EATING BEHAVIOR OF INDONESIAN ADULTS DIFFER BY METROPOLIZATION LEVELS BASED ON THE 2018 INDONESIAN FOOD BAROMETER

Perbedaan Perilaku Makan Orang Dewasa di Indonesia pada Berbagai Level Metropolisasi berdasarkan Indonesian Food Barometer 2018

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ABSTRACT

Modernization leads to nutrition transition process, shifts eating behavior into a more modernized pattern that may increase the risk of non-communicable diseases (NCDs). Using the 2018 Indonesian Food Barometer (IFB) data, this study assessed the differences in eating behavior between metropolization levels among Indonesian adults. 1482 adults aged 18-64 in six provinces were involved. Eating behavior was defined by the number of eating events, food preparation, eating location, eating companion, and activity while eating. Metropolization level was defined based on the gross domestic regional product (GRDP), GRDP/capita, population size, population density, and non-agricultural worker proportion. Differences in each eating behavior dimension between metropolization levels were analyzed using the Chi-square test ($p<0.05$) and adjusted with sociodemographic factors using logistics regression. 83.9% of the subjects had ≤5 eating events/day and dominated by 4-5 eating events/day. 51.2% and 83.1% of the subjects cooked and ate at home frequently, indicating the practice of traditional eating. Meanwhile, the tendency towards modern dimension can be seen as the proportion of eating alone frequently and eating only less frequently were 60.3% and 67.9%, respectively. Eating behavior differed significantly ($p<0.05$) between metropolization levels, except for eating with company. Proportion of not cooking and eating away from home frequently increase as metropolization level increases ($p<0.05$) after adjusted with sociodemographic factors while eating alone and eating only showed no significant differences. Modern eating behavior tendency increases along with metropolization level. Improving living and working conditions in metropolitan areas is imperative to facilitate healthier eating behavior among the inhabitants.

Keywords: adults, eating behavior, metropolitan, modern, nutrition transition

INTRODUCTION

Modernization, urbanization, economic development, and increased wealth led to a shift in dietary patterns called the nutrition transition process (Sannigrahi, 2016), which was indicated among others by the increase of overweight and obesity (Popkin & Ng, 2022). Indonesian Basic Health Research (*Riset Kesehatan Dasar/Riskesdas*) 2018 showed that overweight prevalence among adults gradually increased from 8.6% in 2007 to 11.5% in 2013 and 13.6% in 2018. A similar pattern was also observed in obesity prevalence, with urban areas showing higher prevalence than rural areas. Higher consumption of high-risk food, such as sweet foods and beverages, salty foods, fried/fatty foods, and processed animal protein, as well as an increase of sedentary behavior in urban areas might explain this phenomenon (Balai Penelitian dan Pengembangan Kesehatan, 2019).

Modernization involves a series of sociodemographic factors such as urbanization or more precisely metropolization, increased purchasing power, level of education, number of individuals per household and stylization of consumption (Poulain et al., 2015). As an area becomes more industrialized, the urbanization process follows. Advanced urbanization transforms cities into metropolitan areas. Indonesian

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geographical complexities as the biggest archipelago resulted in the different growth rates of urban areas. Based on the demographic indicator, main cities in different regions in Indonesia showed varied levels of metropolization. Jakarta as the largest metropolitan city in Indonesia has approximately ten million population, Surabaya as the second has 4-5 million population while Medan as the biggest city in Sumatera, and Makassar as the biggest in the eastern area have two million and 1.5 million population, respectively (Adisasmita, 2013).

As the cities grow, increased socioeconomic advantages may affect the health and well-being of the population. Evidence showed that increasing urbanization is in line with increasing health risks. Higher urbanicity and higher education level in the area may lead to more sedentary occupational physical activity (Khusun et al., 2016) The traditional eating pattern is gradually replaced with modern eating as people are adjusting to modernization dynamics. Modern eating can be seen from the shift from a regular food day pattern to 'grazing' (repetitive and unplanned consumption of small amount of food), eating together to eating alone, buying meals instead of cooking, and others (Sproesser et al., 2019). Modern eating practice can be seen from the simplification of meal structures, the increase of in-between meals, the location of food consumption, and profiles of food days (Poulain, 2017).

