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Breakfast eating practices and diet quality among urban and rural Indonesian adults

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ABSTRACT

Introduction: Diet quality is an important determinant of health; however, many Indonesian adults have poor dietary intake, with low fruit and vegetable consumption and high intake of fats and fried foods. Breakfast plays a crucial role in shaping diet quality and health outcomes, but practices vary widely across populations. Urban adults are more exposed to processed foods and eating out, while rural adults rely on staple-based diets. This study explored the association between breakfast practices and overall diet quality among Indonesian adults in urban and rural areas. **Methods:** Data from the Indonesia Food Barometer 2018 were analysed for 770 adults aged 26–45 years from six provinces. Breakfast practices, including consumption, location, companion, activity, and preparation, were assessed alongside socioeconomic characteristics (age, gender, job, education level, and wealth index). Diet quality was measured using the Diet Quality Index-International. Statistical analyses included chi-square, Mann–Whitney, and Kruskal–Wallis tests and linear regression. **Results:** In rural areas, gender and breakfast activity were significantly associated with diet quality ($p<0.05$). In urban areas, age and breakfast consumption were significant factors ($p<0.05$). Across both settings, breakfast-related practices showed significant associations with diet quality. **Conclusion:** Associations between breakfast practices and diet quality differed between urban and rural adults, underscoring the importance of context-specific strategies. Interventions to improve diet quality should therefore be tailored to local dietary behaviours and environments.

Keywords: breakfast eating practices, diet quality, Indonesian adults, urban and rural

INTRODUCTION

Diet quality is crucial to an individual's nutritional status, as high-quality diets are associated with reduced markers of inflammation and a lower risk of overweight and obesity (Vahid *et al.*, 2022). In Indonesia, poor dietary intake has been highlighted by the Basic Health

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Research (Riskesdas), which indicates that fruit and vegetable consumption requires significant improvement. Only 5% of adults aged 20–40 years meet intake recommendations, while most consume excess fats, cholesterol, and fried foods (Kemenkes RI, 2018). Eating practices are recognised as important social and cultural factors influencing diet quality, including behaviours such as eating with company, skipping breakfast, and social eating (Sartika, 2018). Among these, breakfast is often referred to as the most important meal of the day. A review found that eating breakfast aids weight management and lowers the risk of cardiovascular disease, dyslipidaemia, and diabetes (O'Neil *et al.*, 2014). Regular breakfast consumption is also associated with higher intakes of micronutrients, including fruits and vegetables, and less frequent consumption of soft drinks (O'Neil *et al.*, 2014).

Other factors influencing diet quality include the area of residence, whether urban or rural, which is one of the most significant drivers of food practices and nutritional changes (Cockx, Colen & De Weerdt, 2019). Sartika (2018) reported that urban adults skip breakfast more and have lower diet quality than rural adults. Furthermore, studies have revealed increased health risks among urban populations. Urbanisation affects food consumption and nutrition by influencing consumption habits and practices (Arifa *et al.*, 2024). Urbanisation also impacts agricultural land, food availability, cost, and the environment in which food is produced (Bricas, 2019). The social and physical environments shape behaviours such as eating out and consuming food prepared away from home, which contributes to health and well-being (Zhai *et al.*, 2014). In countries such as Malaysia, the prevalence of 'food away from home' consumption is positively related to urbanisation (Poulain *et al.*, 2020). Sartika (2018) found poor diet quality in Indonesia, with 96.9% of urban and 92.1% of rural adults affected. A study of Sundanese and Padangnese women in 2019 reported 99% had low diet quality scores (Stefani *et al.*, 2018). Urban adults often access diverse, processed foods and eat out more, while rural adults rely on staples, limited fortified foods, and traditional diets. These disparities are influenced by differences in socioeconomic status, food environment, infrastructure, and work schedules (Colozza & Avendano, 2019).

Despite many studies abroad, research on the diet quality of Indonesian adults, especially between urban and rural areas, remains limited (Arifa *et al.*, 2024). Previous studies have largely focused on the diet quality and eating practices in urban and rural areas of East Java, Indonesia. Most Indonesian studies focused on children and adolescents, leaving a gap in breakfast practices and diet quality among urban and rural adults, with prior research largely region-specific. The novelty of this study lies in its comparative approach across urban and rural settings on adults, also examining the relationship between breakfast eating practices and total diet quality using robust national data. This study aimed to explore the association between breakfast eating practices, including breakfast consumption, location, companionship, activity, and meal preparation, and diet quality among Indonesian adults, utilising data from the Indonesia Food Barometer (IFB) 2018. This study hypothesised that breakfast eating practices are significantly associated with overall diet quality and that these associations differ between urban and rural populations.

