

Determinants of diet quality among mothers of young children in an urban slum area in Jakarta: Mother's age, vegetables availability, and eating out frequency

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ABSTRACT

Introduction: Poor diet quality is a major issue, and health concerns may be related to diet. Mothers with young children usually have their meals at home; thus, home food environment plays a role in determining dietary behaviours. This study examined the association between health concerns and diet quality among mothers; additionally, the effect of home food environment on this relationship was assessed. **Methods:** This cross-sectional study comprising 229 mothers (aged 19–49 years) with young children was conducted in an urban slum area in North Jakarta. Data were collected via interviews using a structured questionnaire. The General Health Interest Scale and Consumer Behaviour Questionnaire were used to assess health concern and home food environment, respectively. The 24-hour dietary recall method was used to calculate the Diet Quality Index-International (DQI-I) score. Spearman's correlation, multiple linear regression, and path analysis were used to analyse the data. **Results:** Majority of the mothers had poor diet quality (mean DQI-I score, 41.44/100). No significant correlation between health concern and diet quality was observed. After adjusting for age, the relationship between health concern and diet quality was not mediated by vegetables availability or eating out frequency (indirect effect=0.012; $p=0.096$). Multiple linear regression analysis revealed age as a significant predictor of diet quality ($B=0.196$; $p=0.024$). **Conclusion:** Diet quality among mothers of young children differed with age and was related to both health concerns and home food environment. Thus, the development of strategies to promote healthy eating based on different age groups is warranted.

Keywords: diet quality, healthy diet, home environment, mothers

INTRODUCTION

Presently, Indonesia is facing the triple burden of malnutrition, namely stunting, micronutrient deficiencies such as anaemia in women of reproductive age (WRA), and overweight. These nutrition-related problems may be related to diet.

Suboptimal dietary habits comprising high consumption of sugar-sweetened beverages (SSB) and processed meats, as well as inadequate consumption of healthy foods such as fruits and vegetables, whole grains and legumes have been observed worldwide (GBD 2017

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Diet Collaborators, 2019). Unfortunately, the understanding regarding nutrition is widely associated with quantity, rather than quality. In a recent study, the diet quality of Indonesian adult women from two different ethnic groups (Sundanese and Minang) was reported to be poor (Stefani *et al.*, 2018).

Diet quality refers to the intake of foods by an individual, and it is based on several indicators such as diversity and adequacy, which can be used to assess compliance with existing dietary recommendations (Alkerwi, 2014). Poor diet quality has been associated with a higher risk of obesity and non-communicable diseases (NCDs), particularly in women (Sundararajan *et al.*, 2014). Thus, a healthy, high quality diet that leads to optimal health and nutritional status should be considered as an important step for WRA who are going to be mothers in the future. Maternal diet is known to be a predictor of a child's diet. A recent study showed a positive association between mother's and child's intake of foods from the same food groups such as fruits, vegetables, saturated fats, and added sugars (Kueppers *et al.*, 2018). Thus, it was highlighted that promoting a mother's diet might prove beneficial in improving the diet of a child.

Health concern is one of several factors used to determine diet quality and refers to an individual's perception about health-related issues, including nutrition. A study in Luxemburg reported a direct association between nutritional awareness and diet quality among adults (Alkerwi *et al.*, 2015). Additionally, a study among Taiwanese college students showed that the relationship between health concern and healthy eating attitudes was partially mediated by food choice motives (Sun, 2008). Presently, the food environment is considered a crucial factor that can influence diet. It consists of several

