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Nutrient-rich food index 9.3 score and food choice values among female online food delivery users during COVID-19 pandemic

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Abstract

Background: The COVID-19 pandemic has transformed eating habits, leading to an increased reliance on online food delivery. It's crucial to comprehend the diet quality and food choices among female users during this period.

Objective: This study aims to explore the association between diet quality score and the food choice motives among female online food delivery users during the COVID-19 pandemic

Methods: This online cross-sectional study involved surveying 405 female users recruited through consecutive sampling. The Food Choice Values Questionnaire (FCVQ) was utilized to understand their food choices, while nutrient intake and diet quality were assessed using the Nutrient-Rich Food 9.3 Index Score (NRF 9.3). Subsequently, the collected data underwent both univariate and multivariate analyses. Potential biases might arise due to time constraints during the pandemic and reliance on self-reported online data. Moreover, the method used to measure nutrient intake might not be ideal for this demographic, lacking tailored tests. Nonetheless, it's important to highlight that the survey underwent prior validation among Indonesian adults, affirming its broad applicability.

Results: Female users showed low average NRF 9.3 scores (241.67), indicating poor diet quality. Their prioritized food choice motives were also low. Significant associations surfaced between NRF 9.3 scores and food choice motives—tradition ($p<0.01$, r: 0.229), comfort ($p<0.01$, r: 0.223), organic ($p<0.01$, r: 0.231), safety ($p<0.001$, r: 0.162), weight control/health ($p<0.01$, r: 0.171), and income ($p<0.05$).

Conclusion: The NRF 9.3 score is likely to increase when there are higher scores for tradition, comfort, and organic factors, and when income exceeds the minimum regional wage.

Keywords: diet quality, food choice motives, NRF 9.3, female online food delivery users

Introduction

Extensive literature has documented the profound impact of dietary quality on health and well-being. It is widely acknowledged that low dietary quality significantly contributes to health issues due to deficiencies in essential nutrients. For instance, inadequate iron intake leading to iron-deficiency anemia[1], and diets rich in unhealthy

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components such as calories, saturated fats, trans fats, and sugars, have been linked to weight-related problems, notably obesity.[2] Moreover, the association between poor dietary quality and a spectrum of health conditions, including heart disease, diabetes, cancers, and musculoskeletal disorders,[3] has been thoroughly explored.

While numerous studies have addressed the implications of poor dietary habits, recent literature has taken a novel direction by examining the shifts
in dietary behaviors during the COVID-19 pandemic. Studies published in sources like Obesity Reviews and research conducted in Indonesia highlight altered eating habits during the pandemic, indicating a decline in diet quality, particularly among women.[4] This emerging trend underscores a critical gap in understanding how crises like the pandemic influence dietary choices and quality.

Furthermore, the surge in reliance on online food delivery services during the pandemic has emerged as a significant aspect of dietary behavior. This shift raises intriguing questions about the interplay between food choice motives and diet quality during such crises—a facet that remains relatively unexplored in current literature.[5]

While existing studies have proposed various indices and methodologies to evaluate diet quality, such as the Nutrient-Rich Food (NRF) Index, their application and assessment amid the unique circumstances of the COVID-19 pandemic have received limited attention. Therefore, this study aims to bridge this gap by exploring the Nutrient-Rich Food Index 9.3 score and its correlation with food choice motives, particularly among female users of online food delivery services. This research aims to offer a new perspective on the evolving landscape of dietary behavior during an emergent context, contributing new knowledge by quantitatively associating the Nutrient-Rich Food Index 9.3 Score with food choice values within this demographic.

Methods

This cross-sectional online survey, conducted in Indonesia, utilized the *Limesurvey*® web-based application. Employing consecutive convenience sampling, 405 female online food delivery users from the *Jabodetabek* (Jakarta, Bogor, Depok, Tangerang, and Bekasi) area were selected based on specific inclusion and exclusion criteria. The study focused on assessing the association between the Nutrient-Rich Food 9.3 (NRF 9.3) index score and singularly evaluated food choice values.