METHODOLOGY

This study analysed secondary data from the IFB 2018. Data were collected from January to February 2018 across six provinces (Jakarta, West Java, East Java, West Sumatra, Bali, and South Sulawesi), representing approximately 48% of Indonesia's population. Data collection was conducted through face-to-face interviews by trained enumerators using a structured questionnaire. This approach ensured accurate data recording, allowed clarification of respondents' answers, and minimised misinterpretation (Khusun *et al.,* 2022). From the initial IFB sample of 1,727 adults, implausible energy intakes (<500 or >4000 kcal/day) were excluded; data were weighted by location, age, sex, and population density. The final sample included 1,665 adults, with 770 aged 26–45 years from urban or rural areas. Those outside this age range (n=862) or who were pregnant/lactating (n=33) were excluded. No data were missing.

Diet quality was assessed using the Diet Quality Index-International (DQI-I), derived from repeated 24-hour food recalls. The DQI-I included four components: variety (0–20), adequacy (0–40), moderation (0–30), and overall balance (0–10), totalling 0–100, with higher scores indicating better diet quality. Variety covered food groups and protein-source diversity. Adequacy measured how well intakes met recommendations: vegetables (≥3 servings/day), fruits (≥2 servings/day), grains/staples (5–8 servings/day), fibre (23–28.5 g/day), protein (≥10% of energy), iron (9–18 mg/day), and calcium (1000 mg/day). Intakes below 50% of these cut-offs were assigned the lowest score, while intakes meeting or exceeding these cut-offs received the maximum score. Moderation assessed limiting fat, cholesterol, sodium, and empty-calorie foods, while overall balance assessed macronutrient ratios (carbohydrate, protein, and fat) and fatty acid ratios [polyunsaturated fatty acid (PUFA):saturated fatty acid (SFA) and monounsaturated fatty acid (MUFA):SFA]. Scores followed Kim *et al.* (2003) using 24-hour diet recall data, with >60 denoting good diet quality (Kim *et al.,* 2003). Nutrient intake was estimated using the Multiple Source Method and food composition tables from Indonesia, the Philippines, and the USDA.

Wealth index was based on housing conditions and ownership of household items. Wealth index status was measured using a wealth index based on the principal component analysis (PCA) approach (Rutstein & Johnson, 2004). From 24 initial variables, 13 were retained following reliability analysis. These included wall and floor materials, toilet type, electricity and fuel sources, and ownership of items such as a car, mobile phone, and refrigerator. Principal component analysis with varimax rotation was used to generate a score, which was then divided into tertiles (Khusun *et al.,* 2022).

Breakfast practices were assessed using 24-hour diet recall data. Breakfast was defined as any food or drink consumed between 5:00 and 10:00 a.m. Breakfast consumption status was based on respondent's answer on food recall (skip breakfast/breakfast); eating location referred to where breakfast was consumed (at home/outside); eating companion to whether it was eaten alone or with others; meal preparation to food source (home-cooked/purchased); and breakfast activity to whether eating was combined with other activities or done alone. The breakfast practice variables were adapted from eating practices studies in Indonesia, such as Sartika (2018) and Febriana *et al.* (2024). The questionnaire used in this study was a

validated questionnaire, translated from the Malaysian Food Barometer (Khusun *et al.,* 2022).

Data were analysed using IBM SPSS Statistics® version 25 (IBM Corp., Armonk, NY, USA) between February and April 2023. Normality was tested using the Kolmogorov-Smirnov test. Urban and rural data were analysed separately. Two-category comparisons were done using *t*-test or Mann-Whitney U test. Variables with >2 categories were analysed using analysis of variance (ANOVA) or Kruskal-Wallis tests. Chi-square test was used for proportions. Variables with $p<0.05$ in the bivariate analysis were included in the multivariate analysis. Multiple linear regression identified significant and confounding factors. $p<0.05$ was considered statistically significant.

This study noted limitations, including recall bias and lack of causal inference, mitigated by nationally representative data, validated dietary tools, and urban–rural stratified analysis. Ethical approval was obtained from the Human Ethics Committee of the Faculty of Medicine, Universitas Indonesia (No. 927/UN2.F1/ETIK/2017). Written consent was provided by all participants. Additional ethical approval was granted for this study (Protocol No. 23-05-0639; KET-743/UN2.F1/ETIK/PPM.00.02/2023).

RESULTS

Table 1 summarises the respondents' characteristics and breakfast practices. Gender distribution was similar across urban and rural areas, with the 26–35 years old age group being the most represented. Nearly 70% of urban adults had higher education, while about 50% of rural adults had lower education levels. Employment rates were comparable, but differences were noted in wealth index: rural respondents were mostly in the lowest tertile, while urban respondents dominated the highest tertile. Significant differences were found in education and wealth index. Breakfast skipping was more prevalent in urban areas (20.9%) than rural (10.5%). Eating alone was more common in both areas, especially in urban areas (68.9%). Over 82% of respondents in both groups ate breakfast at home. Urban respondents were more likely to buy breakfast (40.3%), whereas most rural respondents (76.2%) cooked their meals. Significant differences were also observed in breakfast skipping, eating with a companion, and activities during breakfast.