aspects (physical, political, economic, and socio-cultural) that exist at both the macro-level (community) and micro-level (household) (Rosenkranz, 2008). In developed countries, modifications of the home food environment have been proposed as a strategy for obesity prevention and management, especially in children (Robson *et al.*, 2019). Food availability at home was reported as a mediator between the children's diet and maternal nutrition knowledge (Campbell *et al.*, 2013), as well as maternal healthy eating schema, i.e. how mothers define themselves in terms of healthy eating (Kueppers *et al.*, 2018). However, this relationship is not well understood among adults, particularly among mothers in developing countries and specifically among those living in urban slum areas. In 2018, 30.6% of the Indonesian urban population were reported to be living in slums (World Bank, n.d.). In Jakarta, 445 out of 520 screened hamlets were classified as slum areas (BPS Provinsi DKI Jakarta, 2017). These findings indicated that there is a large proportion of low socioeconomic communities living in the urban areas of Indonesia. Urban slum areas in Indonesia, particularly Jakarta, are known to have abundant food stores that could promote unhealthy eating (Sufyan *et al.*, 2019).

To the best of our knowledge, the degree of health concern or health consciousness among mothers of young children, particularly in urban slum settings, is rarely discussed. Understanding the level of importance given to health and nutrition among mothers would aid in delivering the appropriate level of education to improve their dietary behaviours. Thus, this study aimed to examine the association between health concern and diet quality among mothers of young children, and to determine the effect of home food environment on this relationship.

MATERIALS AND METHODS

Study design, sampling procedures and sample size estimation

This observational cross-sectional study was conducted in Indonesia from November 2019 to March 2020. The Jakarta province was chosen as a representative of urban areas in Indonesia because of high prevalence of overweight and obesity, as well as a large proportion of slum areas. The sub-district of North Jakarta and the urban village of Pejagalan were randomly selected for this study. An obesity assessment conducted in North Jakarta revealed that 44.9% of women aged 15 years and older were obese. Moreover, North Jakarta had the least number of food vendors who supply food in compliance with the health requirements set by the primary healthcare centre (Provincial Health Office of DKI Jakarta, 2018). Pejagalan, an urban village located in North Jakarta, is densely populated and characterised as a slum area because of its low socioeconomic situation and unfavourable housing and environment. The subjects enrolled in this study comprised of mothers with children under five years of age and pre-school children. The list of subjects was obtained from randomly selected community health posts (*Posyandu*), and consecutive sampling was applied. Mothers aged 19–49 years who were apparently healthy, fluent in Bahasa Indonesia, maintained the role of primary food provider at home, and agreed to participate by signing the informed consent were included in the study. Pregnant and lactating mothers, and those who were on a specialised or restrictive diet were excluded.

The estimated sample size was determined using a correlation formula with an r coefficient of 0.3, based on previous studies regarding health concern, home food environment,

and dietary behaviour, along with a confidence level of 95% and a power of 80%. A design effect of two was applied to increase the variation because of the non-probability sampling technique used. A 20% increase in the sample size was applied in consideration of non-response rate, resulting in a total of 204 subjects. This number was considered to be sufficient for path analysis, which requires a minimum of 100 subjects.

Ethical approval for this study was obtained from the Ethical Committee of Faculty of Medicine, Universitas Indonesia (No. ND-6/UN2.F1/ETIK/PPM.00.02/2020 dated 6 January 2020). Written consent to participate in the study was obtained from the mothers.

Research tools and data collection

The subjects were visited for a face-to-face interview using a structured questionnaire consisting of four sections. Before data collection, all instruments were pre-tested among 30 individuals with characteristics that were similar to those of the subjects. Subsequently, necessary corrections and modifications were made, particularly in the third and fourth sections of the questionnaire. The first section pertained to the sociodemographic and individual characteristics of the subjects, which included the following: age; level of education (elementary school, junior high school, senior high school or university); employment status ('unemployed' including housewives, 'partially employed' defined as working half-day and working at home [e.g. owning a small store at home], 'full-time employed' defined as working full-day or at least for eight hours a day); average monthly household income; and self-reported medical history.