Increased urbanization and income in low and middle-income countries (LMICs) was in line with the adoption of urban lifestyles, such as eating out and consumption of food prepared away from home (Zhai et al., 2014). A study by Mognard et al. (2023) showed that in 50% of meals were purchased out of home in Singapore, while 35% and 21% of lunch in Indonesia and Malaysia were eaten outside of home. Urban population has been shown to be exhibit a high proportion of eating out habit, among others due to food environments and social patterns of eating. In urban slum area, frequencies of buying food from small shops (*warung*), street food vendors, and modern food stores, which are abundant around the neighborhood, were significantly associated with consumption of snacks, mixed dishes, and fruit (Anggraini et al., 2016). The consumption of food considered as 'less healthy pattern' such as fried foods, oils, and fats was associated with higher risk of obesity (Khusun et al., 2016) The shift of dietary pattern shifted the prevalence of obesity towards the lower socioeconomic population (Yulia et al., 2016). Eating location, especially leisure places, food outlets, and on-the-go, was associated with increased consumption of non-core food, such as pastries, high-fat snacks, and sugary beverages (Ziauddeen et al., 2017), frequent eating alone was found to influence the consumption of sweet snacks and beverages, processed foods (Kwon et al., 2018), and longer eating duration within a day were related to increased fat intake (Tiuganji et al., 2020). Social patterns of eating might explain the overweight/obesity pandemic (Bittman et al., 2019).

The 2018 Indonesian Food Barometer (IFB) was part of the Asian Food Barometer (AFB), the tools developed to study the socioeconomic, demographic, and cultural determinants of food consumption and to analyze the health and sociocultural consequences of nutrition transition and food transition (Khusun, et al., 2022). Cultural and social dimensions of eating cannot be ignored, seeing their impact on decision-making regarding food intake, which will influence health outcomes (Briones Alonso et al., 2018); Robinson & Field, 2015). Most existing studies focused on what people eat, such as the type and the amount of food consumed, while subdimensions of how people eat remain under-explored.

As a rapidly developing country, more cities in Indonesia will grow into metropolitan areas. More than 70% of Indonesians are productive adults who play crucial roles in economic growth (Peterson, 2017) and the caretakers of the next generation. Considering the urgency, this study will explore the differences in eating behavior between metropolization levels among Indonesian adults based on the 2018 IFB.

METHODS

Ethical approval was issued by the Ethical Committee Faculty of Medicine, Universitas Indonesia – Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia, with the number KET-446/UN2.F1/ETIK/PPM.00.02/2023. This study is an exploratory quantitative study with a cross-sectional study design conducted in December 2022 until

April 2023 using secondary data from the 2018 IFB. IFB data was collected in March-July 2018 and involved adults aged >18 years old in six provinces in Indonesia (Jakarta, East Java, West Java, South Sulawesi, Bali, and West Sumatera covering both urban and rural areas. Subjects were selected using multi-stage random sampling, proportionate to population size, to obtain a representative sample of the Indonesian population. Sociodemographic characteristics data and dietary intake were collected using a structured questionnaire 24-h food recall, respectively, through in-person interviews (Khusun et al., 2022)

The current study only included non-pregnant/lactating productive adults (18-64 years old). From the total of 1665 subjects of the 2018 IFB, the current study included 1482 subjects. Metropolization was defined based on the gross domestic regional product (GRDP), GRDP/capita, population size, population density, and proportion of workers in the non-agricultural sector (Dardak et al., 2008). Cities/municipalities were ranked for each criterion, and weights were applied on each criterion according to its contribution to metropolization. Total score was calculated and metropolization was sorted into four levels from the least metropolized to the most metropolized: non metropolitan (Padang Pariaman, Luwu Timur, and Klungkung), semi metropolitan (Garut, Lumajang, and Denpasar), secondary metropolitan (Bandung, Makassar, and Padang), and primary metropolitan (DKI Jakarta, and Surabaya).

Eating behavior was defined by the number of eating events, food preparation, eating location, eating companion, and activity while eating. The number of eating events was classified as '≤5 eating events' and '>5 eating events' which comprised any eating events, including meals and snacks. Since the number of eating events differed between subjects, the other eating behavior dimensions were defined based on the relative proportion of each activity reported from the number of eating events. The relative proportion was then recategorized as 'less frequent' (≤66.67%) and 'frequent' (>66.67%) (Holm et al., 2016). The differences in each eating behavior dimension between metropolization levels and sociodemographic factors were analyzed using the Chi-square test ($p<0.05$). Significant results with $p<0.02$ were analyzed further using logistics regression. Data were analyzed using IBM SPSS Statistics version 29.

RESULTS AND DISCUSSIONS

The number of subjects included in this study was 1482 subjects with the majority being 26-35 years old (29.9%), male (51.5%), Jawa-Madura (24.6%), in the highest income tertile (49.3%), had graduated from junior and/or high school (62.6%), workers (60.3%), and lived in small households (50.0%) (Table 1). The sociodemographic characteristics of the subjects in this study reflects the characteristics of Indonesian adults in 2018. Central Bureau of Statistics (BPS) data showed that most Indonesian adults have a middle income, which might result from the different standards used to determine income level (Badan Pusat Statistik, 2018) The result of this study can still be generalized to a similar population.