Significant differences in the DQI-I total score, moderation, and overall balance components were observed between rural and urban populations, with rural participants showing higher scores overall. However, the median total DQI-I scores in both groups, 46 in urban and 48 in rural, remained below the "good diet" threshold of 60, indicating generally poor diet quality across the population (Table 2). The higher score in rural areas may be attributed to greater vegetable intake and lower consumption of foods high in fat, cholesterol, and sodium compared to urban areas. While the variety and adequacy components showed no significant differences overall, specific subcomponents revealed disparities. Urban adults consumed more meat, whereas rural adults had higher vegetable intake. In terms of protein sources, urban residents commonly consumed poultry, fish, eggs, and beans, while rural residents primarily consumed fish, eggs, and beans. Adequacy scores showed that rural adults were more likely to meet their vegetable and grain recommendations, possibly due to higher accessibility, as many rural participants were farmers. Significant differences were noted in moderation scores, with urban adults having higher intakes of total fat, saturated fat, cholesterol,

Table 1. Characteristics of respondents and breakfast practices in rural and urban settings

Characteristics of respondents and breakfast practices	*Rural (n=315) n (%)*	*Urban (n=455) n (%)*	*Total (n=770) n (%)*	*p-value*[†]
Gender				
Male	154 (48.9)	225 (49.5)	379 (49.2)	0.878
Female	161 (51.1)	230 (50.5)	391 (50.8)	
Age				
26-35 years old	190 (60.3)	264 (58.0)	454 (59)	0.525
36-45 years old	125 (39.7)	191 (42.0)	316 (41)	
Education level[‡]				
Low education level	159 (50.5)	139 (30.5)	298 (38.7)	<0.001*
High education level	156 (49.5)	316 (69.5)	472 (61.3)	
Job				
Worker	213 (67.6)	285 (62.6)	498 (64.7)	0.155
Non-worker	102 (32.4)	170 (37.4)	272 (35.3)	
Wealth index[§]				
Tertile 1	142 (45.1)	114 (25.1)	256 (33.2)	<0.001*
Tertile 2	75 (23.8)	124 (27.3)	199 (35.8)	
Tertile 3	98 (31.1)	217 (47.7)	315 (40.9)	
Breakfast eating practices				
Eating breakfast	*n*=315	*n*=455	*n*=770	
Skipping breakfast	33 (10.5)	95 (20.9)	128 (16.6)	<0.001*
Eating breakfast	282 (89.5)	360 (79.1)	642 (83.4)	
Eating companion	*n*=282	*n*=360	*n*=642	
Alone	162 (57.4)	248 (68.9)	410 (63.8)	0.003*
Together	120 (42.6)	112 (31.1)	232 (36.2)	
Eating location	*n*=282	*n*=360	*n*=642	
Eating outside home	33 (11.7)	62 (17.2)	98 (15)	0.050*
Eating at home	249 (88.3)	298 (82.8)	547 (85)	
Meal preparation	*n*=282	*n*=360	*n*=642	
Buy	67 (23.8)	145 (40.3)	212 (33)	<0.001*
Cook	215 (76.2)	215 (59.7)	430 (67)	
Eating activity	*n*=282	*n*=360	*n*=642	
Doing other activities	154 (54.6)	176 (48.9)	330 (51.5)	0.150
Just eating	128 (45.4)	184 (51.1)	312 (48.5)	

[†]Data were analysed using chi-square
[‡]Educational level, low educational level: never go to school, elementary school, JHS; high educational level: SHS, diploma, graduate, post-graduate
[§]Wealth Index: according to tertile of wealth index. Tertile 1 was the poorest.
*significantly different, *p*-value <0.05

and sodium. These trends were linked to greater consumption of fried foods, animal products, and dairy in urban diets. For overall balance, urban adults were less likely to meet the recommended macronutrient ratios.

In Table 3, gender differences were significant in both settings, with males showing higher DQI-I scores. Regarding consumption, rural women consumed less energy, carbohydrates, and calcium than men, while urban