Data collection commenced in February and March 2023 after obtaining ethical clearance from the Faculty of Medicine at Universitas Indonesia (approval number KET-85/UN2/F1/ETIK/PPM.00.02/2023) and involved questionnaires covering screening queries, sociodemographic details, and the Food Choice Values Questionnaire. The Nutrient-Rich Food 9.3 scores were derived from the SQ-FFQ, capturing dietary intake. Analytical processes, encompassing univariate to multivariate analysis, were performed using SPSS 20.

However, it is imperative to note potential biases introduced due to reliance on self-reported measurements, particularly concerning the SQ-FFQ's methodology. Despite prior validation among Indonesian adults, limitations persisted as the food list might not entirely represent female online food delivery users. Moreover, this study faced constraints in data comprehensiveness, limiting insights into energy intake underestimation, owing to restricted available data, comprising solely age and gender information.

Results

The sociodemographic characteristics of the subjects are presented in **Table 1** below. 65.9% of the total subjects were aged between 19 and 29 years old. The majority of them are private employees (27.4%) and college students (24.9%). Those who have an occupation have an income above MRW (49.6%). Most of them are not married (59%) and they have a nuclear family

(86.2%) with less than equal to 4 members left at home (67.7%). The two most popular online food delivery apps that they usually use are *GoFood* (50.6%) and *GrabFood* (36%). Other apps, such as *ShopeeFood* (11.9%), are also likely to be used for ordering food online.

Figures 1 and **2** show the kinds of food and beverages they purchased on an online food delivery app in the last 7 days.

Table 1. Sociodemographic characteristics of the subjects (n=405)

Characteristics	n	%
Age (years)		
19 – 29 years old	267	65.9
30 – 49 years old	110	27.2
50 – 64 years old	28	6.9
Occupation		
Unemployed	6	1.5
College Student	101	24.9
Housewife	49	12.1
Private Employee	111	27.4
Civil Servant	48	11.9
Contract Worker	35	8.6
TNI/Police	-	-
Entrepreneur	48	11.9
Retired	7	1.7
Income		
Above MRW	201	49.6
Under or equal to MRW	85	21
No Income	119	29.4
Marital Status		
Married	166	41
Not Married	239	59
Family Type		
Nuclear Family	349	86.2
Extended Family	56	13.8
Family Size		
> 4	131	32.3
≤ 4	274	67.7
Online Food Delivery Apps		
GoFood	205	50.6
GrabFood	146	36
Fast Food Delivery Apps	6	1.5
Others	48	11.9

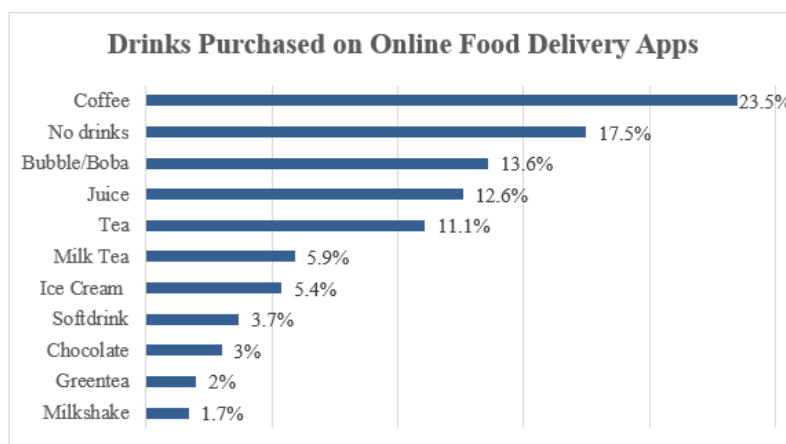**Figure 1.** Food purchased in the last 7 days

Figure 2. Beverages purchased in the last 7 days

The results found that the most commonly purchased foods are chicken dishes (*ayam geprek*) (23.2%) and fast food (14.3%). For beverages, they commonly purchased coffee (23.5%) and bubble drinks or boba (13.6%).

