Dietary habits, physical activity, and sedentary behaviour of children of employed mothers: A systematic review

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ABSTRACT

Since approximately 40% of the global workforce are women, a comprehensive understanding of association of maternal employment with child dietary patterns, physical activity and sedentary behaviour needs more focus. This systematic review aims to identify the association between maternal employment and dietary patterns (DP), physical activity (PA) and sedentary behaviour (SB) of children and adolescents (6 to 18 years). Searches were performed using electronic databases and manual searches. Peer reviewed journal articles, conference papers, theses at masters/doctoral levels in English were included. A total 42 studies met selection criteria, which indicated associations between maternal employment and at least one of the domains of interest: DP, PA and/or SB. Using individual samples of analysis, it was found that, 9 samples of DP, 11 samples of PA and 12 samples of SB were positively correlated with maternal employment, whereas 25 samples of DP, 5 samples of PA and 5 samples of SB showed an opposite association. Results suggest that PA and SB were positively related with maternal employment, whereas DP had an inverse relationship. Findings from this review provide evidence that children of employed mothers had poorer DP and greater prevalence of SB, however, their children are more physically active. Future interventions need to create a positive environment at the workplace and for families to support employed mothers and improve children’s dietary patterns and decrease sedentary behaviours. Future studies should prioritise the domains of DP, PA and SB that have been studied inadequately and have inconsistent results.

1. Introduction

Two important worldwide trends can be identified in recent years: increasing prevalence of childhood overweight/obesity and increasing participation of women in the paid labour force. Childhood obesity is an emerging salient public health challenge of the 21st century (WHO, 2020). Childhood obesity is risky as it has strong associations with likelihood of adult obesity, which has led to the increasing risk of morbidity, including non-communicable diseases (NDCs) such as cardiovascular disease, type 2 diabetes mellitus, some cancers, poor skeletal health, and some aspects of mental health (Biddle et al., 2004; Das and Horton, 2012; Lee et al., 2012; Wolin et al., 2010). According to World Development Indicator (World Bank, 2020), worldwide female employment rate increased substantially in the last century. Employment creates a double burden for women as they often take the family responsibilities of unpaid household tasks and childcare due to traditional division of labour. Balancing with daily multiple roles and responsibilities, employment may impact upon the wellbeing of children if, as hypothesized, employed mothers spend less time on household activities centred on children, such as children’s diet and physical activity (Bianchi, 2000; Cawley and Liu, 2012). However, employment may contribute to greater economic opportunities and
resources, which may also enhance health and wellbeing (Waddell and Burton, 2006).

Literature from the USA (Datar et al., 2014; Anderson et al., 2003), U.K. (Hawkins et al., 2008), Canada (Chia, 2008) and Germany (Baten and Bohm, 2010) have demonstrated that children of employed mothers demonstrate a trend towards being overweight due to changes in food intake patterns (e.g., homemade food vs meals from outside, more processed food and ‘junk’ food), reduced physical activity and increased sedentary behaviour. The latter is defined as sitting or lying with low energy expenditure during waking hours (Tremblay et al., 2017). Poorer health behaviours among children (e.g., unhealthy dietary patterns, physical inactivity, sedentary behaviours) serve as gateways towards poorer health trajectories and increased health comorbidities in adulthood, including being overweight and obese (Mu et al., 2017). Childhood adiposity as well as physical inactivity and sedentary behaviour among children; represent key modifiable risk factors, to enhance both current and future health outcomes (Raynor et al., 2012).

There has been a visible shift in women’s employment in low to middle-income countries (LMIC) over the past two decades (Dodzin and Vamvakidis, 2004; Lopez-Arana et al., 2013). The increase in women’s participation in the labour force parallels the increasing prevalence of overweight among children (BMI Z-score > 2), which is believed to occur as a result of the country’s nutrition transitions (referred to as characteristic changes in food and physical activity patterns that occur as a result of macro-level changes in economic development, globalization and urbanization) (Lopez-Arana et al., 2013). While the literature confirms that children of working mothers in developed countries demonstrate a trend for being overweight (Datar et al., 2014; Anderson et al., 2003; Baten and Bohm, 2010), research related to dietary patterns, physical activity and sedentary behaviour of children in LMICs are scarce to confirm any definite relationship. Thus, the relationships between maternal employment and children’s dietary patterns, physical activity and sedentary behaviour are largely unexplored in LMIC.

No systematic review has investigated how dietary patterns, physical activity and sedentary behaviours (in combination) among children are related to maternal employment. Some previous research that has been identified investigated the association of maternal employment with child obesity and discussed solely one or two of these behaviours as influencing factors towards overweight and obesity (Duch et al., 2013; Mech et al., 2016; Hoyos Cillero and Jago, 2010; Shrewsbury and Wardle, 2008). However, not only single behaviours, but the combination of multiple risk behaviours ultimately determines the risk of being overweight or obese. It is already identified that consumption of energy dense foods, low levels of physical activity and high levels of recreational screen use (e.g., TV watching and computer use) are key behavioural determinants of overweight and obesity in children and adolescents (Barnett et al., 2018; Rennie et al., 2005). Dietary and physical activity habits are developed at early stages of life (Savage et al., 2007) and have been tracked into adulthood (Kelder et al., 1994; Tammelin et al., 2014), suggesting the importance of increasing our understanding of the roots and development of these behaviours in children. The relationships among maternal employment and these three key behavioural variables remains largely unknown. Since approximately 40% of the global workforce are women (World Bank, 2020), a comprehensive understanding of association of maternal employment with child dietary patterns, physical activity and sedentary behaviour needs more focus considering its short- and long-term impacts on health and wellbeing trajectories over the life course.

This systematic review aims to identify the association between the dietary habits, physical activity and sedentary behaviour of children, with the employment status of mothers. Our main research question is, therefore, ‘does the employment status of mothers with children aged 6–18 years affect children’s dietary habits, physical activity and sedentary behaviour?’

2. Methods

The research protocol of this study is registered in PROSPERO, an international prospective register of systematic reviews (registration number: CRD4202145438).