Table 1. Sociodemographic Characteristics of the Subjects

Variable	n (%)
Age	
18-25 y.o.	328 (22.1%)
26-35 y.o.	443 (29.9%)
36-45 y.o.	321 (21.7%)
>45 y.o.	390 (26.3%)
Sex	
Male	763 (51.5%)
Female	719 (48.5%)
Ethnicity	
Sunda	284 (19.2%)
Betawi	117 (7.9%)
Jawa-Madura	364 (24.6%)
Bali	270 (18.2%)
All Sumatra[a]	242 (16.3%)
Sulawesi[b]	205 (13.8%)
Income[c]	
T1	511 (34.5%)
T2	241 (16.3%)
T3	730 (49.3%)
Education[d]	
Low	333 (22.5%)
Middle	927 (62.6%)
High	222 (15.0%)
Occupation[e]	
Workers	894 (60.3%)
Non-workers	203 (13.7%)

Housewives	385 (26.0%)
Family size[f]	
Single-person HH	44 (3.0%)
Small HH	741 (50.0%)
Large HH	697 (47.0%)
Metropolization Level[g]	
Non-metropolitan	369 (24.9%)
Semi metropolitan	390 (26.3%)
Secondary metropolitan	365 (24.6%)
Primary metropolitan	358 (24.2%)

[a]Comprises all ethnicity in Sumatra region

[b]Comprises all ethnicity in Sulawesi region

[c]Income variable was developed from composite measures of household cumulative living standard analysed using principal component analysis (PCA) and defined as tertile with T1 as lowest income, T2 as middle income, and T3 as highest income level

[d]Education level was defined based on the highest educational attainment of the subjects; 'low education' comprises subjects with elementary school to lower educational attainment, 'middle education' consists of subjects graduated from junior and/or high school, and 'high education' consists of subjects with diploma or higher educational attainment.

[e]'Workers' including all type of workers, 'non-workers' comprises of unemployed subjects, students, and retirees

[f]Family size was classified based on the number of people living together with the subjects; Single person househpld consists of subjects who live alone, small household comprised of family with up to 4 members, while families with >4 family members

[g]Metropolization level was defined using data from BPS; 'Non metropolitan' consists of Padang Pariaman, Luwu Timur, Klungkung, 'semi metropolitan' consists of Denpasar, Garut, Lumajang, 'secondary metropolitan' consists of Bandung, Makassar, Padang, and 'primary metropolitan' consists of DKI Jakarta and Surabaya

Eating behavior of the subjects showed the practice of traditional eating patterns as seen from the number of eating events, food preparation, and eating location dimensions. 83.9% of the subjects had ≤5 eating events in a day. This study found that the subjects had at least one eating event and a maximum of 10 eating events within a day. A higher proportion of >5 eating events in a day was observed in more metropolized areas (primary and secondary metropolitan areas). A higher number of eating events may indicate 'grazing' behavior as the influence of modernization (Sproesser et al., 2018). 'Grazing' pattern was found to be associated with higher energy intake and later night-time eating which increase the risk of metabolic diseases (Manoogian et al., 2019; Zeballos & Chelius, 2021).

Most of the subjects prepared food by cooking and eating at home, showing the practice of traditional eating behavior dimension. However, modern eating practices were observed in the eating companion and activity while eating in which eating alone frequently and eating only less frequently were more dominant (60.3% and 67.9%). (Table 2).

Table 2. Distribution of Eating Behavior in a Day among Subjects (N=1482)

Variable			n (%)
Number of eating events[h]		≤5 eating events	1244 (83.9%)
		>5 eating events	238 (16.1%)
Food preparation[i]	Cooking	Less Frequent [j]	723 (48.8%)
		Frequent	759 (51.2%)
	Not cooking	Less Frequent	1150 (77.6%)
		Frequent	332 (22.4%)
Eating location	Home	Less Frequent	251 (16.9%)
		Frequent	1231 (83.1%)
	Away from home	Less Frequent	1376 (92.8%)
		Frequent	106 (7.2%)
Eating companion	With company	Less Frequent	1167 (78.7%)
		Frequent	315 (21.3%)
	Alone	Less Frequent	589 (39.7%)
		Frequent	893 (60.3%)
Activity while eating	Eating only	Less Frequent	1007 (67.9%)
		Frequent	475 (32.1%)
	Eating while doing something else	Less Frequent	762 (51.4%)
		Frequent	720 (48.6%)

[h]Number of eating events were calculated based on total number of eating events among the subjects within a day and categorized as up to 5 total number of eating events within a day and more than 5 total number of eating events within a day

[i]Food preparation was defined as the way the subjects prepare their food. Cooking and cooked by friends/partners were categorized as 'cooking' while means other than cooking such as buying, catered, delivery, or given by someone else were categorized as 'not cooking'

