Dietary Habits Based on Indonesian Dietary Guidelines During the Covid-19 Pandemic

Slamet Riyanto*[1], Ika P. Asturiningtyas[2], Ismi Setianingsih[3], Eka D. Machfutra[4]

[1, 4] Research Center for Public Health and Nutrition, National Research and Innovation Agency, Bogor, Indonesia
[2, 3] Magelang Unit for Health Research and Development, Ministry of Health of Indonesia, Magelang, Indonesia

DOI: 10.24252/al-sihah.v15i2.41266
Received: 12 September 2023 / In Reviewed: 7 November 2023 / Accepted: 20 December 2023 / Available online: 30 December 2023

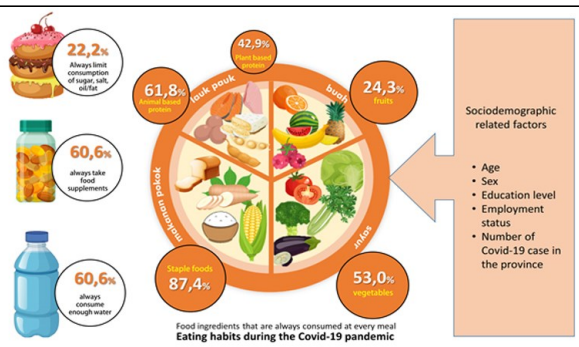
ABSTRACT

Decreased immunity is a risk factor for viral respiratory infections, underscoring the crucial role of balanced diets to support the immune system. Therefore, this study aimed to determine the eating habits of people in the location based on balanced nutrition guidelines during the Covid-19 pandemic. A cross-sectional design was used and the samples included 3394 respondents who met the criteria of being ≥15 years old and living in the provinces of Central Java, East Java, Riau, and Southeast Sulawesi. Data were collected using a Google form-based online questionnaire filled out independently by respondents. The gathered data comprised compliance with balanced nutrition recommendations for consuming staples, protein-rich foods, fruits, vegetables, water, salt, sugar, and oil. In addition, diet was also observed based on several sociodemographic variables. The results showed that during the Covid-19 pandemic, 75.7% of respondents had not fulfilled intake according to balanced nutrition advice due to insufficient fruit consumption. However, about 60.6% consistently used dietary supplements, and 77.8% did not limit salt, sugar, as well as oil intake. The population at more risk of inadequate nutrition included younger age groups, males, those with low education, unemployed, and living in areas with high Covid-19 cases. This study concluded that during the Covid-19 pandemic, many Indonesians did not implement a diet based on the principles of balanced nutrition. Therefore, education on the importance of balanced nutrition consumption, local food campaigns, cheap markets, and food aid was needed, specifically for rarely consumed diets such as fruit, by targeting the most vulnerable groups.

ABSTRAK

Kekebalan tubuh yang menurun merupakan faktor risiko dari infeksi saluran pernapasan akibat virus. Mengonsumsi makanan yang seimbang akan mendukung sistem kekebalan tubuh. Penelitian ini bertujuan untuk mengetahui kebiasaan makan masyarakat di lokasi penelitian berdasarkan pedoman gizi seimbang selama pandemi Covid-19. Penelitian menggunakan desain crossectional melibatkan 3394 responden yang telah memenuhi kriteria berusia ≥ 15 tahun dan tinggal di Provinsi Jawa Tengah, Jawa Timur, Riau, dan Sulawesi Tenggara. Data dikumpulkan menggunakan kuesioner daring berbasis google form yang diisi mandiri oleh responden. Data yang dikumpulkan meliputi kesesuaian dengan anjuran gizi seimbang untuk konsumsi makanan pokok, makanan kaya protein, buah-buahan, sayuran, air putih, garam, gula, dan minyak. Pola makan juga diamati berdasarkan variabel sosiodemografi. Hasil penelitian menunjukkan selama pandemi Covid-19 75,7% responden belum memenuhi asupan sesuai saran gizi seimbang diantaranya akibat tidak mengonsumsi buah. Namun sekitar 60,6% malah selalu mengonsumsi suplemen makanan dan sekitar 77,8% belum membatasi asupan garam,gula, dan minyak. Kelompok usia muda (15-35 tahun), laki-laki, pendidikan rendah, tidak bekerja, dan tinggal di daerah dengan kasus Covid-19 tinggi lebih berisiko tidak mengonsumsi makanan sesuai anjuran gizi seimbang terutama akibat jarang mengonsumsi buah. Penelitian ini menyimpulkan selama pandemi Covid-19, banyak masyarakat Indonesia yang belum menerapkan pola makan sesuai dengan prinsip gizi seimbang. Diperlukan edukasi tentang pentingnya konsumsi gizi seimbang, kampanye pangan lokal, pasar murah, dan bantuan pangan terutama untuk pangan yang jarang dikonsumsi seperti buah dengan menyasar kelompok paling berisiko berdasarkan penelitian ini.