2.1. Search strategy

The review followed the protocol of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). Literature searches were conducted using the bibliographic databases of Scopus, PubMed, Science Direct, JSTOR, Google Scholar and ProQuest. For the primary search, no restriction was imposed on publication type, or study design, however, only English language papers were considered. Initial search was applied to title, abstract and key words. For working mothers and physical activity, the following search terms were used: (physical activity OR physical inactivity OR exercise OR sedentary behaviour) AND (maternal work OR working mother OR maternal employ* OR working women) AND (child OR ‘adolescent’ OR youth OR juvenile’). For diet, ‘dietary pattern OR dietary intake OR food intake OR dietary habits OR feeding behaviour’ were used instead of ‘physical activity’ or ‘sedentary behaviour’. Additional literature and document searches were undertaken via backward searching through the key words identified from the literature review and the secondary literature search of the reference lists of all full text articles selected in the primary search. The search strategies are presented in Supplementary Material.

2.2. Inclusion criteria

Studies were incorporated in the present review if they (i) reported on maternal employment status, and dietary patterns (DP), physical activity (PA), or sedentary behaviour (SB) of children aged 6 to 18 years; (ii) were written in English; (iii) published as a peer reviewed journal article, conference paper, or thesis at masters or doctoral level. All research methods, designs, as well as measurement instruments were included. Studies were not considered for inclusion in the systematic review if: (i) the population of the study was only adults, (ii) had obesity or overweight as the focal point of research outcomes, (iii) published as a literature review, (iv) did not provide information about the age of the study population, (v) full text was not available and (vi) was not written in English.

2.3. Study selection and data extraction

All studies identified by database search and additional searches were screened for eligibility based on title, abstract and full text by two independent reviewers (SA and LB). Any disagreements were resolved by discussion with the other reviewers/authors.

The data for each included study were extracted by the first author using a standardized extraction form and verified by other authors. Data were extracted on: (1) characteristic of publication [title of the article, author(s), year, country/data source, study design], (2) sample characteristics [sample size, age/age group, employment status/working hours], (3) primary and secondary outcomes as well as measurement methods used for dietary patterns, physical activity and sedentary behaviour. A narrative synthesis of results of included studies was provided. The number of studies included in the systematic literature review were too diverse in outcome as well as measurement to pool data to conduct a meta-analysis.

2.4. Coding associations with dietary outcome, physical activity and sedentary behaviour

Studies with significant associations identified between maternal employment and domains of dietary patterns, physical activity and
sedentary behaviour were not discussed unless three or more studies were available (for each category) (Sallis et al., 2000). Conceptually similar domains were combined if there were not enough studies to examine the domains individually. For example, ‘snack food including fast food & junk food’ domain combined fast food, junk food and processed food. Domains relating to physical activity in included studies were too diverse to report on separately, thus conceptually similar domains were aggregated as moderate to vigorous intensity physical activity (MVPA).

Studies with significant associations between maternal employment and variables (dietary patterns, physical activity and sedentary behaviour) were included in the ‘Related to maternal employment’ column of Table 2; and associations were classified and coded as: positive association (+), negative association (–). Studies reporting no significant associations were entered in the “Unrelated to maternal employment” column. The coding process was completed following the rules used by Sallis et al. (2000). Studies with low risk of bias scores are presented in bold numbers in the Table 2. Included studies typically used univariate tests for assessing the statistical significance of associations. However, even if multivariate tests were conducted, univariate tests were reported for consistency across studies to ensure meaningful comparisons of key findings.

2.5. Summary codes

Numbers in the second and the fourth columns of Table 2 refer to the study numbers in Table 1. Studies that examined multiple domains of dietary patterns, physical activity or sedentary behaviour, multiple associations with maternal employment were recorded. The column ‘number of samples’ includes the number of samples that have been studied for each identified domain. The ‘Summary’ column contains a code to summarize the state of the domain for that variable. After assessing all the studies, calculating the percentages of findings supporting the overall association, each domain was classified as no association (0%–33% of studies supporting the association), indeterminate/ inconsistent (34%–59% of studies supporting the association) and positive or negative association (60%–100% of studies supporting the association) and coded as ‘0’, ‘?’ and ‘+/-’ respectively. These rules for classifying variables strength of evidence and direction of association are in accordance with Sallis et al. (2000).

2.6. Risk of bias

Risk of bias of the included studies was assessed using a modified version of Cochrane Collaboration tool adopted for observational studies following Higgins et al. (2011), and the JBI Critical Appraisal Checklist was used for the qualitative study. The adapted tool of Cochrane Collaboration has been used in prior studies (Poitras et al., 2016; Prince et al., 2017; Castro et al., 2018). The tool for observational studies focused on six potential sources of bias: selection bias (sampling method), performance bias (measurement of maternal employment), detection bias (measurement of DP, PA, SB), attrition bias (completeness of outcome data), selective reporting bias (selective outcome reporting), and other bias (control for confounding). Each type of bias was marked as “high”, “low”, or “unclear” according to pre-specified criteria. The comprehensive explanation of these criteria is provided in the supplementary document. One reviewer (SA) assessed the risk of bias score while the other reviewers verified these by assessing randomly selected 2 studies each and discussed any conflicting results (initially 83% consistency was attained between reviewers). Further disagreements were resolved through team discussion. The overall risk of bias score was determined by summing the total number of criteria marked as ‘low risk of bias’, ‘high risk of bias’ and ‘unclear risk of bias’ according to the pre-established criteria. The JBI Critical Appraisal Checklist was used to assess the quality of the qualitative study based on study methodology. The corresponding score (out of 10 with 10 the highest) and the JBI Level of Evidence of Meaning (range from 1 to 5 with 5 the lowest) was applied. (Detail documents are available in supplementary files).

3. Results

The search of bibliographic databases yielded 14,306 potentially relevant citations, with a further 88 identified through the secondary backward reference searching. Full text papers were reviewed for 108 studies, of which 68 were excluded. A further two papers were identified from reviewing reference lists of included papers, providing a total of 42 papers for the review, as shown in Fig. 1. The papers were published between 1984 and 2020, with 95.2% published in 2000s (see Fig. 2). Most studies were peer-reviewed journal articles (85.7%), with others being theses (9.5%), conference papers (2.3%), and working papers (2.3%). Results showed an association of maternal employment with all three variables of dietary patterns, physical activity and sedentary behaviour in 9.5% papers, while 59.5% of studies focused on any one of the three variables. The remaining studies (30.9%) included a combination of two variables (dietary pattern-physical activity; dietary pattern-sedentary behaviour or physical activity-sedentary behaviour). This review identified 10 domains for dietary patterns, two for physical activity and four for sedentary behaviour.