[j]'Less frequent' and 'frequent' categories were developed based on the relative proportion from total number of eating events of each eating behavior dimension. The proportion up to 66.67% then recategorized as 'less frequent' and proportion above 66.67% were categorized as 'frequent

Table 3 shows that after adjustment with sociodemographic factors (age, sex, ethnicity, income, education, occupation, and family size), significant differences were still observed in eating behavior dimensions (except on eating alone and eating only) between metropolization levels. Within the number of eating events, the highest tendency to eat >5 times was observed in the

secondary metropolitan area (aOR 2.303;1.439-3.686). Metropolitan residents usually engage with modernized lifestyles and habits. Modernization contributes to the increased number of eating events as it influences people to no longer follow fixed eating pattern and 'grazing' becomes more common (Sproesser et al., 2018). In addition, the disruption of circadian rhythm from electricity and light usage results in longer waking time, which could lead to irregular eating since there is a longer eating period within a day (Paoli et al., 2019; J. P. Poulain et al., 2020).

The tendency towards modern eating was found in food preparation and eating location as aOR value for modernized eating behavior (not cooking and eating away from home) increased as the metropolization levels increased. This finding was consistent with the traditional eating behavior (cooking and eating at home) that decreased as the metropolization levels increased. Areas with higher urbanization levels are more spatially and financially stable and have more varied food outlets which may affect their food system in general. Practical food preparation methods, such as buying food instead of cooking, are popular among modern eaters (Sproesser et al., 2018), as a coping mechanism for time constraints (Tharrey et al., 2020).

Eating alone practice showed no significant patterns between metropolization levels after adjustment with sociodemographic factors. Activity while eating showed higher odds (1.880; 1.212-2.914) of eating while doing something else in the primary metropolitan area compared to the non-metropolitan area. The traditional dimension of activity while eating (eating only) no longer showed a significant pattern after being adjusted to sociodemographic factors.

The tendency to cook frequently was found among older age groups (36-45 and >45 years old) with aOR 1.444; 1.031-2.024 and 2.596; 1.850-3.642, also among Jawa-Madura ethnicity (2.016; 1.376-2.953). The highest income (T3) group (0.512; 0.388-0.675), subjects with high education (0.614; 0.406-0.927), and all-Sumatera ethnicity (0.647; 0.427-0.981) were less likely to cook frequently. Millennials usually prefer prepared foods and have more disposable income so they cook less and consume more food away from home (Saksena et al., 2018). In metropolitan areas, numerous food retail retailers enable higher consumption of food prepared away from home (Stanton, 2015).

The 26-35 years and 36-45 years old age groups had higher odds to be eating away from home frequently (3.754; 1.936-7.279 and 2.336; 1.230-4.435, respectively). In contrast, non-workers (0.315; 0.153-0.648), housewives (0.199; 0.088-0.450), and subjects living in small households (0.310; 0.123-0.782) were less likely to eat away from home frequently. The increase in eating away from home might be related to adaptation to working life. In this study, subjects aged 26-45 years, who are mainly workers, tended to eat away from home frequently. Culture and social media can also influence eating out practice. In Indonesia, eating out with family and friends has almost become a culture as numerous dining options in urban areas, from hawker street foods to fancy restaurants, are available anywhere (Anyanwu et al., 2022) Through food vlogs and social media, information spreads among populous Indonesian netizens and influences food purchasing behavior (Vita et al., 2021).

No significant differences were found in the eating companion dimension between metropolization levels. The possible explanation might be that the increase in individualization was happening while socialization of eating prevailed, both in metropolized and less metropolized areas. This phenomenon was also found in Malaysia (Poulain et al., 2014) which can be explained by the similar characteristics between both countries, such as multiethnicity, rising economy, and rapid modernization (Poulain et al., 2020).

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Table 3. Differences in Eating Behavior in a Day after Adjusted with Sociodemographic Factors