Table 2. Total DQI-I and component scores of urban and rural respondents

		Mean±SD/Median (Q1-Q3)		*Proportion (%)*		*p-value*[a]
		Rural (n=315)	*Urban (n=455)*	*Rural (n=315)*	*Urban (n=455)*	
DQI-I Total Score	Score					
DQI-I Total Score	0-100 points	48.27±0.44 48 (43-54)	46.26±0.41 46 (40-52)			0.001*
Variety	0-20 points	14.17±0.22 15 (12-17)	14.22±0.19 15 (10-18)			0.733
Adequacy	0-40 points	18.88±0.24 19 (16-21)	18.43±0.20 18 (15-21)			0.092
Moderation	0-30 points	13. 56±0.29 12 (12-15)	12. 38±0.21 12 (9-15)			0.001*
Overall balance	0-10 points	1.47±0.10 0 (0-2)	1.13±0.08 0 (0-2)			0.005*
DQI-I Components						
Variety						
Food groups						
1-2 food groups				56 (17.8)	94 (20.7)	0.818
3-4 food groups				236 (75)	318 (69.9)	
5 food groups				23 (7.3)	43 (9.5)	
Protein source						
<3 protein sources				225 (71.7)	304 (67.1)	0.453
≥3 protein sources				89 (28.3)	151 (33.2)	
Adequacy						
Vegetable[b] , cut off = 3 servings						0.027*
No consumption				61 (19.4)	100 (21.9)	
<50% of cut off				216 (68.6)	304 (66.8)	
50-100% of cut off				38 (12.1)	51 (11.3)	
Fruits[b], cut off = 2 servings						0.538
No consumption				213 (67.4)	300 (66)	
<50% of cut off				79 (25.1)	115 (25.2)	
50-100% of cut off				23 (7.3)	40 (8.8)	
Grain/staple food[b,d], cut off = 5-8 servings (Based on age and gender)						0.003*
<50% of cut off				128 (40.6)	230 (50.5)	
50-100% of cut off				127 (40.3)	167 (36.7)	
≥100% of cut off				60 (19.0)	58 (12.7)	
Fibre[c], cut off = 23-28.5 gram (Based on age and gender)						0.179
<50% of cut off				295 (93.7)	434 (95.4)	
50-100% of cut off				19 (6)	19 (4.2)	
≥100% of cut off				1 (0.3)	2 (0.4)	
Protein, cut off = 10% of total energy						0.238
<50% of cut off				315 (100)	451 (99.1)	
50-100% of cut off				0 (0)	2 (0.4)	
Iron[c], cut off = 9&18 mg (RDA based on gender)						0.877
<50% of cut off				39 (12.4)	65 (14.2)	
50-100% of cut off				138 (43.8)	184 (40.4)	

to be continued...

Table 2. Total DQI-I and component scores of urban and rural respondents *(continued)*

	Mean±SD/ Median (Q1-Q3)		*Proportion (%)*		*p-value*[a]
	Rural (n=315)	*Urban (n=455)*	*Rural (n=315)*	*Urban (n=455)*	
Calcium, cut off = 1000mg (RDA)					0.116
<50% of cut off			94 (29.8)	168 (36.9)	
50-100% of cut off			193 (61.3)	245 (53.8)	
≥100% of cut off			28 (8.9)	42 (9.2)	
Vitamin C[c], cut off =75&90 mg (RDA based on gender)					0.352
<50% of cut off			183 (58.1)	281 (61.7)	
50-100% of cut off			103 (32.7)	135 (29.7)	
≥100% of cut off			29 (9.2)	39 (8.6)	
Moderation					
Total fat					<0.001*
≤20 % of total energy			21 (6.6)	12 (2.7)	
>20-30% of total energy			107 (34)	118 (25.9)	
>30% of total energy			187 (59.4)	325 (71.4)	
Saturated fat					0.060*
≤7 % of total energy			11 (3.5)	13 (2.9)	
>7-10% of total energy			40 (12.7)	39 (8.6)	
>10% of total energy			264 (83.8)	403 (88.6)	
Cholesterol					0.004*
≤300 mg			224 (71.1)	274 (60.2)	
>300-400 mg			43 (13.7)	94 (20.7)	
>400 mg			48 (15.2)	87 (19.1)	
Sodium					0.037*
≤2400 mg			305 (96.9)	421 (92.5)	
>2400 mg			10 (3.2)	32 (7)	
>3400			0 (0)	2 (0.4)	
Empty calorie					0.476
≤3% of total energy			34 (10.8)	58 (12.7)	
>3-10% of total energy			76 (24.1)	111 (24.4)	
>10% of total energy			205 (65.1)	286 (62.9)	
Overall balance					
Macronutrient ratio					0.008*
Acceptable			103 (32.7)	109 (24)	
Not acceptable			212 (67.3)	346 (76)	
Fatty acid ratio					0.471
Acceptable			64 (20.3)	83 (18.2)	
Not acceptable			251 (79.7)	372 (81.8)	

[a]Data were analysed using Mann-Whitney U test (DQI-I total score) and Chi-Square (DQI-I components).
[b]According to MoH Regulation No. 41/2014 about Balanced Nutrition Guidelines
[c]According to calculations following the Indonesian RDA (MoH Regulation No. 28/2019)
[d]Grain recommendation based on age and gender on PMK no. 4
*significant difference, *p*-value<0.05; *p*-values were calculated using Mann-Whitney U test for continuous variables and Chi-square test for categorical variables

women had lower intakes of energy, protein, fat, carbohydrates, and iron than men, contributing to the gender gap in diet quality. In urban areas, age showed a significant association with DQI-I scores. Older adults (36–45 years) had lower scores than younger ones, associated with higher intake

Table 3. Socioeconomic status and diet quality of urban and rural respondents

Variable	*DQI-I total score*			
	Rural (n=315)		*Urban (n=455)*	
	Median (Q1-Q3)	*p-value*	*Median (Q1-Q3)*	*p-value*
Gender				
Male	49 (44-45)	0.001*	47 (41-54)	0.017*
Female	47 (42-52)		46 (39-51)	
Age				
26-35 years old	48 (42-54)	0.897	47 (41-52)	0.009*
36-45 years old	48 (44-53)		44 (38-52)	
Educational level				
Low education level	48 (42-53)	0.744	44 (39-51)	0.017*
High education level	48 (44-54)		47 (40-53)	
Job				
Worker	48 (43-54)	0.467	47 (41-54)	0.008*
Non-worker	48 (44-52)		45 (38-50)	
Wealth index				
Tertile 1	48 (42-54)	0.986	47 (41-53)	0.197
Tertile 2	48 (44-53)		45 (39-53)	
Tertile 3	48 (44-54)		47 (41-53)	