GRAPHICAL ABSTRACT



Keyword
adult
diet
covid-19
dietary habits
sociodemographic

*** Correspondence**
BRIN – Kawasan Kerja Bersama (KKB) Muhilal Magelang, Jl Stupa III, Dusun XI, Borobudur 56553, Kabupaten Magelang, Central Java, Indonesia
Email: slam026@brin.go.id

ISSN-P : 2086-2040
ISSN-E : 2548-5334

INTRODUCTION

In 2020, the world was affected by an uncontrolled pandemic known as coronavirus disease (Covid-19). Almost all countries globally were impacted, both in the health and socio-economic sectors. The first case was reported in Wuhan, China at the end of 2019, and the virus, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has spread rapidly worldwide through direct or indirect transmission (Lotfi et al., 2020). On July 31, 2020, the World Health Organization (WHO) stated that over 17 million people had tested positive for Covid-19, and around 3.6% had died (World Health Organization, 2020). Similar data shows that infections and deaths have been reported in all WHO regions with varying degrees of severity. In particular, Southeast Asia is one of the regions with the highest cases of infection and death. As one of the most populated countries, Indonesia is also affected by Covid-19, with local transmission reported in all provinces. According to data from the Ministry of Health, Republic of Indonesia, by the end of July 2020, more than 100,000 cases of Covid-19 were reported. The fatality rate (CFR) in the same period was 4.8%, or nearly 5,000 deaths (Kemenkes RI, 2020).

In general, decreased immunity is a risk factor for viral respiratory infections, while consumption of a balanced diet and good nutritional status serve as important factors in optimizing immunity (Im et al., 2020). Consuming a balanced diet will support the immune system, as well as prevent, protect, and decrease the chances of contracting infections, thereby reducing the severity of the disease during Covid-19. Western food diets such as processed foods, high sugar content foods, hydrogenated fats, and difficult-to-digest protein allergens are a type of pro-inflammatory food. This food type can cause inflammatory mediators and free radicals secretion, affecting the innate and adaptive immune response (Im et al., 2020).

The Indonesian government has made various policies and efforts to control Covid-19 and its impacts. The declaration of a Public Health Emergency Situation for Covid-19 was announced at the end of March 2020 based on President Decree No. 11/2020. In this context, large-scale social restrictions (LSSR) have been implemented in various regions (Djalante et al., 2020). The government is also campaigning for a healthy lifestyle, including implementing health protocols to prevent viral transmission and recommending a balanced diet to increase immunity (Kementerian Kesehatan, 2020).

Based on the results of the Total Diet Study (SDT), only approximately 14.5% and 46.5% of the Indonesian population meet adequate energy and protein intake, respectively. Consumption of vegetable and fruit groups is also low (Badan Penelitian dan Pengembangan Kesehatan, 2014). In response to existing nutrition and health problems, the government launched the Public Movement for Healthy Life (GERMAS) in 2016. One of the points highlighted in GERMAS is a campaign to implement a balanced diet in the community. The increase in Covid-19 cases further supported the campaign, encouraging people to maintain immunity. The Ministry of Health of the Republic of Indonesia launched an image of a plate called "Isi Piringku" (*the content of my* plate) as a campaign to promote balanced nutrition intake at every meal with easy-to-understand illustrations. "Isi Piringku" contains the recommended serving of four food groups including staples, animal and plant base-protein as a side dish, vegetables, and fruits that need to be consumed at every meal (Florentino et al., 2016). The plates also show the importance of hydration and hygiene before and after meals.

Despite the guidelines and campaigns on balanced nutrition carried out during the Covid-19 pandemic, only a few studies have

captured how the Indonesian people practiced balanced nutrition in this period. Therefore, this study aimed to determine the practice of consuming balanced nutrition in the community based on dietary guidelines during the Covid -19 pandemic in Indonesia and the associated sociodemographic variables.

METHODS

This observational study with a cross-sectional approach was conducted during the Covid-19 pandemic in Indonesia from June 30 to July 15, 2020, as part of a survey on healthy lifestyle habits (Riyanto et al., 2021). Data were collected through an online survey distributed in four provinces with high and moderate-to-low Covid-19 cases. The provinces included Central and East Java, with a high case of Covid-19, while Riau and Southeast Sulawesi represented provinces with moderate-to-low cases. The population was all residents in the study area aged >15 years, while respondents were selected purposively with the criteria of having lived in the location during the pandemic and claiming to be in good health. Respondents unwilling to participate and did not complete the questionnaire as directed were excluded from the analysis. At the end of the study, 3394 respondents met the criteria.