Variable		Number of Eating Events	Food Preparation		Eating Location		Eating Companion	Activity while Eating	
		>5 eating events	Cooking Frequently	Not Cooking Frequently	Eating at Home Frequently	Eating Away Frequently	Eating Alone Frequently	Eating Only Frequently	Eating while Doing Something Else Frequently
		OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Metropolization Level (Ref. Non metropolitan)	Semi metropolitan	1.572 (0.937-2.636)	0.454 (0.310-0.664)**	1.650 (1.032-2.640)*	0.650 (0.388-1.089)	1.640 (0.735-3.657)	0.697 (0.464-1.047)	0.933 (0.641-1.357)	1.292 (0.905-1.845)
	Secondary metropolitan	2.303 (1.439-3.686)**	0.452 (0.311-0.658)**	1.917 (1.185-3.102)*	0.505 (0.312-0.815)*	2.206 (1.109-4.386)*	1.105 (0.767-1.590)	0.979 (0.676-1.420)	1.116 (0.801-1.554)
	Primary metropolitan	1.932 (1.062-3.517)*	0.173 (0.105-0.286)**	7.428 (4.119-13.397)**	0.382 (0.206-0.708)*	4.706 (1.959-11.302)*	0.785 (0.483-1.276)	0.641 (0.395-1.042)	1.880 (1.212-2.914)*
Age (Ref.18-25y ref)	26-35y	-	0.989 (0.726-1.348)	0.932 (0.639-1.359)	0.427 (0.273-0.668)**	3.754 (1.936-7.279)**	-	1.122 (0.782-1.609)	0.879 (0.637-1.213)
	36-45y	-	1.444 (1.031-2.024)*	0.571 (0.373-0.873)*	0.637 (0.421-0.963)*	2.336 (1.230-4.435)*	-	1.521 (1.041-2.222)*	0.614 (0.435-0.866)*
	>45y	-	2.596 (1.850-3.642)**	0.388 (0.255-0.590)**	0.820 (0.519-1.295)	1.911 (0.949-3.848)	-	1.984 (1.386-2.840)**	0.482 (0.349-0.666)**
Sex (Ref. Male)	Female	-	-	-	0.790 (0.561-1.114)	1.047 (0.649-1.687)	1.591 (1.206-2.100)**	1.672 (1.255-2.229)**	1.601 (1.232-2.081)**
Ethnicity (Ref. Sunda)	Betawi	0.957 (0.501-1.827)	0.922 (0.509-1.671)	1.072 (0.596-1.928)	0.906 (0.464-1.769)	1.483 (0.584-3.765)	1.966 (1.148-3.364)*	1.427 (0.775-2.626)	0.835 (0.489-1.427)
	Jawa-Madura	0.615 (0.390-0.972)*	2.016 (1.376-2.953)**	0.539 (0.334-0.868)*	1.411 (0.852-2.335)	0.930 (0.425-2.034)	2.271 (1.584-3.254)**	2.122 (1.439-3.131)**	0.595 (0.418-0.849)*
	Bali	0.629 (0.369-1.073)	0.680 (0.444-1.043)	1.635 (0.977-2.736)	1.213 (0.693-2.123)	1.450 (0.617-3.407)	7.144 (4.533-11.260)**	2.523 (1.618-3.934)**	0.550 (0.373-0.810)*
	All Sumatra	1.291 (0.811-2.057)	0.647 (0.427-0.981)*	1.311 (0.798-2.153)	0.758 (0.457-1.255)	2.124 (0.979-4.608)	1.783 (1.179-2.696)*	0.829 (0.523-1.315)	1.224 (0.823-1.820)
	Sulawesi	0.354 (0.192-0.652)**	1.445 (0.936-2.232)	1.163 (0.686-1.971)	1.372 (0.773-2.434)	1.767 (0.770-4.056)	0.653 (0.428-0.997)*	1.797 (1.151-2.807)*	1.042 (0.693-1.566)
Income (Ref. T1)	T2	-	0.734 (0.523-1.031)	1.544 (1.012-2.357)*	-	-	1.402 (0.987-1.990)	-	-
	T3	-	0.512 (0.388-0.675)**	1.553 (1.100-2.194)*	-	-	1.342 (1.014-1.775)*	-	-

Education (Ref. Low)	Middle	-	0.788 (0.581-1.071)	1.035 (0.697-1.538)	0.601 (0.382-0.946)*	-	-	0.772 (0.572-1.041)	-
	High	-	0.614 (0.406-0.927)*	1.550 (0.950-2.529)	0.427 (0.245-0.742)*	-	-	0.678 (0.447-1.029)	-
Occupation (Ref. Workers)	Non-workers	-	-	0.943 (0.629-1.416)	2.535 (1.573-4.086)**	0.315 (0.153-0.648)*	1.295 (0.913-1.837)	0.818 (0.553-1.209)	1.551 (1.091-2.206)*
	Housewives	-	-	0.709 (0.512-0.982)*	3.080 (1.883-5.037)**	0.199 (0.088-0.450)**	0.833 (0.607-1.143)	1.101 (0.787-1.541)	1.079 (0.796-1.462)
Family size (Ref. Single-person HH)	Small HH	-	-	-	1.789 (0.839-3.814)	0.310 (0.123-0.782)*	-	-	-
	Large HH	-	-	-	1.194 (0.565-2.523)	0.468 (0.190-1.154)	-	-	-

* $p<0.05$
** $p<0.001$
- Not adjusted for the sociodemographic factor

In modernized society, formality was reduced as the social constraints grew more relaxed (Wouters, 2009). The findings on activity while eating in this study might indicate that the informalization process was happening. Higher use of social media and the internet in metropolitan areas (Koiranen et al., 2020) might influence the activity done while eating.