3.1. Maternal employment and dietary patterns

Among the 42 studies included in the review 26 assessed dietary patterns, with 11 assessing dietary patterns using standard dietary pattern questionnaires, three with 24 h dietary recall, two studies used 3-day food diaries, four used food frequency questionnaires (FFQ), two used a healthy eating index (HEI), two used a youth and adolescent food frequency questionnaire (YAFQ) and Global school based student health survey (GSHS) questionnaire, and 2-day food diary each were used by one study. Ten studies used self-reporting or parent reporting measures to assess dietary patterns. The review identified ten domains of dietary patterns, and eight were studied three or more times. Snack’s food including fast food & junk food was the most assessed domain of dietary pattern used in 9 studies followed by family meals assessed in 8 studies. Four studies (Bauer et al., 2012; Datar et al., 2014; Gaiya et al., 2009; Meyer, 2016) among nine reported an increase in snack food consumption when the mother was in full-time employment, three studies (Brown et al., 2010; Sweeting and West, 2005; Taylor et al., 2012) reported no association, and two studies (Adhi et al., 2017; Pearson et al., 2009) reported a negative association with employment status of the mother. Family meal (eating together and meals with family members) had a negative relationship with maternal employment in seven (Anderson, 2012; Bauer et al., 2012; Chang and Lee, 2012; Chang, 2012; Gwozdz et al., 2013; Nadia, 2012; Neumark-Sztainer et al., 2003) out of eight papers, with one (Nie and Sousa-Poza, 2014) showing no association. Maternal employment was negatively associated with children’s fruit and vegetables consumption in five studies (Bauer et al., 2012; Datar et al., 2014; Meyer, 2016; Nadia, 2012; Sethi et al., 2014) and one study (Taylor et al., 2012) reported no association. Maternal employment was negatively associated with children’s juice, soda, and soft/sports drinks consumption in one sample (Nadia, 2012), positively in one sample (Datar et al., 2014) and no association in another study (Taylor et al., 2012). Healthy eating habits was negatively related to maternal employment in three studies (Bauer et al., 2012; Nadia, 2012; Sweeting and West, 2005) and positively related in one study (Honajee et al., 2012). Five studies (Chowhan and Stewart, 2014; Fitzsimons and Pongiglione, 2019; Gaiya et al., 2009; Nadia, 2012; Shuhaimi and Munandy, 2012) reported a negative relationship with maternal employment for eating meals regularly.

Dietary quality showed a positive relationship with maternal employment in one study (Touliatos et al., 1984), a negative relationship in two studies (Ben-Shalom, 2010; Li et al., 2012) and was unrelated in another study (Taylor et al., 2012). Maternal employment was...
Table 1
Characteristics of included studies, along with the results of the study quality assessment for each study (n = 42).

| Study | Type of country | Study design | Sample size, source of data, recruitment method | Empirical method / Theoretical framework | Measure of maternal employment | Measure of dietary patterns (DP) | Measure of physical activity (PA) | Measure of sedentary behaviour (SB) | Association with maternal employment | Risk of bias |
|-------|----------------|-------------|-----------------------------------------------|------------------------------------------|-------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------------|------------|
| Brown et al., 2010 (1) Australia | HIC | Cross sectional | 6–7 years (n = 4464) Child cohort of the second wave of the Longitudinal Study of Australian Children (LSAC) | Path model (multiple regression analysis) | Full-time employment < 34 h per week, part-time 1–34 h per week. Part-time employed 44% | Interview with 24 h diary of consumption | Interview with 24 h dairy (Walk for travel or fun, ‘ride bike, trike etc for travel or fun, ‘other exercise (e.g., swim, dance, run about) | Interview with 24 h dairy on watching TV, video, DVD or movie | Mother’s part time working status is negatively associated to television viewing and snack food consumption | Low risk of bias |
| Vazquez-Nava et al., 2013 (2) Mexico | UMIC | Cross sectional study | 6–12 years (n = 897) Randomly selection | Logistic regression | Self-reported employment status. Employed mother = 38.8% | Interview on dietary habits | Interview on sports practice. | Interview on play minutes per session / week and TV watching, video games. | Maternal employment had positive association with sedentary lifestyle | High risk of bias |
| Adbi et al., 2017 (3) India | LMIC | Cross-sectional study | 13–17 years (n = 1416) Data collected from three public schools. 7–9 years (n = 100) Data collected from two govt. schools. | Simple chi-square test and multinomial logistic regression | Self-reported employment status | Self-administered GHSQ questionnaire | – | – | Adolescents’ junk food intake was negatively related to working mothers | Low risk of bias |
| Sethi et al. (4) India | LMIC | Observational study | 7–9 years (n = 100) Data collected from two govt. schools. | Descriptive statistics | Self-reported employment status. Working mother = 70% | Interview with 24 h dietary recall method | – | – | Children food intake had negative association with working mothers | High risk of bias |
| Park et al. (5) South Korea | HIC | Qualitative | 10–16 years (n = 26) Data collected from 26 schools. 11–18 years (n = 4746) Data collected from 31 schools. | Thematic analysis (5 principal themes) | Self-reported employment status | In-depth interviews and focus group discussions | – | – | Eating out and minimal breakfast is positively related to maternal employment. | Low risk of bias |
| Neumark-Sztainer et al. (6) USA | HIC | Cross-sectional | 11–18 years (n = 4746) Data collected from 31 schools. | Cross tabulations, log-linear modelling, and linear regressions. | Self-reported employment status | Survey with YAQ | – | – | Maternal employment was negatively associated with family meal patterns. | High risk of bias |
| Honajee et al., 2012 (7) Mauritius | UMIC | Cross-sectional | 2–11 years (n = 289) | Chi square test and factor analysis. | Self-reported as Professional worker | – | – | – | Healthier eating of children was significantly and positively associated to maternal employment. | Unclear risk of bias |
| Fitzsimons and Pongiglione, 2010 (8) UK | HIC | Longitudinal cohort study | 9 months – 14 years (n = 7, 894) | OLS and FE linear probability models | Self-reported employed if work in the last week or had a job and did not work in the past week for reasons other than parental leave. Part-time employment – 1 and 34 h, full-time – 35 h or more. | Interview about regularity of breakfast on every weekday | – | Interview on TV watching (exceeding three hours per weekday) | Children of employed (both part- and full time) mother watch more TV and less likely to have regular breakfast. | High risk of bias |
| Cho, 2017 South Korea (9) | HIC | Cross sectional study | 14.2 years (n = 1,873) Stratified multi-stage | OLS regression, logistic regression | Mothers reported their daily start and end times at work. Average | – | Interview on average hours per week in vigorous exercise | Watching TV/video/DVD and playing electronic (computer) | Longer working hours of mothers was positively associated to TV/Video/ | Low risk of bias |