Data were analysed using Mann-Whitney and Kruskall-Wallis. Mann–Whitney test was used for 2-group comparisons; Kruskal–Wallis test was used for variables with three or more categories.
*significantly different, *p*-value <0.05

of fat, sodium, and MUFA. Education level was significantly linked to diet quality in urban participants; those with higher education had better diet scores. Employment status also influenced diet quality. Workers had higher DQI-I scores than non-workers in both areas, particularly in urban settings, where jobs were often higher-paying and associated with better nutrient intake.

As shown in Table 4, breakfast practices were associated with diet quality. In rural areas, eating activity was significantly related to DQI-I scores, with those who ate without engaging in other activities having better scores. In urban areas, skipping breakfast was significantly associated with lower DQI-I scores. Nutrient analysis revealed that breakfast skippers had lower intakes across several adequacy components and fatty acids. Among rural participants, those who focused solely on eating at breakfast had higher carbohydrate intake, which may explain their higher DQI-I scores. Significant findings from non-parametric tests (Mann–Whitney and Kruskal–Wallis) were further explored through linear regression analyses.

Table 5 shows unadjusted and adjusted linear regression results for factors associated with DQI-I scores in rural and urban areas. In rural areas, gender and breakfast activity were significant: men had lower scores than women (*B*=-2.582, *p*=0.005) and those eating only breakfast scored higher than those doing other activities during breakfast (*B*=2.217, *p*= 0.017). In urban areas, age and breakfast consumption were significant after adjustment: adults aged 26–35 years scored higher than those aged 36–45 years (*B*=2.086,

Table 4. Practices at breakfast and diet quality of urban and rural respondents

Variable	*DQI-I total score*			
	Rural		*Urban*	
	Media (Q1-Q3)	*p-value*	*Median (Q1-Q3)*	*p-value*
Eating breakfast	*n*=315		*n*=455	
Skip breakfast	47 (44-54)	0.702	42 (37-51)	0.005*
Eating breakfast	48 (43-53)		47 (41-52)	
Eating companion	*n*=282		*n*=360	
Eating alone	48 (43-54)	0.280	47 (40-53)	0.658
Eating together	48 (43-52)		47 (42-52)	
Eating location	*n*=282		*n*=360	
Eating outside home	47 (40-54)	0.600	47 (42-54)	0.201
Eating at home	48 (44-53)		47 (40-52)	
Meal preparation	*n*=282		*n*=360	
Buy	48 (42-54)	0.933	47 (41-52)	0.942
Cook	48 (44-53)		47 (41-53)	
Eating activity	*n*=282		*n*=360	
Doing other activities	48 (42-51)	0.003*	47 (42-52)	0.466
Just eating	49 (45-55)		47 (41-52)	

Data were analysed using Mann-Whitney
*significantly different, *p*-value <0.05

p=0.011) and breakfast eaters scored higher than skippers (*B*=2.559, *p*=0.011). Gender, education, and job were significant only in the unadjusted models.

DISCUSSION

Results showed that urban and rural areas have different associated factors influencing diet quality. In rural areas, gender and eating activity during breakfast were significant, whereas in urban areas, age and breakfast consumption were associated factors. In rural areas, gender played a significant role. In bivariate analysis, men showed a higher DQI-I total score than women, but in the linear regression, women had a higher DQI-I total score than men. This discrepancy can be explained by the different statistical approaches employed: the Mann–Whitney U test compares the median DQI-I scores between groups, whereas linear regression estimates differences in the mean values. Linear regression may therefore provide a more representative estimate, as it takes the entire distribution into account and allows for adjustment.

Regarding gender roles in nutrition, most of the women in the current study were housewives without jobs outside the home (Arifa *et al.*, 2024), which may have influenced their dietary habits. Women, more often responsible for cooking, tended to eat home-cooked meals, while men preferred eating out. Frequent home cooking by women was linked to higher DQI-I scores, aligning with research showing home cooking improves diet quality. For example, Wolfson, Leung & Richardson (2020) reported that more frequent home cooking was associated with higher Healthy Eating Index scores in U.S. adults.