Based on the prior study, the FCVQ exhibited values ranging from 0.4 to 0.9, signifying the strong validity of its items. Additionally, Cronbach's alpha, used to assess the questionnaire's reliability, yielded a value of 0.889 for the FCVQ.[6] **Table 2** presents the median scores attributed to food choice motives. Sensory appeal and organics emerged as the most significant factors influencing decisions regarding food selection and consumption, each receiving a median score of 14. Following closely, access and convenience garnered median scores of 13 and 12, respectively. Among respondents, tradition was identified as the least influential factor.

Table 2. Food choice motives of the subjects (n=405)

Food Choice Motives	Median (Q1-Q3)
Convenience	12 (10 – 14)
Access	13 (12 – 15)
Tradition	8 (6 – 9)
Safety	11 (10 – 12)
Organic	14 (12 – 15)
Comfort	11 (9 – 13)
Sensory Appeal	14 (12 – 15)
Weight Control/Health	9 (8 – 11)

The NRF 9.3, validated for assessing nutrient density, encompasses nine recommended nutrients while restricting three others. It computes the nutrient density score by subtracting the percentage daily reference values (DRVs) of limited nutrients from the recommended ones, aiming for a diet quality closer to the maximum score of 900. Using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), participants reported food consumption frequencies and portion sizes. Nutrient intake was computed from *Tabel Komposisi Pangan Indonesia* (TKPI)[7], United States Department of Agriculture (USDA)[8], and *Survey Konsumsi Makanan Individu* (SKMI)[9] datasets in Microsoft Excel. Nutrient-Rich (NR) and Limiting Nutrient (LIM) foods were pinpointed via Nutrient-Rich Food algorithm calculations, comparing intake against recommended and maximum daily values. The Nutrient-Rich Food Index 9.3 score was derived from the disparity between NR and LIM values. Based on **Table 3**, it was observed that the nutrient intake among the Female Online Food Delivery users was generally low, with most nutrients falling below the recommended RDA levels, except for vitamin D, which was relatively sufficient at 115%. This indicates that the participants' diets were lacking in essential nutrients, raising concerns about potential nutrient deficiencies and their impact on overall health.

This study also revealed that the average NRF 9.3 score among female online food delivery users

was 241.67, which is considered very low when compared to the maximum possible NRF score of 900. **Figure 3** provides an overview of how the NRF 9.3 was constructed, and it was used in this study to assess diet quality. The figure demonstrates that the percent daily values for index nutrients increased with higher quartiles of

the NRF 9.3 score, while the LIM subscore, on the contrary, decreased. As expected, transitioning from the lowest (Q1) to the highest quartiles (Q3) of NRF 9.3 scores was associated with an increase in the percent daily values of nutrients to encourage and a corresponding decrease in the percent daily values of nutrients to limit.

Table 3. Nutrient intake and percentage based on RDA among female online food delivery users during COVID-19 pandemic (n=405)

| Nutrient	Median (Q1-Q3)	% RDA[a]
Protein (grams)	27.11 (21.77 – 34.03)	45% (36% - 57%)
Fiber (grams)	4.72 (3.32 – 5.99)	15% (11% - 20%)
Vitamin A	200.69 (138.45 – 309.30)	33% (23% - 52%)
Vitamin C	20.34 (12 – 33.77)	27% (16% - 45%)
Vitamin D	17.25 (12.49 – 21.59)	115% (83% - 144%)
Iron	4.76 (3.71 – 6.08)	26% (21% - 34%)
Calcium	112.30 (79.1 - 142	11% (8% - 14%)
Potassium	641.27 (478.54 – 882.41)	14% (10% - 19%)
Magnesium	47.87 (34.65 – 66.28)	14% (10% - 20%)
Saturated Fat	4.95 (3.39 – 9.11)	25% (17% - 46%)
Sodium	320.91 (226.25 – 437.49)	13% (9% - 18%)
Added Sugar	8.51 (5.86 – 11.98)	17% (12% - 24%)
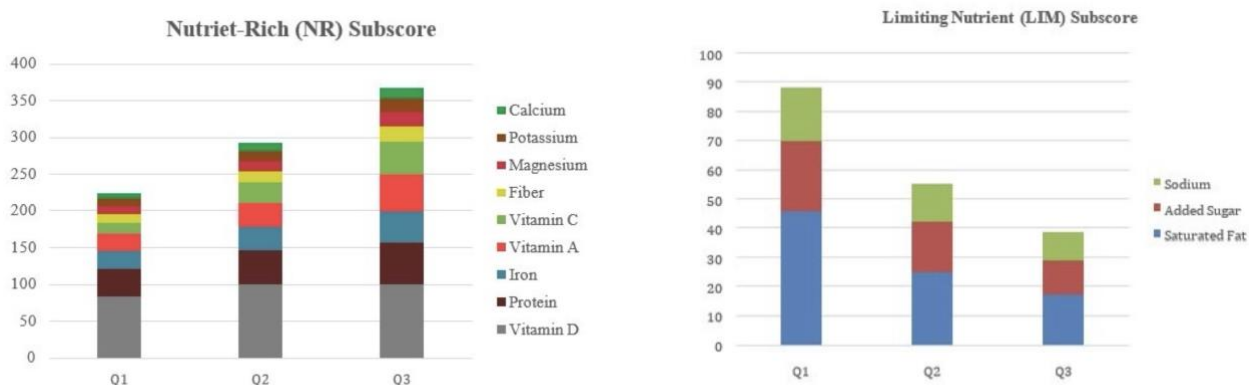
Figure 3. Nutrient subscore of the Nutrient-Rich Food 9.3 Index (NRF 9.3) by quartiles (Q1, Q2, Q3) of total NRF 9.3 scores