The second section comprised of dietary assessment to measure diet quality, which was calculated using the Diet Quality Index-International

(DQI-I). DQI-I is a global tool that is used internationally to monitor diet that relates to nutrition transition issues (Kim *et al.*, 2003). The element of adequacy in the DQI-I was modified according to the Indonesian dietary guidelines in this study. Dietary assessment was conducted via a 24-hour dietary recall over two non-consecutive days. The interviewer was trained to conduct the procedure of a 24-hour dietary recall using multiple-pass method as follows: (i) information about the overall foods consumed by the subjects were collected; (ii) details about the ingredients and cooking methods used were noted, and an estimation of the amount of foods consumed was made; (iii) and finally, the data collected were reviewed from the beginning. The interviewer used a food photo book published by the Indonesian Ministry of Health to assist subjects in estimating the amount of foods consumed. Dietary data were analysed using NutriSurvey for Windows, Version 2007, with the Indonesian Food Composition Table published by the Indonesian Ministry of Health, Singapore Energy and Nutrition Composition of Food, and USDA Food Data Central used for nutrients that were unavailable in the Indonesian food database. Underreporting and over-reporting of energy intake was considered using a cut-off of 500–3500 kcal per day. Hence, subjects with an energy intake of <500 or >3500 kcal were excluded from further analysis in the DQI-I. Likewise, those who were not able to complete the second day of their 24-hour dietary recall were excluded from the analysis. The average result from 24-hour dietary recall was used to compute the scores for DQI-I, which ranged from 0 to 100; a higher score indicated better diet quality.

The third section was used to assess the home food environment. The questionnaire used a modified version of the National Health and Nutrition

Examination Survey Consumer Behaviour Questionnaire (NHANES CBQ) (CDC, 2010), which consisted of questions pertaining to the availability of the five food groups (vegetables, fruits, salty snacks, low-fat milk, and soft drinks), the characteristics of family meals (cooking frequency, eating out frequency, having take-out food frequency, and eating together frequency), and food expenditure (groceries, eating out, and take-out food). Food availability, cooking frequency, and the frequency of eating together were expressed by the number of days in the past week. For food availability, low-fat milk from the original questionnaire was substituted with sweet snacks because of the low consumption of dairy products among the Indonesian population. Soft drinks referred to any SSB, including homemade drinks with added sugar or manufactured products. The frequency of eating out and ordering a take-out was expressed as the number of days over the past month. The original response for the frequency of eating out, having a take-out, and cooking at home comprised a five-level response ranging from 'never' to 'always'. We modified this response using the number of days to reduce bias among subjects who provided neutral answers (such as 'rarely' or 'sometimes'). Food expenditure was defined as the money spent on food over the past month and was expressed in Indonesian Rupiah (IDR). In this study, food expenditure referred to the expenditure per capita, considering variations in the sizes of households.

The last section was used to assess health concern utilising the General Health Interest Scale (GHIS) (Roininen, Lähteenmäki & Tuorila, 1999). The original questionnaire consisted of eight statements related to dietary behaviours, with responses ranging from 0 to 6 on a 7-point Likert scale, wherein the subjects

had to declare whether they 'strongly disagreed' or 'strongly agreed' with each statement. However, in the present study, the procedure was modified and interviews were conducted, wherein the interviewer read the statements and asked the subjects to rate each of them. The original GHIS questionnaire was translated from English to Bahasa Indonesia, followed by a preliminary interview comprising of mothers with similar characteristics; a Cronbach's alpha value of 0.71 was obtained. The GHIS score ranged from 0 to 48. Higher score indicated greater health concern perceived by the subjects. The scores were categorised further according to the 33rd and 66th percentiles to determine low, moderate, and high groups.

Statistical analysis

Data analysis was conducted using SPSS Version 20. For numerical data, a normality test was conducted to determine the data distribution using the indicators of Kolmogorov–Smirnov: $p > 0.05$, coefficient of variance of $< 20\%$ or skewness and kurtosis z -values of ± 1.96 . Normally distributed data were presented as mean \pm standard deviation (SD), whereas the asymmetrically distributed data were presented as median and interquartile range. Multiple linear regression was conducted to determine the predictors of diet quality. The level of significance was set at < 0.05 . Mediation analysis was conducted with path analysis using SPSS AMOS Version 23 by calculating indirect effect (IE), which was calculated by multiplying the regression standardised coefficients of the independent and mediating variables. Because of data normality issues, bootstrapping was applied and set at 5,000. IE estimates of 95% CI not containing zero were interpreted as statistically significant and indicated as potential mediation.