In urban areas, individuals aged 26–35 years (younger adults) appeared to have higher DQI-I scores compared to those aged 36–45 years. This finding supports previous evidence indicating

Table 5. Linear regression on factors associated with DQI-I scores in rural and urban areas

Variable	*Unadjusted*				*Adjusted*			*p-value*
	B	*95% CI*		*p-value*	*B*	*95% CI*		
Rural								
Gender								
Male	-2.851	-4.693	-1.090	0.002*	-2.582	-4.387	-0.778	0.005*
Female (ref)	-	-	-	-	-	-	-	-
Eating activity								
Just eating	2.580	0.764	4.395	0.006*	2.217	0.406	4.028	0.017*
Doing other activities (ref)	-	-	-	-	-	-	-	-
Urban								
Gender								
Male	-2.142	-3.745	-0.539	0.009*	-0.929	-2.926	1.068	0.361
Female (ref)	-	-	-	-	-	-	-	-
Age								
26-35 years old	2.232	3.855	0.609	0.007*	2.086	3.699	0.473	0.011*
36-45 years old (ref)	-	-	-	-	-	-	-	-
Educational level								
Low education level	-2.037	-3.780	-0.294	0.022*	-1.526	-3.277	0.225	0.087
High education level (ref)	-	-	-	-	-	-	-	-
Job								
Worker	-2.337	-3.992	-0.682	0.006*	-1.948	-4.015	0.188	0.065
Non-worker (ref)	-	-	-	-	-	-	-	-
Eating breakfast								
Eating breakfast	2.808	0.838	4.778	0.005*	2.559	0.595	4.522	0.011*
Skipping breakfast (ref)	-	-	-	-	-	-	-	-

[a] Data were analysed using linear regression
* significantly associated, *p*-value <0.05

that diet quality tends to decline during the transition from youth to middle adulthood (Gupta *et al.*, 2018; Tiuganji *et al.,* 2020). The decline has been attributed to irregular eating habits (Arifa *et al.*, 2024), including skipping meals, frequent snacking, and increased consumption of commercially prepared foods such as takeaways and pre-packaged items, behaviours commonly linked to poorer diet quality (Hamrick & Mcclelland, 2016). These findings align with the present study showing urban adults aged 36–45 years consuming significantly more fat, sodium, and MUFA than those aged 26–35 years. Urbanisation, a hallmark of more developed economies, may contribute to these changes in dietary patterns. Rapid urbanisation has been recognised as one of the most significant drivers of shifts in food practices and nutritional status (Cockx *et al.*, 2019). This may explain why older urban adults had lower DQI-I scores. Long commutes, irregular hours, peer trends, and intermittent fasting make them more likely to skip breakfast, thus increasing their metabolic risks (Martin *et al.*, 2017).

Breakfast eating practices in urban areas were found to be associated with diet quality; individuals who skipped breakfast tended to have inadequate micronutrient intake and an imbalanced macronutrient ratio. Breakfast skippers also exhibited higher glucose concentrations and lower satiety, which in turn led to increased food intake at subsequent meals, potentially raising the consumption of fat and added sugars

(Alwattar, Thyfault & Leidy, 2015). This study found no link between breakfast and diet quality in rural areas, possibly because urban adults skip breakfast more due to time constraints, while rural populations have better access to fresh, healthy foods. This aligns with previous findings indicating that urbanisation is associated with increased consumption of fat, saturated fat, cholesterol, and sodium (Sartika, 2018), which may disproportionately affect diet quality in urban settings.

Eating while engaging in other activities was significantly associated with diet quality in the rural areas. This finding is consistent with previous studies suggesting that, in modern society, eating is frequently performed while attention is focused on other tasks or stimuli. A strong and consistent association has been found between the use of social media and eating concerns among young adults in the United States (Sidani *et al.*, 2016). External stimuli from concurrent activities during meals are known to influence eating behaviours, often resulting in higher food intake (Wagnild & Pollard, 2021). Engaging in distracting activities while eating may lead to increased caloric intake and diminished cognitive awareness of the quantity of food consumed (La Marra, Caviglia & Perrella, 2020). These results suggest that promoting mindful eating behaviours may be an effective approach to improving diet quality among adults.

The overall low diet quality in urban and rural areas among the Indonesian population aligns with findings from other studies in Indonesia by Sartika (2018) and Stefani *et al.* (2018), which examined various diet quality indices such as the DQI-I and HEI. However, rural areas appeared to have relatively better diet quality than urban areas. A study conducted in various global region including Philipphines (Hall *et al.,* 2009) found that rural populations have a higher proportion of individuals meeting vegetable intake guidelines. Similarly, results of 11 countries by Hall *et al.* (2009) reported significant differences in fruit and vegetable consumption between urban and rural areas.

The moderation score results suggested that respondents in urban areas may have greater exposure to unhealthy foods, such as fats and processed foods. In contrast, although rural areas showed lower protein consumption than urban areas, the intake of unhealthy foods was also lower (Bricas, 2019). Urbanisation has been associated with increased consumption of fats, saturated fats, and sugary foods. This is likely due to improved access to a wide range of food options and the greater influence of media and marketing in urban environments, which encourage the purchase of processed foods that contribute to higher intakes of sugar, fat, and sodium (Khusun *et al.,* 2022).

For the component of overall balance, urban areas showed a higher proportion of respondents with unacceptable nutrient ratios compared to rural areas. This indicates a potentially increased risk of diet-related health issues among the urban population. Imbalanced macronutrient intake can lead to various health problems. For example, insufficient protein intake is linked to impaired immune function, while excessive protein intake is associated with cancers of the upper digestive tract and kidneys. Additionally, high consumption of carbohydrates and fats increases the risk of obesity and chronic diseases (Grech, Rangan & Allman-Farinelli, 2018).