Given the non-normal distribution of the data, Spearman correlation and non-parametric tests were employed. Spearman correlation was utilized to evaluate the relationship between the NRF 9.3 score and food choice motives. As shown in **Table 4**, a significant positive correlation was observed between the NRF 9.3 score and tradition, comfort, organic, safety, and weight control/health. These correlations were

statistically significant, although their strengths varied. Notably, the correlations between the NRF 9.3 score and safety (r = 0.162) and between weight control/health (r = 0.171) were very weak. Conversely, the correlations between the NRF 9.3 score and tradition (r = 0.229), comfort (r = 0.223), and organic (r = 0.231) were weak. These findings indicate differing prioritization among female online food delivery users concerning

tradition, comfort, organics, safety, and weight control/health in relation to nutrient-rich food scores.

Table 4. Correlation between NRF 9.3 index score and food choice values (n=405)

Food Choice Values	NRF 9.3	
	r	p
Convenience	0.064	0.201
Access	-0.005	0.916
Tradition	0.229	< 0.01**
Comfort	0.223	< 0.01**
Organic	0.231	< 0.01**
Safety	0.162	0.001**
Sensory Appeal	0.003	0.956
Weight Control/Health	0.171	< 0.01**

Statistical analysis used Spearman correlation test
*Significance level at P-value < 0.05;**Significance level at P-value < 0.01

In **Table 5**, the association between the NRF 9.3 score and sociodemographic characteristics is examined. The results indicate that there is no significant difference in the NRF 9.3 score among the age groups of 19-29, 30-49, and 50-64 years (p-value > 0.05). Furthermore, there is no significant difference (p-value > 0.05) in the associations between the NRF 9.3 score and occupation, marital status, family type, family size, and online food delivery app. In contrast, the results demonstrate a significant difference (p-value < 0.05) in the association between income and the average NRF 9.3 score among female online food delivery users during the COVID-19 pandemic. Females with an income higher than the minimum regional wage (MRW) exhibited the highest average NRF 9.3 score of 251.82, indicating a healthier diet compared to those with no income (235.03) and those with income equal to or below the MRW (226.92).

As shown in **Table 6**, the variables included in the analysis, which consisted of convenience, tradition, comfort, organic, safety, weight control/health, income, and marital status. The inclusion criteria for these variables were based on a p-value < 0.2 in the bivariate analysis. Based on the final model, the tradition score, comfort score, organic score, and income emerged as significant predictors of the Nutrient-Rich Food

Index 9.3 Score among female users of online food delivery during the COVID-19 pandemic, after adjusting for other variables.