This study used self-administered online questionnaires using the Google form platform and disseminated through social media such as WhatsApp. The questionnaire was tested online on limited respondents in the study area. Data on consumption habits, including staples, protein-rich foods (animal and plant-based protein), fruits, and vegetables for the past month during the Covid-19 pandemic were collected. In addition, respondents were also asked about the consumption habits of water, sugar, salt, fat/oil, and food supplements. When the respondents confirmed always consuming the food group at least four days a week according to the "isi piringku" recommendation, such condition was categorized as implementing balanced nutrition. Balanced diet practices were also analyzed based on the sociodemographic characteristics of the respondents, including age, gender, education level, and employment status.

Data were analyzed using a computer program for data analysis, in this context, descriptive analysis was carried out to determine the characteristics and eating habits of the respondents. Bivariate analysis used the Chi-Square test to assess the relationship between sociodemographic variables and eating habits. Variables with a p-value <0.25 from the bivariate analysis were then included in the multivariable analysis using logistic regression. The significance level was set at p-value <0.05 with a 95% Confidence Interval (CI). This study received ethical approval from the National Health Research Ethics Committee (KNEPK), the Health Research and Development Agency (Balitbangkes), Ministry of Health of the Republic of Indonesia (Number: LB.02.01/2/KE.380/2020). All respondents had completed an informed consent form to participate in this study.

RESULTS

Table 1 shows the characteristics of the respondents showing that a total of 3349 respondents from four provinces in Indonesia successfully filled out the online questionnaires distributed through various social media platforms. More than 60% were living in provinces with moderate-to-low Covid-19 cases, while the majority were aged 26-35 (44.5%), female (73.9%), highly educated (78.3%), and employed (81.8%).

Table 2 shows the dietary habits of the respondents during the Covid-19 pandemic. The majority consumed staple foods at every meal (87.4%) and animal-based protein

Table 1
Respondents Characteristics

Characteristics	N (3394)	%
Age groups		
15-25	758	22.3
26-35	1509	44.5
36-45	820	24.2
46-55	256	7.5
>56	51	1.5
Sex		
Male	886	26.1
Female	2508	73.9
Education level		
Low	38	1.1
Moderate	699	20.6
High	2657	78.3
Employment status		
Unemployed	617	18.2
Employed	2777	81.8
Number of Covid-19 cases in the province		
High	1288	37.9
Moderate-low	2106	62.1

Note: N= total number of subjects, %= proportion of subjects based on characteristics

(61,8%) more often than plant-based protein (42,9%), and rarely ate fruit (75.7%) and vegetables (47.0%). A large proportion also did not consume enough water and tended not to limit the sugar, salt, and oil/fat consumption. Respondents consumed more supplements during the pandemic compared to other food types.

Table 3 shows the bivariate analysis results between sociodemographic variables and eating habits during the Covid-19 pandemic. Based on the results, almost all sociodemographic characteristics had a significant correlation with eating habits ($p<0.05$). Sex was identified as the only variable unrelated to the sugar, salt, and oil consumption of the respondents ($p=0.059$), alongside the number of Covid-19 cases with staple food consumption ($p=0.186$).

Based on Table 4, the older respondents tended to consume more staple foods, animal-based protein, and plant-based protein at every mealtime as recommended. Respondents over 56 years were 6.03 times more likely to consume fruits and 2.89 times more likely to consume vegetables as recommended than the younger age groups. The elderly group (>56 years), according to this study, was also better at limiting the intake of sugar, salt, and oil/fat (OR = 3.11). Furthermore, those with moderate-high education and female respondents tended to consume foods according to balanced nutrition. These groups also consumed food supplements more frequently during the pandemic than the other groups. Employed respondents were more likely to eat fruit (OR=1.77), vegetables (OR=1.53), and water (OR=1.69) as per the recommendation. This group also consumed more food supplements (OR=1.56). Meanwhile, respondents living in low Covid-19 cases provinces tended to be better at adopting a balanced diet except for consuming plant-based protein (OR=0.61).

DISCUSSION

Indonesian dietary guidelines outline the recommended types and portions of each food for every meal. The guidelines explain the composition of each meal, namely half of the plate should be staples in larger proportions and protein-rich foods, while the other half should consist of vegetables in larger portions and fruit.