(continued on next page)
| Study                        | Type of country | Study design          | Sample size, source of data, recruitment method | Empirical method / Theoretical framework                                                                 | Measure of maternal employment | Measure of dietary patterns (DP) | Measure of physical activity (PA) | Measure of sedentary behaviour (SB) | Association with maternal employment | Risk of bias |
|------------------------------|-----------------|-----------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------|
| Maher et al., 2017 (10) USA  | HIC Longitudinal study | 8–12 years (n = 191) Students were recruited from school. | Linear regression model and Hochberg Procedure (to reduce Type I error). | Self-reported work hours per week calculated as \[\frac{(\text{Weekend work hours} \times 2) + (\text{Weekday work hours} \times 5)}{7}\] | –                             | Accelerometer measures MVPA    | Accelerometer                      | Maternal employment status did not increase child physical activity or sedentary behaviour. | Low risk of bias                  |
| Chowhan and Stewart, 2014 (11) Canada | HIC Cross-sectional study | 12–17 years (n = 3591) | Linear probability model, FE and instrumental variable models. | Weeks employed in the previous year and the usual hours worked during each of those weeks | Interview on eating habits (eating breakfast every day) and allowance | Interview on Sports, gym class, dance, gymnastics, karate or other groups or lessons | Interview on average daily hours spend watching TV | More working hours of mother was positively related to TV viewing and negatively related to eating breakfast daily. More weeks worked by the mother was negatively related to TV viewing and positively related to physical activity. | High risk of bias |
| Ziol-Guest et al., 2013 (12) USA | HIC Cross-sectional study | 10.01 years (n = 370) Data collected from students at elementary schools. | One-way analysis of covariance tests, chi-square tests and multinomial logistic regression | Self-reported. Employed mother = 53.5% | Self-reported eating behaviour | Self-reported exercise | Self-reported screen time (time spent on TV/video/computer/video games) | Children of working mothers had significant positive association with screen time. | High risk of bias |
| Touliatos et al., 1984 (13) USA | HIC Cross-sectional study | 10–13 years (n = 90) Data collected from school. | Factor analysis | Self-reported. Employed mother = 66% | Interviewed with 24 h recalls of dietary intake | – | – | Interview on TV watching (Average number of hours) | More maternal working hours are positively associated with hours of TV watching. Maternal employment and child dietary quality had positive association | Low risk of bias |
| Gaina et al., 2009 (14) Japan | HIC Cross-sectional study | 12–13 years (n = 10453), Data collected from high school children. | t-test and \(\chi^2\) analyses (or Fisher’s exact test), Binomial logistic regression | Self-reported. Full time employed mother = 50.7%; part time = 32.7% | Self-reported eating meals regularity, meals speed and amount | Self-reported physical activity measured in hours per week | Self-reported TV watching time and room tenure | Mothers’ employment has no effect on breakfast. Children of full-time employed mothers skip dinner. Children of part-time employed mothers snacked more, eat dinner regularly and eat larger meal portions compared with children of full-time employed mothers. Children non-employed mothers eat faster. | High risk of bias |
| HIC Longitudinal study | 0–12 years (n = 1127) | Individual FE and IV regressions | – | – | – | Self-reported time use survey on 24-hour | – | Low risk of bias |

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Table 1 (continued)