Discussion

The study found that over half of female online food delivery users were 19–29 years old. This age group has good digital literacy, making them eager to socialize, study, and create digital content.[10] This aligns with Gomes et al.'s 2022 findings, which showed that younger customers are more likely to purchase food online during a pandemic due to their enhanced technological skills, desire for innovative consumption, and perception of the positive aspects of online shopping, such as time savings, convenience, price comparison, and access to a variety of products.[11] The majority of female users in this study are private employees and college students. Candra S. et al. found that the majority of female users in this study are private employees and college students who primarily work as workers.[12] Kartono et al. found that these individuals may be less flexible due to their commitments and time limitations, requiring practical services to provide food and beverages.[10]

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Table 5. NRF 9.3 associated with socio-demographic characteristic (n=405)

Variables	NRF 9.3		
	Mean	Median (min-max)	p value
Age			
19 – 29 years old (n=267)	240.26	221.96 (69.21 – 550.35)	
30 – 49 years old (n=110)	246.57	230.71 (90.22 – 467.31)	0.302[a]
50 – 64 years old (n=28)	235.69	200.69 (148.84 – 455.22)	
Occupation			
Unemployed (n=6)	250.69	258.03 (188.05 – 298.71)	
College Student (n=101)	232.81	219.87 (113.93 – 481.64)	
Housewife (n=49)	262.61	229.92 (135.39 – 467.31)	
Private Employee (n=111)	244.69	220.80 (69.21 – 550.35)	
Civil Servant (n=48)	240.46	223.13 (119.03 – 431.54)	0.681[a]
Contract Worker (n=35)	224.70	212.83 (90.22 – 416.57)	
Entrepreneur (n=48)	242.00	223.26 (143.70 – 480.87)	
Retired (n=7)	257.66	256.29 (153.37 – 435.26)	
Income			
Above MRW (n=201)	251.82	229.50 (90.22 – 550.35)	
Under or equal to MRW (n=85)	226.92	206.97 (69.21 – 491.22)	0.014[a] *
No Income (n=119)	235.03	219.87 (113.93 – 455.22)	
Marital Status			
Married (n=166)	250.51	226.42 (103.28 – 480.87)	
Not Married (n=239)	235.52	221.96 (69.21 – 550.35)	0.200[b]
Family Type			
Nuclear Family (n=349)	241.73	223.46 (90.22 – 550.35)	
Extended Family (n=56)	241.22	219.39 (69.21 – 455.22)	0.956[b]
Family Size			
> 4 (n=131)	245.77	226.38 (69.21 – 481.64)	
≤ 4 (n=274)	239.70	221.56 (90.22 – 550.35)	0.464[b]
Online Food Delivery (OFD) App			
GoFood (n=205)	243.00	219.87 (113.93 – 550.35)	
GrabFood (n=146)	241.45	224.29 (90.22 – 491.22)	
Fast Food Delivery App (n=6)	241.05	218.57 (69.21 – 455.22)	0.879[a]
Others (n=48)	236.68	228.18 (126.32 – 374.51)	

[a]Statistical analysis used Kruskal Wallis; [b]Statistical analysis used Mann-Whitney U
NRF9.3: Nutrient-Rich Food 9.3
*Significance level at p-value <0.05

Table 6. Multiple linear regression analysis of NRF 9.3 (n=405)

Parameter	[a]NRF 9.3			
	Parameter Estimate	Standard Error	95% CI	p-value
Constant	114.023	27.805	80.604 – 263.641	
Convenience	-2.049	1.754	-8.109 – 1.547	0.243
Tradition	5.628	2.025	4.409 – 15.564	0.006*
Comfort	6.237	1.447	4.649 – 12.611	<0.001**
Organic	4.707	2.271	-0.749 – 11.763	0.039*
Safety	0.597	2.513	-5.272 – 8.551	0.812
Weight Control/Health	0.671	2.095	-4.155 – 7.408	0.749
Income	-9.390	4.348	-25.922 – (-2.004)	0.031*
Marital Status	-11.191	8.065	-57.391 – (-3.201)	0.166

[a]Dependent variable: NRF9.3

The multiple linear regression equation is given by: NRF9.3 (score) = 114.023 + 5.628 (tradition) + 6.237 (comfort) + 4.707 (organic) – 9.390 (income), depending on tradition score, comfort score, organic sore, income (1 = above MRW, 2 = under or equal to MRW, 3 = no income), of the subjects