RESULTS

Sociodemographic characteristics, health concern and the home food environment

In total, 254 subjects completed all the sections of the interview. After calculating for underreporting of energy intake and excluding subjects who were unable to complete the second day of their 24-hour dietary recall, 229 subjects were retained for diet quality analysis. Table 1 presents the characteristics of the subjects. Mean age of the mothers was 32.6 years. Majority of the subjects were married (98.3%), held a high school degree (34.9%), and were unemployed (68.6%). The median monthly household income was IDR 3 million (approximately USD 214, as of February 2021), which was lower than the minimum wage in the Jakarta province, as of 2020. According to self-reported medical history, most subjects claimed to have never been diagnosed with obesity, diabetes, hypertension and other NCDs. However, family medical history indicated that hypertension was the most common disease.

The median total GHIS score among the subjects was 32. Furthermore, 27.5%, 37.1%, and 35.4% of the subjects were presented with low, moderate, and high health concerns, respectively. More than half of the subjects reported that vegetables (67.2%), sweet snacks (59.4%), and SSB (86.5%) were always available at home. Majority of the subjects reported never eating out (62%); having a take-out at home was more common (up to 70.3% of subjects had a take-out at least once a week). The subjects usually cooked meals at home, and eating meals together with family members at home was common during dinner time almost every day. The median total food expenditure during the past month for groceries, eating

Table 1. General characteristics, health concern, and home food environment of mothers of young children ($n=229$)

Characteristics	Median (Q1–Q3)	n	%
Sociodemographic characteristics			
Age (years)	32.6 ± 6.1 [†]		
Education level			
Less than elementary school		12	5.2
Elementary school graduate		64	27.9
Junior high school graduate		66	28.8
Senior high school graduate		80	34.9
Diploma/bachelor graduate		7	3.1
Household income (IDR) [‡]	3,000 (2,300–4,275)		
Employment status			
Unemployed		157	68.6
Partially employed		46	20.1
Fully employed		26	11.4
Marital status			
Single or previously married		4	1.7
Married		225	98.3
Individual medical history			
Overweight/obesity		44	19.2
Diabetes mellitus		2	0.9
Hypertension		22	9.6
High level of cholesterol		11	4.8
Other NCDs (gastritis, gout, etc.)		17	7.4
Family medical history			
Overweight/obesity		17	7.4
Diabetes mellitus		54	19.7
Hypertension		93	40.6
High level of cholesterol		30	13.1
Heart disease		26	11.4
Stroke		23	10.0
Other NCDs (gastritis, gout, etc.)		22	9.6
Health concern			
GHIS score	32 (27–37)		
Low health concern		63	27.5
Moderate health concern		85	37.1
High health concern		81	35.4
Home food environment			
Food availability (days) [§]			
Vegetables	7 (4.5–7)		
Fruits	3 (1–5)		
Salty snack	4 (0–7)		
Sweet snack	7 (2–7)		
SSB	7 (7–7)		
Family meal characteristics			
Eating out frequency [¶]	0 (0–3)		
Having take-out food frequency [¶]	8 (3–20.5)		
Cooking frequency [§]	6 (2–7)		
Eating dinner together frequency [§]	7 (3–7)		
Food expenditure per capita (IDR) ^{††}			
Eating out	0 (0–30.8)		
Take-out	41.7 (12.3–150)		
Groceries	225 (120–375)		

GHIS: General Health Interest Scale; IDR: Indonesian rupiah; NCDs: Non-communicable diseases; SSB: Sugar-sweetened beverages

[†]Mean (±SD)

[‡]Income expressed in '000 (1 USD = Rp14,067.29 – as of 19 February 2021)