In terms of education, the findings from this study align with previous research conducted among urban populations, which demonstrated that higher educational attainment is associated with better diet quality (Martin *et al.*, 2017). A higher level of

education is often linked to increased income, which can enhance access to a greater variety of foods and contribute to improved diet quality (Abassi *et al.*, 2019). Regarding nutrient intake, the results indicated that in urban areas, individuals with lower education levels consumed significantly less energy, fat, fibre, vitamin C, and saturated fatty acids (SFA). Employment status also plays a role; a higher income is often associated with employment, which may enable individuals to purchase a wider variety of foods (Sartika, 2018).

The differing characteristics of urban and rural populations may also account for the variation in results between the two settings (Arifa *et al.*, 2024). The literature highlights that urban and rural residents exhibit distinct differences in terms of eating patterns, shift work, and food access, which could contribute to variations in dietary intake (Nabdi, Boujraf & Benzagmout, 2022). For example, urban populations are more exposed to dietary transitions influenced by urbanisation and sociodemographic factors, which can shape breakfast practices and overall diet patterns (Febriana *et al.*, 2024). Besides that, the influence of cultural factors, including diverse eating habits, traditional food types, and differing preferences across Indonesia's various ethnic groups, could also shape eating practices and behaviours of the Indonesian urban and rural adults (Wijaya, 2019).

Furthermore, the different associated factors between urban and rural areas may also be partially attributed to the statistical methods used in the analysis. Specifically, non-parametric tests were employed due to the non-normally distributed data. However, non-parametric tests generally have lower statistical power than parametric tests, which may limit their ability to detect significant differences. Despite these limitations, this study offers valuable insights into breakfast eating practices and diet quality among adults in both rural and urban settings across six provinces in Indonesia. These findings may reflect broader national patterns, as the IFB 2018 applied population-weighted sampling. However, it is important to note that the eastern region of Indonesia was not fully surveyed. Future research should strive to include nationally representative samples to improve external validity and better capture regional dietary differences throughout Indonesia.

CONCLUSION

In rural areas, significant associations with diet quality were observed for gender and eating activity. Specifically, being male and engaging in additional activities while eating breakfast were linked to lower total DQI-I scores. In urban areas, diet quality was significantly associated with eating breakfast and age. Skipping breakfast and being in the older adult age group (36–45 years) were both associated with lower DQI-I scores. These findings underscore that the factors influencing diet quality differ between urban and rural populations. The findings support targeted nutrition education for regular breakfast in urban adults and improved dietary diversity in rural areas. Policymakers could boost access to affordable nutrient-dense breakfasts via workplaces, schools, and community markets, with interventions tailored to local needs.

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Authors' contributions

Arifa VH, responsible for all scientific content of the article, formulating the problem formulation, analysing and interpreting the data, and preparing the draft manuscript and making revisions; Khusun H, responsible for giving input, assistance, and supervision on all the processes of research and manuscript writing; Wiradnyani LAA, responsible for giving input, assistance, and supervision on all the processes of research and manuscript writing; Februhartanty J, responsible for giving input, assistance, and supervision on all the processes of research and manuscript writing.

Conflict of interest

The authors declare no commercial or financial conflicts of interest. This study was self-funded.

References

Abassi MM, Sassi S, El Ati J, Ben Gharbia H, Delpeuch F & Traissac P (2019). Gender inequalities in diet quality and their socioeconomic patterning in a nutrition transition context in the Middle East and North Africa: A cross-sectional study in Tunisia. *Nutr J* 18(1):18.

Alwattar AY, Thyfault JP & Leidy HJ (2015). The effect of breakfast type and frequency of consumption on glycemic response in overweight/obese late adolescent girls. *Eur J Clin Nutr* 69(8):885-890.

Arifa VH, Wiradnyani LAA, Khusun H & Februhartanty J (2024). Breakfast practices among Indonesian adults urban and rural. *Amerta Nutr* 8(3):441-451.

Bricas N (2019). Urbanization issues affecting food system sustainability. In C Brand, N Bricas, D Conaré, B Daviron, J Debru, L Michel & CT Soulard (eds). *Designing Urban Food Policies. Concepts and Approaches* (pp. 1-25). Springer, Cham.

Cockx L, Colen L & De Weerdt J (2019). Urbanization as a driver of changing food demand in Africa: Evidence from rural-urban migration in Tanzania. *JRC Technical Report*. European Commission, Brussels. From https://www.researchgate.net/publication/331983411_Urbanization_as_a_driver_of_changing_food_demand_in_Africa_Evidence_from_rural-urban_migration_in_Tanzania [Retrieved August 14 2024].

Colozza D & Avendano M (2019). Urbanisation, dietary change and traditional food practices in Indonesia: A longitudinal analysis. *Soc Sci Med* 233:103-112.

Febriana NL, Februhartanty J, Hanisa N & Khusun H (2024). Eating behavior of Indonesian adults differ by metropolization levels based on the 2018 Indonesian Food Barometer. *Media Gizi Indones* 19(1):1-10.