| Study                     | Type of country | Study design | Sample size, source of data, recruitment method | Empirical method / Theoretical framework | Measure of maternal employment | Measure of dietary patterns (DP) | Measure of physical activity (PA) | Measure of sedentary behaviour (SB) | Association with maternal employment | Risk of bias |
|---------------------------|-----------------|--------------|-----------------------------------------------|------------------------------------------|-------------------------------|----------------------------------|----------------------------------|-----------------------------------|--------------------------------------|-------------|
| Hsin and Felfe, 2014 (18) | USA             | HIC Cross sectional study | Adult Sample: n = 2893. | Linear regression models, generalized estimating equations | Working full-time; working part-time; stay-at-home caregiver; currently unemployed but actively seeking work; and not working for pay. Full-time employed mothers = 46% | – | – | – | association with children’s unstructured activities (watching television, listening to music, and unspecified leisure activities) | Low risk of bias |
| Bauer et al., 2012 (17)   | USA             | HIC Cross sectional study | Adolescent recruited from middle and high schools. n = 2893. | Linear regression models, generalized estimating equations | Interview on family meal with questionnaire | – | – | – | Full-time employment of mothers had negative association with family meals, positive with fast food family meal and negative with fruit and vegetable intake. | High risk of bias |
| Li et al., 2012 (18)      | Australia       | HIC Longitudinal study | 1–14 years (n = 1629) | Multivariate linear regression models | Not working, working 1–15 h, 16–24 h, 25–34 h or ≥ 35 h (full time) weekly. | Self-reported Semi-quantitative FFQ for dietary intake | – | – | Increasing working hours of full time employed mothers were negatively associated with diet quality. | High risk of bias |
| Sweeting and West, 2005 (19) | Scotland    | HIC Cross-sectional study | 11 years (n = 2146) Data collected from school. | Logistic regression | Self-reported as full-time home maker, part-time work, full-time work and unemployed | Self-reported Questionnaires on healthy eating habits | – | – | The likelihood of less healthy eating is lower for the children of part-time mothers. Unhealthy snacking was not associated to maternal employment. | High risk of bias |
| Morrissey et al., 2011 (20) | USA           | HIC Observational study. | 3rd, 5th and 6th grade (N = 990) | RE and within-child FE regressions. | Self-reported | – | Physical activity monitor (seven consecutive days during a typical school week) | Interview on watching TV | Grade 3 children of employed mother watched an average of 15.2 h of television per week and spent about one-fifth of their time in moderate or vigorous physical activity. 5th and 6th grade children of employed mother had poorer food choices and more sedentary activity relative to younger age. Weekly hours worked by the mother was positively associated with probability of watching more hours of television or video programs per day. Mother’s weekly working hours is positive and statistically significant with regular | High risk of bias |
| Chia, 2008 (21)           | Canada         | HIC Cross sectional study | 6–11 years (n = 4107). | OLS regression. Reduced form equation | Average number of hours of paid work per week | – | Interview on organized and non-organized sports | Interview on watching TV and videos | Weekly hours worked by the mother was positively associated with probability of watching more hours of television or video programs per day. Mother’s weekly working hours is positive and statistically significant with regular | High risk of bias |
| Study                                | Type of country | Study design          | Sample size, source of data, recruitment method | Empirical method / Theoretical framework | Measure of maternal employment | Measure of dietary patterns (DP) | Measure of physical activity (PA) | Measure of sedentary behaviour (SB) | Association with maternal employment | Risk of bias |
|--------------------------------------|-----------------|-----------------------|------------------------------------------------|----------------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|----------------------------------|--------------|
| Chang and Lee, 2012 (22) South Korea | HIC Cross sectional study | 10 or older (n = 14228) | Two-part regression model of time (The first part regression used Probit and the second part was estimated OLS) | Local unemployment rates as instrumental variables | Self-reported Two-day time diaries | Self-reported two-day time diaries on supervising or playing with children | – | – | Participation in organized sporting activities, Mothers employment had negative association with family meals, and supervision of children’s physical activity | Low risk of bias |
| Chang, 2012 (23) USA                 | HIC Cross sectional study | 12–17 years (n = 637) Stratified random sampling. Survey data collected from school | Multivariate multilevel linear regression | Average number of working hours per week. | Family dinner | Number of glasses of juice drink, number of times soda pop/sport drinks/fruit drinks drank, number of times green salad, carrots, other vegetables, fruits, and fast food eaten in last week. | Number of days per week of 20 min exercise. | TV watching | Children’s TV-watching hours were not associated with Primary Care Givers’ employment status | High risk of bias |
| Nadia (2012) (24) USA               | HIC Cross sectional study | Fifth grade (average age of children is about 10 years). Data (survey) collected from school | Ordered Probit. | Number of hours worked per week. Full time employment > 20 h per week. | Self-reported and employed. | Self-reported children’s three-days food intake record | – | – | Maternal full-time employment was positively associated to watching TV and negatively to number of times child drank juice, ate carrots, other vegetables, fruits, and number of times child ate dinner regularly. | High risk of bias |
| Shuhaimi and Muniandy, 2012 (25) Malaysia | UMIC Cross sectional survey | 4–6 years (n = 142) Data collected from 7 Kindergarten. | Two-way ANNOVA, Pearson rank correlation. | Self-reported as unemployed and employed. | – | – | – | – | Negative association was found between maternal working hours and child’s energy, protein and fat intake; breakfast eating | Low risk of bias |
| Aniza I et al., 2009 (26) Malaysia   | UMIC Cross sectional study | 14 and 16 years (n = 519) Data collected from secondary school students | Bivariate analysis and logistic regression | Self-reported employment status | – | – | – | Maternal employment had positive association with physical activity | Low risk of bias |
| Martin et al., 2016 (27) USA        | HIC Longitudinal study | 12–18 years (n = 10,518) | FE and cross-sectional model. | Hours a week does s/he work for pay | – | – | Self-reported weekly hours of watching television, videos and playing video or computer games. | – | Positive association of screen time with mothers’ work hours and mothers’ unemployment. | High risk of bias |
| Meyer, 2016 (28) Germany             | HIC Cross-sectional study. | 9–12 (n = 2447) | OLS, linear probability model, 2SLS and IV estimate. | Self-reported employment status | Self-report on combined measure of eating raw and cooked vegetables. | Self-reported frequency of physical activity (exercise) 3 times per week | Self-reported hours of watching TV/ playing video games per day. | – | Maternal full-time employment has positive relation to unhealthy dietary habits (lower consumption of fruits and vegetables, and a higher consumption of soda drinks and processed food) and | High risk of bias |
Table 1 (continued)