This study showed how metropolization might shift the eating behavior of adults in Indonesia into a more modernized pattern. Modern eating was related to an increased risk of obesity and NCDs since how people eat might influence what people eat. Higher total energy intake and later night-time eating were found to be related to the "grazing" pattern (Kahleova et al., 2017). Eating location was found to influence eating patterns and behaviors and resulted in diet quality. Leisure places, food outlets, and eating on-the-go may influence the type of food consumed as people are more exposed to non-core food in such places (Ziauddeen et al., 2017). Social influence shifts food intake, whether the amount or type of food consumed (Higgs, 2015). Stimuli from other activities done while eating were known to influence eating, resulting in higher food intake (Wagnild & Pollard, 2021).

Eating behavior in this study was defined using five dimensions that encompass the temporal aspect, preparation, spatial aspect, social aspect, and informalization. These combinations might provide a better understanding of eating behavior and become the strength of this study. However, this study did not differentiate the type of eating event (meal or in-between meal). It might be the limitation of this study since identifying the type of each eating event might result in more comprehensive data as different eating events might have different characteristics. A separate analysis of the variables used to define eating behavior might also reduce the understanding since each variable might interact with one another. Further studies should explore the possibility of these interactions.

City size can be determined using several indicators, such as economic indicators (e.g., GRDP, unemployment rates), social indicators (e.g., crime rates, social interaction), and demographic indicators (e.g., population size). Based on the consensus, the demographic indicator is used to define the city size (Adisasmita, 2013). This study used a new approach by combining economic and demographic indicators assuming their influence on the food and social environment in the metropolitan area. However, since it was not a standardized approach, further cross-disciplinary research might still be needed to develop the standard for defining metropolization level as misclassification potential exists.

CONCLUSION

This study showed that people in more metropolized areas have more tendency to have more modernized eating behavior, i.e. having >5 eating events/day, not cooking frequently, and eating away from home frequently. More areas will grow into larger cities and metropolises as Indonesia develops. Urban development should align with sustainable development goals (SDGs) and New Urban Agenda goals. Improving access to healthy food, providing a healthy food environment, and work environment to enable people to have better eating behavior are necessary to build a healthy city. Building supporting facilities (e.g., efficient & sufficient mass transport system to reduce traffic jams and commuting time) and enforcing a conducive working environment (e.g., working hours, reasonable workload) could improve quality of life that people have more time to eat proper meals, preparing home-cooked food, and eat with the family. Good urban planning might reduce barriers and enable people in metropolized areas to eat better.

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REFERENCES

Adisasmita, S. A. (2013). *Mega City and Mega Airport* (1st ed.). Graha Ilmu.

Anggraini, R., Februhartanty, J., Bardosono, S., Khusun, H., & Worsley, A. (2016). Food Store Choice Among Urban Slum Women Is Associated With Consumption of Energy-Dense Food. *Asia Pacific Journal of Public Health*, *28*(5), 458–468. https://doi.org/10.1177/1010539516646849

Anyanwu, O. A., Naumova, E. N., Chomitz, V. R., Zhang, F.-F., Chui, K., Kartasurya, M. I., & Folta, S. C. (2022). The Socio-Ecological Context of the Nutrition Transition in Indonesia: A Qualitative Investigation of Perspectives from Multi-Disciplinary Stakeholders. *Nutrients*, *15*(1), 25. https://doi.org/10.3390/nu15010025

Badan Pusat Statistik. (2018). *Statistik Indonesia 2018*.

Balai Penelitian dan Pengembangan Kesehatan. (2019). *Laporan Nasional RISKESDAS 2018*.

Bittman, M., Cleary, E., Wilkinson-Bibicos, C., & Gershuny, J. (2019). The social disorganization of eating: A neglected determinant of the Australian epidemic of overweight/obesity. *BMC Public Health*, *19*. https://doi.org/10.1186/s12889-019-6768-3

Briones Alonso, E., Cockx, L., & Swinnen, J. (2018). Culture and food security. *Global Food Security*, *17*, 113–127. https://doi.org/https://doi.org/10.1016/j.gfs.2018.02.002

Dardak, H., Oetomo, A., Susantono, B., Samiadji, B. T., Kusbiantoro, Tjahjati, B., Rukmana, D., Budihardjo, E., Winarso, H., Suselo, H., Silas, J., Gardiner, M. O., Gardiner, P., Purnomohadi, N., Argo, T. A., Utomo, W., & Sarosa, W. (2008). *Metropolitan di Indonesia: Kenyataan dan Tantangan dalam Penataan Ruang* (H. Winarso, Ed.; 1st ed.). Direktorat Penataan Ruang, Departemen Pekerjaan Umum.

