the patients at a similar point in the course of their condition/illness?

3. Has bias been minimised in relation to selection of cases and of controls?

4. Are confounding factors identified and strategies to deal with them stated?

5. Are outcomes assessed using objective criteria?

6. Was follow up carried out over a sufficient time period?

7. Were the outcomes of people who withdrew described and included in the analysis?

8. Were outcomes measured in a reliable way?

9. Was appropriate statistical analysis used?

---

Overall appraisal:  Include Exclude Seek further info

Comments (Including reason for exclusion)

________________________________________

________________________________________

________________________________________
JBI Critical Appraisal Checklist for Descriptive/ Case Series

Reviewer ___________________ Date __________
Author _____________________ Year __________ Record Number ______

Yes  No  Unclear

1. Was study based on a random or pseudo-random sample?

2. Were the criteria for inclusion in the sample clearly defined?

3. Were confounding factors identified and strategies to deal with them stated?

4. Were outcomes assessed using objective criteria?

5. If comparisons are being made, was there sufficient descriptions of the groups?

6. Was follow up carried out over a sufficient time period?

7. Were the outcomes of people who withdrew described and included in the analysis?

8. Were outcomes measured in a reliable way?

9. Was appropriate statistical analysis used?

Overall appraisal:  Include  Exclude  Seek further info

Comments (Including reason for exclusion)

__________________________________________________________

_________________________________________________________
Appendix II: JBI Data Extraction Tool

JBI Data Extraction Form for Experimental/Observational Studies

Reviewer _____________________________  Date __________________
Author _____________________________  Year __________
Journal _____________________________  Record _______

Study Method
- RCT
- Quasi-RCT
- Longitudinal
- Retrospective
- Observational
- Other

Participants
Setting ___________________________________________________________
Population ___________________________________________________________
Sample size
Intervention 1 _______  Intervention 2 _______  Intervention 3 _______

Interventions
Intervention 1 ___________________________________________________________
Intervention 2 ___________________________________________________________
Intervention 3 ___________________________________________________________

Clinical outcome measures

<table>
<thead>
<tr>
<th>Outcome Description</th>
<th>Scale/measure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>