[§]Number of days in the past week

[¶]Number of days in the past month

^{††}Amount of money spent for food in the past month expressed in '000 (1 USD = Rp14,067.29 – as of 19 February 2021)

Table 2. Diet quality of the mothers of young children ($n=229$)

<i>DQI-I component score</i>	<i>Score range (points)</i>	<i>Median (Q1–Q3)</i>
Total score	0–100	41.4±7.4 [†]
Variety	0–20	12.6±3.5 [†]
Overall food group variety	0–15	9.6±2.7 [†]
Within-group variety for protein source	0–5	3 (1–5)
Adequacy	0–40	16 (13–19)
Vegetable group	0–5	1 (1–1)
Fruit group	0–5	0 (0–1)
Grain group	0–5	3.3±1.2 [†]
Fibre	0–5	1 (1–1)
Protein	0–5	5 (5–5)
Iron	0–5	1 (1–3)
Calcium	0–5	1 (1–3)
Vitamin C	0–5	1 (1–3)
Moderation	0–30	11.7±4.3 [†]
Total fat	0–6	0 (0–3)
Saturated fat	0–6	0 (0–0)
Cholesterol	0–6	6 (3–6)
Sodium	0–6	6 (3–6)
Empty-calorie food	0–6	0 (0–3)
Overall balance	0–10	0 (0–0)
Macronutrient ratio (CHO: Protein: Fat)	0–6	0 (0–0)
Fatty acid ratio (PUFA: MUFA: SFA)	0–4	0 (0–0)

CHO: Carbohydrates; MUFA: Monounsaturated fatty acids; PUFA: Polyunsaturated fatty acids; SFA: Saturated fatty acids

[†]Mean±SD

out, and having a take-out was IDR 1.5 million (approximately USD 107). The median food expenditure per capita was IDR 41,670 (approximately USD 3) for take-out food and IDR 225,000 (approximately USD 16) for groceries.

Diet quality of the subjects

The mean DQI-I score was 41.4 out of 100 (Table 2), which highlighted that the diet quality of the subjects was poor. Majority of the subjects had low-quality diets, with a total DQI-I score of less than 60 (98.7%). Among the four elements of DQI-I, adequacy and moderation had relatively lower scores than variety, and the score for overall balance was 0. These findings indicated that poor diet among the subjects was attributed to the low consumption of

fruits and vegetables, inadequate intake of fibre, iron, calcium and vitamin C, and a lack of macronutrient balance. Moreover, the intake of fats exceeded the recommended amount. Spearman's correlation analysis revealed no significant relationship between health concern and diet quality ($r=0.092$; $p=0.166$). Likewise, the correlations between health concern and other DQI-I elements were not statistically significant.

Predictors of diet quality

Table 3 shows the results of the multivariate analysis conducted using multiple linear regression with the enter method. The variables included in the analysis were age, education level, household income, employment

Table 3. Multiple linear regression analysis for diet quality predictors among mothers of young children ($n=229$)

Variable	B	SE	p-value
Age (years)	0.196	0.087	0.024*
Education level [†]	-0.608	0.537	0.768
Average monthly household income (IDR)	<0.001	<0.001	0.522
Employment status [‡]	-0.608	0.823	0.461
Health concern	0.053	0.067	0.431
Food availability (days) [§]			
Vegetables	0.521	0.261	0.047*
Fruits	0.370	0.224	0.101
Salty snack	0.152	0.175	0.385
Sweet snack	-0.211	0.174	0.226
Sugar-sweetened beverages	0.169	0.271	0.534
Family meals characteristics			
Eating out frequency (days) [¶]	0.250	0.107	0.021*
Having take-out food frequency (days) [¶]	-0.033	0.072	0.649
Cooking at home frequency (days) [§]	0.023	0.243	0.924
Food expenditure per capita (IDR) ^{††}			
Food groceries	<0.001	0.003	0.901
Eating out	-0.018	0.009	0.037*
Having take-out food	0.007	0.007	0.298