*Significance level at P-value <0.05; **Significance level at P-value <0.01

R square = 17%, P-value = <0.01 analyzed with multiple linear regression using enter method

Almost half of the employed female users have a higher income than Rp4.641.854. Data from Statista 2021 shows high incomes holding the largest share (45.26%).[13] This aligns with a 2022 study by Gomes S. et al., which found that consumers with higher incomes were more likely to purchase online during the pandemic.[11] These individuals are busier at work and have more flexibility in spending, making them more likely to prefer online purchases. Over half of the subjects are not married and have a nuclear family with less than four members. A 2022 study by Algheshairy et al. found that food delivery apps were easy for unmarried women, but their duty towards meal planning and home-meal preparation appeared deficient.[14] Over half of female users used GoFood for online food delivery, similar to a 2020 study by Iisnawati et al. where 43% of females used the app.[15] Kartono et al. found that most online food users prefer heavy foods over snacks and beverages to satisfy cravings.[10] The study surveyed participants about their recent food and beverage purchases in the last 7 days. The most frequently purchased foods were chicken dishes, hamburgers, pizza, spaghetti, and fast food. Female users frequently purchase coffee and boba drinks as beverages, while some do not consume them. The 2021 study by Martha E. et al. found that fast food, chicken dishes, bubble tea, coffee, and sweet cakes were the most popular food and drink orders.[16]

The results of the study revealed that sensory appeal and organic factors had the highest median scores among the food choice motives. Sensory appeal plays a significant role in consumers' perception, purchase decisions, consumption, and satisfaction with convenience foods.[17,18,19] When female online food delivery users browse through the food options available on online delivery apps, the visual appearance of the food becomes the initial criterion for determining its appeal, even before they have a taste. Previous research by Samson L. et al. in 2019 demonstrated that sensory appeal can capture attention, evoke emotions, and influence individuals' preferences for healthy foods that are being promoted.[20] Moreover, according to Prabowo and Nugroho, individuals with prior experience in online food delivery tend to make purchasing decisions based on their previous online shopping experiences.[21] These experiences influence their intentions to repurchase certain products, including food.

Based on Nunes F. et al.'s study in 2021, the most important factor influencing the purchase of organic food is the perceived health benefits.[22] Other organic concerns include the use of natural

ingredients, vitamin and mineral content, and environmental considerations. In a recent study by Zhen Rong et al. in 2021, it was found that the participants expressed a strong interest in ordering healthy food through online food delivery apps in the future.[23] Additionally, a majority of participants agreed that providing more nutritional information could encourage them to choose healthier meal options when using online food delivery apps. Therefore, it can be inferred that female online food delivery users prioritize organic food when making purchasing decisions for the sake of their health. This inference is supported by the study's results, particularly among females aged 30-49 years and 50-64 years. This finding aligns with a study conducted in China, which indicated that adults over the age of 40 placed greater importance on organic food compared to younger age groups.[24]

According to a study conducted by Brata *et al.*, in 2022 on consumers' perceptions of organic food products during the COVID-19 pandemic, there was an increased awareness among people about the products they purchase.[25] This led to an increased consumption of organic food due to its perceived higher quality, nutritional value, and environmental friendliness compared to other food products. The findings of the current study support previous research in this area, which identified key factors that influence consumers' decisions to buy organic products. These factors include intrinsic qualities of the product, such as superior quality, freshness, and perceived health benefits. However, based on the data collected in this study, it was observed that the majority of female users of online food delivery in the past 7 days did not prioritize organic food. This might be attributed to the fact that the majority of participants in this study were females under the age of 30, and their main focus was on satisfying their immediate preferences rather than prioritizing organic choices. This finding aligns with another study by Martha E. *et al.*, which highlighted the importance of satisfaction, social environment, and food preferences in online food delivery.[16]

Access was identified as the second-highest factor influencing the food choices of female users. The concept of access includes considerations such as price, distance, and ease of finding the desired food. In this study, female users of online food delivery expressed the importance of food being easily accessible and providing value for the money spent. This aligns with a previous study by Yeo *et.al* which found that online food delivery platforms often offer promotions and discounts to customers.[26] Additionally, online food delivery services can reach customers in different geographic locations, as they partner with a wide range of restaurants. By using online food delivery apps, customers can overcome obstacles such as transportation costs and save time by avoiding physical visits to restaurants. While there may be a delivery fee associated with online food delivery, it is viewed as a convenient alternative by customers.