Higgs, S. (2015). Social norms and their influence on eating behaviours. In *Appetite* (Vol. 86, pp. 38–44). Academic Press. https://doi.org/10.1016/j.appet.2014.10.021

Holm, L., Lauridsen, D., Lund, T. B., Gronow, J., Niva, M., & Mäkelä, J. (2016). Changes in the social context and conduct of eating in four Nordic countries between 1997 and 2012. *Appetite*, *103*, 358–368. https://doi.org/10.1016/j.appet.2016.04.034

Kahleova, H., Lloren, J. I., Mashchak, A., Hill, M., & Fraser, G. E. (2017). Meal Frequency and Timing Are Associated with Changes in Body Mass Index in Adventist Health Study 2. *The Journal of Nutrition*, *147*(9), 1722–1728. https://doi.org/https://doi.org/10.3945/jn.116.244749

Khusun, H., Februhartanty, J., Mognard, E., Anggraini, R., Hapsari, P. W., & Poulain, J.-P. (2022). *Indonesian Food Barometer: Food, Cultures and Health*. SEAMEO RECFON.

Khusun, H., Februhartanty, J., Roselynne, A., Mognard, E., Pramesthi, W. H., & Poulain, J.-P. (2022). *Indonesian Food Barometer: Food, Cultures, and Health*. SEAMEO RECFON.

Khusun, H., Wiradnyani, L. A. A., & Siagian, N. (2016). Factors associated with overweight/obesity among adults in urban Indonesia. *Penelitian Gizi Dan Makanan (The Journal of Nutrition and Food Research)*, *38*(2). https://doi.org/10.22435/pgm.v38i2.5539.95-110

Koiranen, I., Keipi, T., Koivula, A., & Räsänen, P. (2020). Changing patterns of social media use? A population-level study of Finland. *Universal Access in the Information Society*, *19*(3), 603–617. https://doi.org/10.1007/s10209-019-00654-1

Kwon, A. R., Yoon, Y. S., Min, K. P., Lee, Y. K., & Jeon, J. H. (2018). Eating alone and metabolic syndrome: A population-based Korean National Health and Nutrition Examination Survey 2013–2014. *Obesity Research and Clinical Practice*, *12*(2), 146–157. https://doi.org/10.1016/j.orcp.2017.09.002

Manoogian, E. N. C., Chaix, A., & Panda, S. (2019). When to Eat: The Importance of Eating Patterns in Health and Disease. *Journal of Biological Rhythms*, *34*(6), 579–581. https://doi.org/10.1177/0748730419892105

Mognard, E., Naidoo, K., Laporte, C., Tibère, L., Alem, Y., Khusun, H., Februhartanty, J., Niiyama, Y., Ueda, H., Dasgupta, A., Dupuy, A., Rochedy, A., Yuen, J. L., Ismail, M. N., Nair, P. K., Ragavan, N. A., & Poulain, J.-P. (2023). "Eating Out", spatiality, temporality and sociality. A database for China, Indonesia, Japan, Malaysia, Singapore and France. *Frontiers in Nutrition*, *10*. https://doi.org/10.3389/fnut.2023.1066737

Paoli, A., Tinsley, G., Bianco, A., & Moro, T. (2019). The influence of meal frequency and timing on health in humans: The role of fasting. In *Nutrients* (Vol. 11, Issue 4). MDPI AG. https://doi.org/10.3390/nu11040719

Peterson, E. W. F. (2017). The Role of Population in Economic Growth. *SAGE Open*, *7*(4), 2158244017736094. https://doi.org/10.1177/2158244017736094

Popkin, B. M., & Ng, S. W. (2022). The nutrition transition to a stage of high obesity and noncommunicable disease prevalence dominated by ultra-processed foods is not inevitable. *Obesity Reviews*, *23*(1). https://doi.org/10.1111/obr.13366

Poulain, J. P. (2017). *The Sociology of Food: Eating and Place of Food in Society*.

Poulain, J. P., Laporte, C., Tibère, L., Mognard, E., Ragavan, N. A., Zadeh, A. A., & Noor, I. M. (2020). Malaysian Food Barometer

(MFB): A study of the impact of compressed modernisation on food habits. *Malaysian Journal of Nutrition*, *26*(1), 1–17. https://doi.org/10.31246/MJN-2019-0042

Poulain, J.-P., Smith, W., Laporte, C., Tibère, L., Ismail, M. N., Mognard, E., Aloysius, M., Neethiahnanthan, A. R., & Shamsul, A. B. (2015). Studying the consequences of modernization on ethnic food patterns: Development of the Malaysian Food Barometer (MFB). *Anthropology of Food*. https://doi.org/10.4000/aof.7735

Poulain, J.-P., Tibère, L., Laporte, C., & Mognard, E. (2014). *Malaysian Food Barometer: Food, Cultures & Health*. Taylor's Press.