Statistical analysis using multiple linear regression with enter method

[†]Education level (1=bachelor/diploma graduate, 2=senior high school graduate, 3=junior high school graduate, 4=elementary school graduate, 5=less than elementary school)

[‡]Employment status (1=fully employed, 2=partially employed, 3=unemployed)

[§]Number of days in the past week

[¶]Number of days in the past one month

^{††}Amount of money spent for food in the past month

* $p < 0.05$

status, health concern, food availability (vegetables, fruits, salty snacks, sweet snacks, and SSB), family meal characteristics (frequency of eating out, having take-out food, and cooking at home), and food expenditure per capita (groceries, eating out, and take-out food). Our model implied that older age, frequent availability of vegetables at home, and frequently eating out were associated with a higher DQI-I score. In contrast, an increase in the eating out expenditure was associated with a lower DQI-I score.

Mediating factors between health concern and diet quality

The variables included for path analysis were the significant predictors according to the results from the multiple linear regression analysis. Because of a strong correlation between the variables, the eating out expenditure was omitted from path analysis, and health concern was included as the main independent variable. Before adjusting for age, several direct effects were observed between health concern with the availability of vegetables ($\beta=0.115$; $p=0.034$)

and frequency of eating out ($\beta=-0.152$; $p=0.027$), but not with the quality of the diet ($\beta=0.101$; $p=0.179$). A significant IE between health concern and diet quality through the availability of vegetables was observed (IE=0.021; $p=0.019$). However, after adjusting for age, several associations lost their significance, indicating that age might have a stronger effect on these variables. Only the availability of vegetables had a significant direct effect on diet quality ($\beta=0.167$; $p=0.002$). However, its IE on diet quality lost its significance (IE= 0.012; $p=0.096$; Table 4). Thus, the relationship between health concern and diet quality among mothers of young children in the urban slum areas of the present study was not mediated by the availability of vegetables. Nonetheless, this model satisfied the assumptions of the goodness of fit tests, such as the Chi-square, Goodness of Fit Index (GFI), Comparative Fit Index (CFI), and Normed Fit Index (NFI).

DISCUSSION

In the present study, less than 3% of the subjects consumed a good diet (DQI-I total score of >60). This finding was consistent with those of previous studies not only among Indonesian women (Stefani *et al.*, 2018), but also in the African-American (Hartman *et al.*, 2015) and Malaysian indigenous population (Chong, Appannah & Sulaiman, 2019), which underlines the fact that poor diet quality among WRA

Table 4. Path analysis estimates after adjusting for age

Variable	Direct effect			Indirect effect		p-value
	Coeff.	SE	p-value	Coeff.	95%CI (lower-upper)	
Age → Health concern	0.243	0.083	0.001**			
Age → Diet quality	0.191	0.081	0.008**			
Age → Vegetable availability	0.153	0.023	0.020*			
Age → Eating out frequency	-0.140	0.079	0.049*			
Health concern → Diet quality	0.061	0.062	0.434			
Health concern → Vegetable availability	0.078	0.018	0.163			
Health concern → Eating out frequency	-0.118	0.061	0.096			
Vegetable availability → Diet quality	0.167	0.231	0.002**			
Eating out frequency → Diet quality	0.060	0.067	0.273			
Health concern → Vegetable availability → Diet quality				0.012	-0.002-0.043	0.096
Health concern → Eating out → Diet quality				-0.007	-0.035-0.003	0.171