Convenience refers to the time saved or the ease of purchasing and preparing food. A study by Soric et al. in 2021 highlighted the increased importance of convenience, particularly among women, during the pandemic. It was found that women tend to place a higher value on convenience in their food choices.[27] Additionally, according to Chowdhury R. et al. in 2022, customers often prefer online shopping due to the convenience of shopping from home and having more free time. This shift has led to the growing popularity of online food delivery services, especially among urban consumers and the working population.[28]

The factor that subjects consider the least when deciding which foods to purchase is tradition. This finding is consistent with the study by Rahmasari et al., which reported that tradition had the lowest median score. Traditions reflect an interest in the familiarity, cultural, and traditional aspects of food.[29] In this study, tradition received a median score of 8, particularly among the older age group. Similarly, the previous study observed that concerns about tradition increased significantly with age, indicating that older respondents place higher importance on tradition.

The study reveals that most female online food delivery users exhibit low intake of essential nutrients, such as protein, fiber, vitamins A and C, iron, calcium, potassium, and magnesium—

except for vitamin D. This deficit may stem from underestimating energy intake, affecting overall nutrient consumption. Barbara E et al.'s study notes that energy intake serves as a foundation for dietary assessment, impacting other nutrient estimations.[30] When total energy intake is underestimated, it extends to undervaluing associated macronutrients, minerals, and vitamins. Calculating energy intake underestimation typically involves contrasting reported energy intake (EI) with estimated energy requirements (EER) or total energy expenditure (TEE). Common methods, like the Harris-Benedict equation and the Goldberg cutoff method, assess this discrepancy.[31] However, due to limited data—only age and gender—the latter method couldn't be employed in this study.

Another probable reason for inadequate nutrient intake among female users might be the SQ-FFQ's food list misalignment with their dietary habits. Insufficient representation of essential nutrients in the questionnaire's food choices could lead to suboptimal intake among participants. Protein intake among users satisfies only 45% of the Recommended Dietary Allowance (RDA), remaining insufficient.[32] The protein intake observed in this study remains low when contrasted with another study conducted in 2022, where adult women reported a protein intake of 51.1%.[33] Similarly, inadequate fiber and iron intake were observed, impacting overall diet quality and variety.[34] These deficiencies align with national data on vitamin A, C, and calcium insufficiency[35], signifying significant health concerns.[36]

Insufficient potassium and magnesium intake among female users hold significance for metabolic syndrome, affecting cardiovascular health and glucose metabolism. Low levels of these minerals have been linked to high blood pressure, insulin resistance, and increased risks of developing metabolic syndrome and type 2 diabetes. Despite a wide array of food choices offered by online delivery services, the average NRF 9.3 score among female users remains notably low at 241.67 out of 900, indicating suboptimal nutrient-rich diets.

The prevalence of nutrient-poor diets, particularly high-fat, sugary, and salty foods among Indonesian adults[37], may influence choices made through online delivery platforms. These shifts in dietary behaviors, especially during the pandemic, signify a preference for less nutrient-dense options.[38] The findings suggest a need for a greater focus on promoting healthier food choices within these delivery platforms to improve the nutritional well-being of users.

According to this study, sensory appeal, access, and convenience did not significantly correlate with the NRF 9.3 score. Sensory appeal, while influencing preferences, doesn't guarantee nutritional quality, leading to the consumption of foods high in unhealthy elements during the pandemic. Access to diverse foods doesn't assure healthy choices, affected by factors like food deserts. Convenience influences food choices[39], yet convenience foods often lack nutrients, contributing to poor diet quality.[40]

Examining food choice motives revealed varying priorities linked to a lower NRF 9.3 score, indicating increased reliance on processed foods, deviating from traditional diets. Younger generations tend to prioritize global food trends over traditional nutrient-rich foods. Tradition, comfort, organic choices, and health concerns influence food choices but don't consistently align with optimal nutrition.[41] Comfort foods offer emotional satisfaction[42] but often contain unhealthy elements, seen in food choices of online delivery users. Health-related concerns like organic choices, food safety, and weight control didn't reflect in the NRF 9.3 score. Ensuring food safety and considering health goals are pivotal in making conscious food choices.