Robinson, E., & Field, M. (2015). Awareness of social influence on food intake. An analysis of two experimental studies. *Appetite*, *85*, 165–170. https://doi.org/10.1016/j.appet.2014.11.019

Saksena, M. J., Okrent, A. M., Anekwe, T. D., Cho, C., Dicken, C., Effland, A., Elitzak, H., Guthrie, J., Hamrick, K. S., Hyman, J., Jo, Y., Lin, B.-H., Mancino, L., Mclaughlin, P. W., Rahkovsky, I., Ralston, K., Smith, T. A., Stewart, H., Todd, J., & Tuttle, C. (2018). *United States Department of Agriculture America's Eating Habits: Food Away From Home United States Department of Agriculture*. www.ers.usda.gov

Sannigrahi, K. (2016). Dietary Transition from Traditional to Modernization increase Non Communicable Diseases. *Indian Journal of Applied Research*, *6*(8), 150–153. http://cip.cornell.edu/dns.gfs/1200428200

Sproesser, G., Imada, S., Furumitsu, I., Rozin, P., Ruby, M. B., Arbit, N., Fischler, C., Schupp, H. T., & Renner, B. (2018). What constitutes traditional and modern eating? The case of Japan. *Nutrients*, *10*(2). https://doi.org/10.3390/nu10020118

Sproesser, G., Ruby, M. B., Arbit, N., Akotia, C. S., Alvarenga, M. D. S., Bhangaokar, R., Furumitsu, I., Hu, X., Imada, S., Kaptan, G., Kaufer-Horwitz, M., Menon, U., Fischler, C., Rozin, P., Schupp, H. T., & Renner, B. (2019). Understanding traditional and modern eating: The TEP10 framework. In *BMC Public Health* (Vol. 19, Issue 1). BioMed Central Ltd. https://doi.org/10.1186/s12889-019-7844-4

Stanton, R. A. (2015). Food Retailers and Obesity. *Current Obesity Reports*, *4*(1), 54–59. https://doi.org/10.1007/s13679-014-0137-4

Tharrey, M., Drogué, S., Privet, L., Perignon, M., Dubois, C., & Darmon, N. (2020). Industrially processed v. home-prepared dishes: what economic benefit for the consumer? *Public Health Nutrition*, *23*(11), 1982–1990. https://doi.org/DOI: 10.1017/S1368980019005081

Tiuganji, N. M., Nehme, P., Marqueze, E. C., Isherwood, C. M., Martins, A. J., Vasconcelos, S., Cipolla-Neto, J., Lowden, A., Skene, D. J., & Moreno, C. R. C. (2020). Eating behavior (Duration, content, and timing) among workers living under different levels of urbanization. *Nutrients*, *12*(2). https://doi.org/10.3390/nu12020375

Vita, B., Deitiana, T., & Ruswidiono, W. (2021). The online marketing of Indonesian street food in Jakarta. *Cogent Business and Management*, *8*(1). https://doi.org/10.1080/23311975.2021.1996215

Wagnild, J. M., & Pollard, T. M. (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). https://doi.org/10.1136/bmjopen-2020-040739

Wouters, C. (2009). Informalization: Manners & Emotions since 1890. *Reis*, *1*. https://doi.org/10.2307/40184900

Yulia, Khusun, H., & Fahmida, U. (2016). Dietary patterns of obese and normal-weight women of reproductive age in urban slum areas in Central Jakarta. *British Journal of Nutrition*, *116*(S1), S49–S56. https://doi.org/10.1017/S0007114516000015

Zeballos, E., & Chelius, C. (2021). The effects of grazing on daily caloric intake and dietary quality. *International Journal of Behavioral Nutrition and Physical Activity*, *18*. https://doi.org/10.1186/s12966-021-01226-4

Zhai, F. Y., Du, S. F., Wang, Z. H., Zhang, J. G., Du, W. W., & Popkin, B. M. (2014). Dynamics of the Chinese diet and the role of urbanicity, 1991-2011. *Obesity Reviews*, *15*(S1), 16–26. https://doi.org/10.1111/obr.12124

Ziauddeen, N., Almiron-Roig, E., Penney, T. L., Nicholson, S., Kirk, S. F. L., & Page, P. (2017). Eating at food outlets and "on the go" is associated with less healthy food choices in adults: Cross-sectional data from the uk national diet and nutrition survey rolling programme (2008–2014). *Nutrients*, *9*(12). https://doi.org/10.3390/nu9121315