Chi-square (df. 1=3.841) = 3.154, $p=0.076$
 RMSEA (root mean square error of approximation) = 0.097>0.08, GFI = 0.995>0.9, CFI = 0.952>0.9, NFI = 0.942>0.9
 * $p<0.05$, with 95% bootstrapped bias-corrected CI does not contain 0

requires immediate attention. Among those with a better quality of diet in the present study, the consumption of foods with protein was adequate. The DQI-I score on protein adequacy was relatively high, indicating that at least 10% of energy intake was obtained from protein sources. Affordable protein-rich foods included eggs, fish, and soybean products (e.g. tofu and *tempeh*). Additionally, tofu and *tempeh* are easily available as fried snacks or side dishes that are usually sold in small food stores in the neighbourhood. Similar to a qualitative study in East Jakarta, the consumption of '*kerongkongan*' (chicken neck and bones with less meat) was common among the subjects in the present study (Sufyan *et al.*, 2019), which were used as another affordable alternative to animal proteins. Nonetheless, despite the high score for protein, intakes of key nutrients, such as iron and calcium, did not meet the necessary recommendations.

Our findings also suggested that adequate consumption of fruits contributed to better quality diet. Fruits, such as bananas, *dukuh* and rambutan, were commonly consumed. The consumption of fruits in the form of *rujak* (eaten along with palm sugar) contributed to a higher score for the adequacy of fruits intake. Vegetable soup was one of the most common dishes cooked at home. Conveniently packaged vegetables used for certain dishes were easily available at affordable prices in traditional markets around the neighbourhood. However, the quantity of the vegetables was little and probably inadequate to satisfy the recommended intake for adults, particularly in households with more than two members. A previous Indonesian study highlighted that the majority of the Indonesian population did consume vegetables; however, the amount of vegetables consumed in grams per day was relatively low regardless of age

group, sex, and socioeconomic status. Thus, over 90% of the population failed to meet the Indonesian dietary guidelines (Hermina & Prihatini, 2016).

Furthermore, limiting the consumption of SSB and other empty-calorie foods plays an essential role. The score for empty-calorie foods was low in the present study; at least 3% of the energy intake among the subjects was obtained from nutrient-poor foods, which was mostly SSB, such as homemade tea with sugar. This result was similar to that reported in a previous study comprising urban adults in Indonesia (Khusun, Wiradnyani & Siagian, 2017). Additionally, the diet was typically similar among the subjects in the present study, hence all resulted in poor quality. Regardless of income, education level, and employment status, no significant difference in diet quality was observed.

The findings of the present study indicated that an increase in health concern was associated with better diet quality. Previous studies among female adolescents (Jezewska-Zychowicz *et al.*, 2017), college students (Botchway, Wiafe-Akenteng & Atefoe, 2015), and adults in Luxemburg (Alkerwi *et al.*, 2015) presented with similar results. However, the insignificant direct effect of health concern on diet quality was not aligned with a previous study, which found a direct association between nutritional awareness and diet quality among adults aged 18–69 years old (Alkerwi *et al.*, 2015). This might be attributed to the different instrument used in their study. Alkerwi *et al.* (2015) referred to nutritional awareness as 'the importance of eating balanced meals' and used a single statement to classify the responses of subjects into three levels: 'high importance', 'moderate importance', and 'little importance'. Alternatively, in the present study, multiple statements from the GHIS were

used, comprising of eating behaviours, food choices, and balanced diet.

The home food environment has been explored as a mediator of food intake and diet, particularly among children. According to Campbell *et al.* (2013), home food availability was a significant mediator between the mother's level of knowledge about nutrition and the children's food intake. Mothers with children were reported to generally eat at home (Raskind *et al.*, 2017); hence, we assumed that home food availability might influence the mother's diet. In the present study, our findings suggested that the availability of fruits and vegetables at home could potentially act as a mediator between health concern and diet quality. It is assumed that adults have more access to foods; thus, they are not dependent on food availability and eating-related activities at home, despite having an increased health interest. As mothers of young children, the motivation to ensure good nutrition for the sake of their children plays an important role in shaping the home food environment. Moreover, when mothers recognise their unhealthy diet, they purchase healthier foods to improve their eating behaviours (Raskind *et al.*, 2017). This practice determines the provision of FV at home as a parental modelling effort to promote healthy eating among their children (Dave *et al.*, 2010). FV intake has been included in the promotion of nutrition in terms of a balanced diet in Indonesia. Nonetheless, as the primary food provider, mothers would always consider the preferences of their children or husband (Raskind *et al.*, 2017; Sufyan *et al.*, 2019), which might explain the wide availability of SSB and sweet snacks at home, regardless of the level of health concern.