Grech A, Rangan A & Allman-Farinelli M (2018). Macronutrient composition of the Australian population's diet; trends from three national nutrition surveys 1983, 1995 and 2012. *Nutrients* 10(8):1045.

Gupta CC, Coates AM, Dorrian J & Banks S (2018). *The factors influencing the eating behaviour of shiftworkers: what, when, where and why*. Master's Thesis, Queensland University of Technology, Brisbane.

Hall JN, Moore S, Harper SB & Lynch JW (2009). Global variability in fruit and vegetable consumption. *Am J Prev Med* 36(5):402-409. e5.

Hamrick KS & McClelland K (2016). Americans' eating patterns and time spent on food: The 2014 Eating & Health Module Data. *Economic Information Bulletin No. 158*. United States Department of Agriculture (USDA), Washington, DC. From https://www.ers.usda.gov/publications/pub-details?pubid=80503 [Retrieved July 30 2024].

Kemenkes RI (2018). *Laporan Riskesdas 2018*. Badan Penelitian dan Pengembangan Kesehatan, Kementerian Kesehatan Republik Indonesia, Jakarta. From http://www.yankes.kemkes.go.id/ [Retrieved August 23 2024].

Khusun H, Februhartanty J, Roselynne EM, Pramesthi A, Hapsari W & Poulain JP (2022). *Indonesian Food Barometer: Food, Cultures, and Health*. SEAMEO RECFON, Jakarta. From https://www.seameo-recfon.org/publications/books/ [Retrieved July 22 2024].

Kim S, Haines PS, Maria Siega-Riz A & Popkin BM (2003). The Diet Quality Index-International (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States. *J Nutr* 133(11):3476-3484.

La Marra M, Caviglia G & Perrella R (2020). Using smartphones when eating increases caloric intake in young people: An overview of the literature. *Front Psychol* 11:587886.

Martin JC, Moran LJ, Teede HJ, Ranasinha S, Lombard CB & Harrison CL (2017). Exploring diet quality between urban and rural dwelling women of reproductive age. *Nutrients* 9(6):1-14.

Nabdi S, Boujraf S & Benzagmout M (2022). Evaluation of rural-urban patterns in dietary intake: A descriptive analytical study – Case series. *Ann Med Surg* 84:104972.

O'Neil CE, Byrd-Bredbenner C, Hayes D, Jana L, Klinger SE & Stephenson-Martin S (2014). The role of breakfast in health: Definition and criteria for a quality breakfast. *J Acad Nutr Diet* 114(12):S8-S26.

Poulain JP, Laporte C, Tibère L, Mognard E, Ragavan NA, Zadeh AA & Noor IM (2020). Malaysian Food Barometer (MFB): A study of the impact of compressed modernisation on food habits. *Mal J Nutr* 26(1):1-17.

Rutstein SO & Johnson KB (2004). *The DHS Wealth Index*. ORC Macro, Calverton, Maryland. From https://www.dhsprogram.com/publications/publication-CR6-Comparative-Reports.cfm [Retrieved August 14 2025].

Sartika AN (2018). *Association of eating behavior and diet quality among adults living in urban and rural area of East Java*. Master's Thesis, Universitas Indonesia, Depok.

Sidani JE, Shensa A, Hoffman B, Hanmer J & Primack BA (2016). The association between social media use and eating concerns among US young adults. *J Acad Nutr Diet* 116(9):1465-1472.

Stefani S, Ngatidjan S, Paotiana M, Sitompul KA, Abdullah M, Sulistianingsih DP, Shankar AH & Agustina R (2018). Dietary quality of predominantly traditional diets is associated with blood glucose profiles, but not with total fecal Bifidobacterium in Indonesian women. *PLoS ONE* 13(12):1-18.

Tiuganji NM, Nehme P, Marqueze EC, Isherwood CM, Martins AJ, Vasconcelos S, Cipolla-Neto J & Lowden A (2020). Eating habits among workers living under different levels of urbanization. *Environ Health Insights* 14:1-15.

Vahid F, Jalili M, Rahmani W, Nasiri Z & Bohn T (2022). A higher Healthy Eating Index is associated with decreased markers of inflammation and lower odds for being overweight/obese based on a case-control study. *Nutrients* 14(23):5127.

Wagnild JM & Pollard TM (2021). How is television time linked to cardiometabolic health in adults? A critical systematic review of the evidence for an effect of watching television on eating, movement, affect and sleep. *BMJ Open* 11(5):e040739.

Wijaya S (2019). Indonesian food culture mapping: A starter contribution to promote Indonesian culinary tourism. *J Ethn Foods* 6:9.

Wolfson JA, Leung CW & Richardson CR (2020). More frequent cooking at home is associated with higher Healthy Eating Index-2015 score. *Public Health Nutr* 23(13):2384-2394.

Zhai FY, Du SF, Wang ZH, Zhang JG, Du WW & Popkin BM (2014). Dynamics of the Chinese diet and the role of urbanicity, 1991–2011. *Obes Rev* 15(S1):16-26.