| Study                        | Type of country | Study design          | Sample size, source of data, recruitment method | Empirical method / Theoretical framework | Measure of maternal employment                                             | Measure of dietary physical activity (PA)                                                                 | Measure of sedentary behaviour (SB) | Association with maternal employment | Risk of bias |
|------------------------------|----------------|-----------------------|-------------------------------------------------|------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------------|----------------|
| Nie and Sousa-Pozza, 2014    | UMIC           | Longitudinal study    | 3–17 years (n = 2618)                           | OLS and quantile regressions.            | Hours worked during the past week                                         | Self-reported dietary patterns: meals at home and caloric intake                                                              | Self-reported total amount of time spent watching TV, playing video games and activity behaviour | Maternal working status is not significantly associated with caloric intake, meals at home, physical exercises, and/or sedentary activities. | High risk of bias |
| Anderson, 2012               | HIC            | Longitudinal study    | Kindergarten to eighth grade.                   | Probit model                            | Working hours per week.                                                   | Regularity and frequency of eating meals at home, fast food, and eat snacks at school                                       | Family rules and actual amounts of television viewing (h/week)                                  | Positive association of maternal employment on children’s organized activities and more working hours were negatively correlated with regular family meals, regular meal-times, and rules about television watching. | High risk of bias |
| Taylor et al., 2012          | HIC            | Cross sectional study.| 5–15 years (n = 614), Random sampling.          | Univariate/multivariate logistic regression | Full-time or part-time employment was determined according to a cut-off of 35 h per week.| Data collected via telephone monitoring system on fruit and vegetables, processed meat; fast food; potatoes; juice; water; and soft/sport drink | Telephone interview (CATI) on physical activity included the time spent per day doing organised sport. Proxy interviews for persons under the age of 16. | No significant relationship was found between diet quality and maternal employment.              | High risk of bias |
| Koca et al., 2017             | UMIC           | Cross sectional study.| 6–18 years (n = 7116), Random sampling.          | Multiple linear regression analysis     | Self-reported. Working mother 39.5%                                       | Self-reported out-of-school physical activity (activity by the child either alone, in sports clubs, or with family or friends) | --                                                                               | Children of working mothers are more active.                                    | Low risk of bias |
| Ben-Shalom, 2010              | HIC            | Cross sectional study.| 0–18 years + household production (Becker 1965)  | Becker’s model of household production  | Full-time employment ≥ 35 h worked per week                              | Parents interview on the HEI and important nutrients                                                                     | Parents interview on TV watching hours/week                                                   | In married couple family’s food-intake quality decrease with maternal employment, but this association is weaker for single mother families (first study) and children are more likely to get rapid exercise when their mothers work more hours per week (second study). | High risk of bias |
| Gwozdz et al., 2013           | Cross sectional study | 5–9 years (n = 7000)  | Multiple regression and Full-time employment. Full-time |                           |                                                                         |                                                                                                                               |                                                                         | Maternal employment had negative association.                                           | Low risk of bias |
| Study | Type of country | Study design | Sample size, source of data, recruitment method | Empirical method / Theoretical framework | Measure of maternal employment | Measure of dietary patterns (DP) | Measure of physical activity (PA) | Measure of sedentary behaviour (SB) | Association with maternal employment | Risk of bias |
|-------|----------------|-------------|-----------------------------------------------|------------------------------------------|-------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|-----------|
| Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain and Sweden Datar et al (2014) (35) USA | Both HIC & UMIC (Estonia) | Longitudinal study | Data collected from 390 kindergartens and school. | quantile regression. | employment ≥ 35 h worked per week; part time employment < 35 h per week and not in paid employment. | Self-administered Youth Healthy Eating Index | Uniaxial accelerometry (Non structured activities) | with children’s calorie intake and positive to physical activity | Low risk of bias |
| Parker, 2007 (36) USA | HIC | Cross sectional study | 5–18 years (N = 260) | Cronbach’s Alpha, Pearson correlations and one-way ANOVA. | Self-reported employment status as full time, part time, and not employed | – | Daily step count using pedometer | Association of maternal employment and children’s physical activity was not statistically significant. | High risk of bias |
| Rabeeq and Arshad (2020) (37) Pakistan | LMIC | Cross sectional study | 5–10 years (n = 250) | Tabular analysis | Self-reported as working and stay at home mothers | – | – | TV watching | Children of working mothers follow the rules about the time duration of watching television more compared to the children of home-maker mothers. | High risk of bias |
| Ferrari et al. (2016) (38) Brazil | UMIC | Cross sectional study | 10 years (n = 328) | Multilevel linear regression model | Self-reported employment as none, less than part time, part time, or full time | FFQ | MVPA using an Actigraph GT3X + accelerometer | TV, video game, and computer time | Children MVPA was negatively associated with maternal employment (mothers who worked part time or less had less MVPA than children whose mothers worked full time). | High risk of bias |
| Pearson et al. (2009) (39) Australia | HIC | Longitudinal | 12–15 years (n = 1884) | Logistic regression and multinominal logistic regression model | Maternal employment – full-time, part-time or not in paid employment | Online survey by FFQ | – | – | Girls of part time employed mothers or not in paid employment had an inverse association with their snack and fast-food consumption. | Low risk of bias |
| Wijtzes et al. (2014) (40) Netherlands | HIC | Cross sectional study | 6 years (n = 4726) | multiple logistic regression | Employment – no paid job, paid job, part-time [< 36 h /week], paid job full time [>=36 hours/week] | Parent-reported children’s sports participation (yes, no) and outdoor play. | – | – | Children’s sports participation was negatively associated with maternal unemployment. | Low risk of bias |
| Lopoo (2007) (41) USA | HIC | Longitudinal | 15 years (n = ) the 1996 Survey of Income and Program Participation | Logit and fixed-effects logit models | Mother worked ≤ 30 h and mother worked >30 h, | – | Self-reported after school activities (sports, lesson) | A positive relationship between maternal work hours and sports participation. | Low risk of bias |
### Table 1 (Continued)

| Study | Type of country | Sample size, source of data, measurement method | Empirical method/ Theoretical framework | Analysis of variance | Measure of maternal employment | Measure of occupational domain | Measure of dietary patterns (DP) | Measure of physical activity (PA) | Measure of sedentary behaviour (SB) | Association with maternal employment | Measure of maternal employment | Measure of dietary patterns (DP) | Measure of physical activity (PA) | Risk of bias | Measure of maternal employment | Measure of dietary patterns (DP) | Measure of physical activity (PA) | Measure of sedentary behaviour (SB) | Association with maternal employment |
|-------|----------------|-----------------------------------------------|--------------------------------------|---------------------|-----------------------------|-------------------------------|--------------------------------|---------------------------------|---------------------------------|----------------------------------|-----------------------------|---------------------------------|---------------------------------|----------------|-----------------------------|---------------------------------|---------------------------------|---------------------------------|----------------------------------|
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
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|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
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|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
|       |                |                                               |                                      |                     |                             |                               |                                 |                                 |                                 |                                 |                             |                                 |                                 |                 |                             |                                 |                                 |                                 |                                 |
Fitzsimons and Pongiglione, 2019; Ham et al., 2013; Hsin and Felfe; 2014; Maher et al., 2017; Martin et al., 2018; Meyer, 2016; Morrissey et al., 2011; Nadia, 2012; Nie and Sousa-Poza, 2014; Raheeq and Arshad, 2020; Richards and Duckett, 1994; Vazquez-Nava et al., 2013; Ziol-Guest et al., 2013) reported an association between sedentary behaviour and maternal employment. Four domains of sedentary behaviour were identified, with three domains studied three or more times. Watching Television (TV) was the most assessed sedentary behaviour (n = 13). Among the studies assessed TV watching, eight reported a positive association (Datar et al., 2014; Chia, 2008; Chowhan and Stewart, 2014; Fitzsimons and Pongiglione, 2019; Morrissey et al., 2011; Nadia, 2012; Richards and Duckett, 1994; Ziol-Guest et al., 2013), three reported a negative association (Anderson, 2012; Chowhan and Stewart, 2014; Parker, 2007) and two study reported no association (Chang, 2012; Nie and Sousa-Poza, 2014) with maternal employment. Screen time (TV, DVD, video, movie, playing video or computer games) was the second most assessed sedentary behaviour (n = 6). In these studies, five (Cho, 2017; Ham et al., 2013; Martin et al., 2018; Meyer, 2016; Vazquez-Nava et al., 2013) reported a positive association with screen time and maternal employment and one paper (Brown et al., 2010) reported a negative association. Average minutes of sedentary behaviour was assessed in three studies, with two (Maher et al., 2017; Nie and Sousa-Poza, 2014) reporting no association and one (Hsin and Felfe, 2014) a negative association with maternal employment. The effect of intensity of maternal employment on children’s sedentary behaviour was reported in 5 studies (Brown et al., 2010; Fitzsimons and Pongiglione, 2019; Hsin and Felfe; 2014; Meyer, 2016; Nadia, 2012). Three studies (Fitzsimons and Pongiglione, 2019; Meyer, 2016; Nadia, 2012) reported a positive association of full-time maternal employment with two domains (watching TV and screen time) of sedentary behaviour. TV watching was reported both positive (Fitzsimons and Pongiglione, 2019) and negative (Brown et al., 2010) association with part time maternal employment. Average minutes of sedentary behaviour was negatively related with full-time maternal employment in one study (Hsin and Felfe; 2014).