Healthy eating is often perceived as costly in low-income communities. This is likely due to financial instability, which enhances the perception of unhealthy

diets being more affordable (Munt, Partridge & Allman-Farinelli, 2017). Although family meal characteristics did not appear to be significant mediators, a significant correlation between health concern and cooking frequency was observed in the present study. Greater health concern was associated with more frequent cooking and fewer takeaways. Furthermore, more frequent cooking was correlated with better diet quality, as supported in a previous study (Farmer *et al.*, 2019). However, the prominent practice of purchasing take-outs could be due to economic reasons. Usually, mothers cook rice at home and purchase ready-to-eat side dishes because they are affordable and could be consumed by other family members. Eating out was not common in the present study, except among full-time working mothers. It is important to note that the results of the multivariate analysis in the present study must be cautiously interpreted because it implies that eating out could contribute to better diet quality. In urban slum areas, people usually eat at local food stalls or from street food vendors, which offer cooked meals, including vegetarian and protein-rich dishes. Therefore, improving the knowledge about healthy eating might prove useful and encourage consumers to choose their food wisely.

Age was found to be a significant predictor of diet quality in the present study. A previous study in Japan found that women aged ≥ 40 years presented with better diet quality (Kurotani, Ishikawa-Takata & Takimoto, 2020). In the present study, subjects under the age of 30 years were more likely to have lower DQI-I and GHIS scores. They ate out more often and cooked less frequently. Age is believed to be related to the familiarity with certain food items. As suggested in a study on Mediterranean diet, ageing was associated with increased familiarity with vegetables, fruits, fish, legumes

and other typical Mediterranean foods; those belonging to the younger age group were more familiar with sweets, soft drinks, and red meat (Predieri *et al.*, 2020). The findings of the present study suggested a significant direct effect of age on health concern. As the risk of NCDs increase along with age, older individuals are encouraged to change their diet to lead a healthier life (Delaney & McCarthy, 2011). Unfortunately, the instrument used in this study to assess health concern was unable to measure the degree of importance of health in relation to the risk of developing NCDs.

This study had some limitations. Firstly, actual calculations based on the individual's nutritional status were not used for underreporting of energy intake. Several attempts to calculate the underreporting of energy intake using established body weight and height according to the Indonesian dietary recommendations were made; however, the results excluded more than half of the subjects. Thus, a 500–3500 kcal cut-off was used in this study instead. Secondly, we did not explore and record the kind of foods typically purchased by the subjects who frequently ate out or ordered a take-out. Given that eating out frequently was a predictor of better diet quality, this finding should be cautiously interpreted.

The findings of this study suggested that it is important to improve the understanding of health, nutrition and healthy eating behaviours among mothers to develop a greater interest in health and to create a healthier food environment at home. Furthermore, age differences among mothers should be taken into account when exploring diets and food-related behaviours, particularly during the development of interventions and education materials. The frequency of cooking, eating out, and purchasing takeaways appeared to vary with age; hence, qualitative methods that include

the barriers and enabling factors related to food preparation practices should be applied to explore the understanding and importance of health and diet among younger and older mothers in future.

CONCLUSION

Diet quality among mothers of young children is a major issue. Interventions to improve diet quality should focus more on increasing the compliance towards consumption of vegetables and fruits. Furthermore, strategies and interventions to improve diet should be tailored according to age groups because of differences in factors that contribute to their diet and food choices.

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Authors' contributions

FSB, conceptualised and designed the study, conducted data collection and analysis, prepared the draft of the manuscript; DNC and LAAW, advised on the study conceptualisation, data collection procedure, analysis and interpretation, and reviewed the manuscript.

Conflict of interest

The authors declare that there is no conflict of interest regarding the research and the publication of this article.

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