This study examined how sociodemographic factors relate to NRF 9.3. Out of various factors like age, occupation, family size, family type, marital status, and use of online food delivery, only income showed a significant difference in NRF 9.3 scores. Notably, females with higher incomes above MRW displayed the highest NRF 9.3 average score at 251.82, indicating a healthier diet compared to those with no income (235.03) or incomes equal to or below MRW (226.92). Supporting research by Gómez G et al. in 2021

found that individuals with lower socioeconomic status tend to consume fewer fruits, vegetables, whole grains, fiber, and fish compared to those with higher status.[43] Higher income levels typically afford greater access to nutrient-rich foods like fresh produce, lean proteins, and whole grains, which can be relatively more expensive than processed options. Studies, including Rehm, C. D., Monsivais, P., and Drewnowski, A, also confirm that higher-income individuals tend to have better overall diet quality and consume more nutrient-rich foods.[44]

The multivariate analysis in this study revealed a significant trend among female online food delivery users. Those who placed less emphasis on tradition, comfort, and organic choices while having an income above the minimum regional wage showed remarkably lower NRF9.3 scores. This aligns with prior research indicating a decline in diet quality during the pandemic, attributed partially to shifting food preferences.[45]

Tradition, comfort, and organic preferences are linked to health considerations in food choices. Although not directly tied to physical health, these factors shape dietary patterns, influencing overall well-being. Organic choices, often associated with reduced pesticide exposure and potential nutrient richness, hold relevance in health-related decisions.[46] Neglecting health-related factors can contribute to poor diet quality, shifting choices toward taste, convenience, or cultural norms. This can result in diets high in unhealthy components while lacking essential nutrients, elevating the risk of chronic diseases.[47]

However, the variables explored in our regression model collectively explain only 17% of the impact on NRF 9.3. Further investigations are necessary to better understand how other health and nutrition-related factors intertwine with NRF 9.3.

Conclusion

Among female online food delivery users, the majority (65.9%) were aged between 19 and 29, employed in the private sector (27.4%), and earned incomes above the minimum regional wage (49.6%). Notably, over half were unmarried (59%) and resided in nuclear families (86.2%) with fewer than four household members (67.7%), with GoFood being the preferred delivery app (36%). While these users favored sensory appeal and organics in food choices, tradition held limited significance. However, their average NRF 9.3 score was notably low, averaging 241.67 out of 900, indicating insufficient intake of vital nutrients such as protein, fiber, vitamins A and C, iron, calcium, potassium, and magnesium. Factors such as tradition, comfort, organics, safety, and income displayed positive correlations with the NRF 9.3 score, influencing users' dietary decisions. Lower emphasis on these factors and incomes below the regional wage were associated with reduced NRF 9.3 scores, persisting even after adjusting for other variables. Greater emphasis on tradition, comfort, and organics, coupled with higher incomes, corresponded to higher NRF 9.3 scores.

Different recipes and culinary traditions greatly impact the nutritional makeup of dishes. Across regions, variations in ingredients, oils, and cooking styles significantly affect the nutrient profiles. For instance, one recipe might focus on vegetables or lean proteins, while another could emphasize certain spices or fats. Culinary traditions, like the Mediterranean diet's emphasis on olive oil and fresh produce, offer high levels of healthy fats and antioxidants. Similarly, Asian cuisines featuring seafood, tofu, and distinctive spices present diverse nutrient compositions. Even within a single cuisine, variations in ingredients used by different restaurants can affect fat content. Nutrient levels also vary based on seasonal availability, with dishes using fresh seasonal produce differing from those relying on frozen or out-of-season ingredients. Cooking methods like grilling, frying, or baking influence fat content, while portion sizes are crucial in determining overall calorie intake.

Conflict of interest

Authors declared no conflict of interest regarding this article.

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