In sum, 13 samples reported positive, 5 samples negative, and 4 samples reported no association between children sedentary behaviour and maternal employment.
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3.4. Differences in outcome between countries differing in income status

The World Bank’s income classification of countries was used in this review. Based on this classification, 32 of 42 reviewed studies were from HIC, 7 from UMIC, and 3 from LMIC. Table 3 summarizes the associations between maternal employment and dietary patterns, physical activity and sedentary behaviour in high-, upper-middle and lower-middle income countries. The association of dietary patterns, physical activity and sedentary behaviour showed an indeterminate relationship with maternal employment in LMIC and UMIC. Twenty-six studies examined dietary patterns in HICs with the majority from the USA (n = 16). The association between “healthy dietary patterns of children in HIC” were indeterminately related to maternal employment. Physical activity and sedentary behaviour were found to have positive associations with maternal employment in HIC. Eight out of thirteen studies reported positive associations between children’s physical activity and maternal employment. Twenty-one studies reported sedentary behaviour, with 14 positively related to maternal employment.

3.5. Risk of bias assessment

Across all studies, 57.1% (n = 24) had high risk of bias score. The remaining 40.5% studies (n = 17) were classified as low risk of bias score, while 2.4% (n = 1) had unclear risk of bias. Concerning each criterion of risk of bias for observational studies, 56.1% of studies (n = 23) used probability sampling methods and were hence identified as low risk of bias. The majority of the studies (70.8%) had high risk of performance bias as most cases of ‘maternal employment’ were measured using non-validated tools. Similar to performance bias, over half of detection bias (51.2%) had high risk for using non-validated measures for dietary patterns, physical activity and sedentary behaviour. Over one third of studies (41.5%; n = 17) did not manage < 20% of missing data and were marked as high risk for attrition bias. One third of studies (34.1%; n = 14) did not provide any reasons for missing data and were identified as unclear risk of attrition bias. Reporting bias is low for two-thirds of the studies (70.7%; n = 29) and 17.1% (n = 7) had high risk of reporting bias. Nearly two-thirds of studies (63.1%; n = 26) reported about the statistical methods to control for potential confounding factors, and hence were coded as low risk of bias; and 22% (n = 9) did not provide sufficient information regarding confounding factors. Detailed risk of bias results is available in the supplementary material.

Effect size is measured for individual studies. Effect sizes ranged from –0.08. to 3.8. Majority of studies fail to produce medium to large effect size.

4. Discussion

The aim of this systematic review was to determine whether maternal employment was associated with children’s health behaviours, specifically dietary patterns, physical activity, and sedentary behaviour. A wide range of domains for these behaviours among children within HIC and LMIC were identified. These domains were assessed using various tools and the association with maternal employment was varied. The review shows that the number of studies on these lifestyle variables among children related to maternal employment has expanded in the last two decades, with two studies between 1980s and 1990s, and all remaining studies published in the 2000s.

Results showed that maternal employment was inversely associated with children’s family meals (Anderson, 2012; Bauer et al., 2012; Chang and Lee, 2012; Chang, 2012; Gwozdz et al., 2013; Nadia, 2012; Neumark-Sztainer et al., 2003), fruits and vegetables consumption (Bauer et al., 2012; Datar et al., 2014; Meyer, 2016; Nadia, 2012; Sethi et al., 2014), healthy eating habits (Bauer et al., 2012; Gwozdz et al., 2013; Sweeting and West, 2005), eating meals regularly (Chowhan and Stewart, 2014; Fitzsimons and Pongiglione, 2019; Gaina et al., 2009; Nadia, 2012; Shuhaimi and Muniandy, 2012), and energy/calorie, protein, and fat intake (Gwozdz et al., 2013; Shuhaimi and Muniandy, 2012). In dual income families it is expected that maternal employment may allow families to spend more on healthy foods (Lowery et al., 2019), however, employment is likely to create a time constraint for meal

![Fig. 2. The number of studies on the association of maternal employment to DP, PA and SB published per year.](https://example.com/fig2.png)
related behaviours (Devine et al., 2003; Jabs et al., 2007). Studies show that employed mothers spend significantly less time in meal preparation (Beshara et al., 2010; Cutler et al., 2003) and consume more meals prepared away from home (Kant and Graubard, 2004). Their children are less likely to eat fruits and vegetables (Hawkins et al., 2009) and more likely to skip meals and have unfixed snacking time (Watanabe et al., 2010; Cutler et al., 2003) and consume more meals at restaurants (Beshara et al., 2010; Cutler et al., 2003) and eat more meals outside the home (Kant and Graubard, 2004). Hence, time pressures for employed mothers may have a greater detrimental effect on children’s food intake patterns as reflected in fewer family meals, less consumption of fruits and vegetables, less healthy eating habits, and greater irregularity or ‘skipping’ of meals (breakfast and dinner). Juice, water, soda, soft/sports drinks were found to have no association with maternal employment (Datar et al., 2014; Nadia, 2012; Richards and Duckett, 1994; Sweeting and West, 2005). In addition to this, employed mothers have less time to supervise their children, which creates opportunities for poorer diets and sedentary behaviour (Devine et al., 2003; Jabs et al., 2007). However, monetary support and encouragement to further engage their children into organized physical activity such as active sports clubs (Datar et al., 2014; Gwozdz et al., 2013; Koca et al., 2017; Meyer, 2016; Morrissey et al., 2011) whereas sports participation showed a negative association (Lopoo, 2010; Taylor et al., 2012) in the current review. Overall, it is indicated that children of working mothers were sufficiently physically active. This finding may seem somewhat contradictory. Working mothers bear a double or triple burden of responsibilities at home and at work (Bond and Sales, 2001), and thus may lack sufficient remaining time and energy to more fully supervise and actively engage with their children (Cawley and Liu, 2012; Fertig et al., 2009). However, monetary support from employed mothers may lead a better quality of life. There is evidence that higher socioeconomic status (SES) of families provides more opportunities for their children to do more activities, some of which are physical activities (Park and Kim, 2008; Stalsberg and Pedersen, 2010), and they could financially support the enrollment of their children into organized physical activity such as active sports clubs (Datar et al., 2014; Kantomaa et al., 2007).

In terms of TV watching in children as a sedentary behaviour, most studies reported positive associations with maternal employment (Chia, 2008; Chowhan and Stewart, 2014; Datar et al., 2014; Fitzsimons and Pongiglione, 2019; Nadia, 2012; Richards and Duckett, 1994; Sweeting...
Additional strengths of the review are the inclusion of a detailed summary and critical narrative synthesis of 42 published papers. Additional strengths of the review are the inclusion of all study designs as well as all type of measures of dietary patterns, physical activity and sedentary behaviour. Furthermore, this review included multiple domains of dietary patterns, physical activity and sedentary behaviour.

This systematic review has some limitations. Although we tried to identify as many studies as possible, we may have inadvertently missed some eligible studies due to limited search strategy and beyond published English language studies. Furthermore, a majority of the studies were cross-sectional, thus conclusions regarding causality of association are not possible. Although device-based measures of physical activity and sedentary behaviour are more reliable, only a small number of studies used them. Most studies used self-report or maternal-report data, hence contributing to the possibility of reporting bias. Risk of bias among included studies were relatively high since many studies did not report on the reliability and validity of measures used to assess maternal employment and dietary patterns, physical activity and sedentary behaviour. The diverse nature of measures and outcomes prevented the use of meta-analysis. Conceptually similar domains were combined which may also narrow down the depth of analysis and generalizability of these findings. Though, multivariate tests are more accurate, use of univariate test for assessing statistical significance is a limitation of this study. Finally, most of the studies are from HIC, hence findings may not be similar in the context of LMIC.

5. Conclusion

To our knowledge, this is the first systematic review that summarises the evidence for links between dietary patterns, physical activity, and sedentary behaviour of children with the employment status of their mothers. Findings suggest that maternal employment was associated with poor dietary patterns but more physical activity and more time on sedentary activities. The latter were particularly for TV viewing and other screen-based activities of children. These findings provide an indication of how maternal employment may increase the risk of childhood obesity. We also identified a lack of validated measurers of dietary patterns and few studies using device-based assessment of physical activity and sedentary behaviour. The findings of this systematic review have important implications in the context of growing participation of women in the labour force. Considering that the employment and economic activity of women will continue to increase in the future, interventions should support employed mothers with an aim to promote healthier children’s dietary patterns and decrease sedentary time. Little can be deduced from the inadequately studied domains (for example-milk and milk products, eating out at restaurant, mothers playing with their children, sitting activities (reading-writing, playing musical instruments)), hence future studies need to focus on these domains of dietary patterns, physical activity and sedentary behaviour. Domains that have inconsistent results also require further testing. In addition to this, future research needs to pay attention to UMIC and LMIC because research related to maternal employment and children’s lifestyle variables are scarce in those countries. Moreover, the use of device-based measures of physical activity and sedentary behaviour are needed in order to produce accurate estimates of total time spent in physical activity and sedentary behaviour.

6. Financial support

This research did not receive any financial support from any organization.

7. Ethics approval

N/A

8. Consent

N/A

Table 3

Summary of studies showing the association between maternal employment and dietary patterns, physical activity and sedentary behaviour based on Lower-middle income, Upper-middle income and High-income countries.

| Type of country (number of studies from each country) | Study no | Association | Summary code (% of study) |
|-----------------------------------------------------|----------|-------------|---------------------------|
| LMIC (7.1%) (India – 2, Pakistan = 1) | DP 11, 12 | + | 100% |
| | PA – | 0 | 0% |
| | SB 37 | + | 100% |
| UMIC (16.7%) (China – 1, Mexico = 1, Malaysia = 2, Mauritius = 1 | DP 7 | + | 100% |
| Turkey – 1, Brazil = 1 | PA 26, 31, 32 | + | 100% |
| | SB 29, 28 | + | 100% |
| HIC (76.2%) (USA – 16, UK = 1, Canada = 2, Australasia = 4, Japan = 1, South Korea = 2, Scotland = 1, Germany = 1, Netherlands = 1, 6 European countries = 2) | DP 5, 14, 15, 16, 17, 18, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42 | + | 100% |
| | PA 9, 20, 21, 28, 30, 34, 35, 41, 10, 22, 23, 34, 35, 41, 10, 22, 40, 42, 36 | + | 100% |
| | SB 2, 8, 9, 11, 12, 13, 16, 20, 21, 24, 27, 28, 35, 42, 1, 11, 16, 30, 10, 23, 29 | + | 100% |

and West, 2005; Ziol-Guest et al., 2013). TV viewing has become a preferred leisure time activity of children during unsupervised time (Datar et al., 2014) and the reason may be the unavailability of outdoor facilities or due to safety reasons. Existing literature support positive associations between maternal employment and TV viewing of children (Fertig et al., 2009). Screen time (TV, DVD, video, or movie, playing video/computer games) indicated a positive relationship with maternal employment (Cho, 2017; Ham et al., 2013; Martin et al., 2018; Meyer, 2016). Children and adolescent’s increasing exposure to screen-based activities are evident in other reviews (Thomas et al., 2019). Results show that children of employed mothers were physically active, but at the same time, children spent more time on sedentary pursuits. While this may appear contradictory, it has been shown that physical activity can be independent of how much time children spend in sedentary behaviours over the day (Marshall et al., 2004; Pearson et al., 2014; Sallis et al., 2000). For example, a child can indulge in high levels of MVPA but also in sedentary screen time. Within a 24-h day, time can be displaced to lighter forms of physical activity or sleep.

4.1. Strength and limitations of the study

Applying a comprehensive and systematic approach, this review included a detailed summary and critical narrative synthesis of 42 published papers. Additional strengths of the review are the inclusion of all study designs as well as all type of measures of dietary patterns, physical activity and sedentary behaviour. Furthermore, this review included multiple domains of dietary patterns, physical activity and sedentary behaviour.
9. Availability of data and materials

Data and other material will be provided as supplementary document.

Authors contributions

All authors contributed to the planning and design of the systematic review. The corresponding author performed the literature searches, full text screening, data extraction and analysed, and wrote the first draft of the review. The other authors contributed to the screening of the studies for eligibility, to the risk of bias assessment of studies. All authors reviewed, edited, and approved the final draft. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2021.101607.

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