Table 2

Eating habits	N (3394)	%
Staple foods consumption at every meal		
Always	2966	87.4
Rarely	428	12.6
Animal-based protein consumption every meal		
Always	2096	61.8
Rarely	1298	38.2
Plant-based protein consumption every meal		
Always	1457	42.9
Rarely	1937	57.1
Fruit consumption every meal		
Always	824	24.3
Rarely	2570	75.7
Vegetable consumption every meal		
Always	1799	53
Rarely	1595	47
Consuming enough water		
Always	2058	60.6
Rarely	1336	39.4
Sugar, salt, oil/fat restriction		
Always	755	22.2
Rarely	2639	77.8
Food supplement consumption		
Always	2621	77.2
Rarely	773	22.8

Note: N= total number of subjects, %= proportion of subjects based on characteristics

Aside from campaigning in favor of dietary guidelines to help increase immunity during the Covid-19 pandemic, the Indonesian Ministry of Health also recommends consuming enough water, limiting sugar, salt, and oil/fat, as well as taking food supplements when needed (Kementerian Kesehatan RI, 2020).

A systematic review showed that macro and micronutrients are associated with Covid-19 susceptibility and severity (James et al., 2021). The most commonly described mechanisms from the studies include immunity mechanisms, the direct impact of macro- and micronutrient intake, and the effects of over- and undernutrition. This is shown by evidence that many people with Covid-19 are overweight or obese. In addition, Covid-19 is also high in countries with lower middle income, assuming the possibility of high malnutrition problems. The results were also in line with the systematic review, showing that respondents in the study locations with medium-high Covid-19 cases tended not to consume food according to the principles of balanced nutrition. This condition may increase the risk of nutritional deficiencies including vitamins and minerals as well as increase the risk of obesity.

Even before the pandemic, the consumption of fruit and vegetables in Indonesia was reportedly low. Only about 4.6% of the population consumes fruits and vegetables as recommended (Kementerian Kesehatan RI, 2019). Similar to other low-middle-income countries, previous data have shown that the consumption of fruit and vegetables was low (Frank et al., 2019), primarily due to weak purchasing power. The increased cost relative to household income was associated with reduced fruit and vegetable consumption (Miller et al., 2016). Moreover, the conditions during the Covid-19 pandemic can worsen these situations. Aside from preventing various chronic

Table 3
Eating Habits Based on The Sociodemographic Characteristics

Respondents Characteristics	Staple food consumption in every meal	Animal-based protein consumption in every meal	Plant-based protein consumption in every meal	Fruit consumption in every meal	Vegetable consumption in every meal	Consuming enough water	Sugar, salt, oil/fat restriction	Food supplement consumption
Age groups								
15-25	622 (82.1)	396 (52.2)	286 (37.7)	116 (15.3)	323 (42.6)	388 (51.2)	136 (17.9)	524 (69.1)
26-35	1340 (88.8)	983 (65.1)	632 (41.9)	364 (24.1)	827 (54.8)	965 (63.9)	331 (21.9)	1224 (81.1)
36-45	731 (89.1)	551 (67.2)	393 (47.9)	246 (30.0)	472 (57.6)	537 (65.5)	196 (23.9)	649 (79.1)
46-55	228 (89.1)	147 (57.4)	123 (48.0)	75 (29.3)	147 (57.4)	143 (55.9)	75 (29.3)	185 (72.3)
>56	45 (88.2)	19 (37.3)	3 (45.1)	23 (45.1)	30 (58.8)	25 (49.0)	17 (33.3)	39 (76.5)
P value	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Sex								
Male	746 (84.2)	444 (50.1)	323 (36.5)	133 (15.0)	364 (41.1)	467 (52.7)	177 (20.0)	617 (69.6)
Female	2220 (88.5)	1652 (65.9)	1134 (45.2)	691 (27.6)	1435 (57.2)	1591 (63.4)	578 (23.0)	2004 (79.9)
P value	0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Education level								
Low	26 (68.4)	12 (31.6)	6 (15.8)	3 (7.9)	7 (18.4)	8 (21.1)	5 (13.2)	18 (47.4)
Medium	578 (82.7)	333 (47.6)	262 (37.5)	109 (15.6)	317 (45.4)	337 (48.2)	125 (17.9)	451 (64.5)
High	2362 (88.9)	1751 (65.9)	1189 (44.7)	712 (26.8)	1475 (55.5)	1713 (64.5)	625 (23.5)	2152 (81.0)
P value	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Employment status								
Unemployed	510 (82.7)	314 (50.9)	232 (37.6)	82 (13.3)	254 (41.2)	285 (46.2)	105 (17.0)	403 (65.3)
Employed	2456 (88.4)	1782 (64.2)	1225 (44.1)	742 (26.7)	1545 (55.6)	17873(63.8)	650 (23.4)	2218 (79.9)
P value	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Number of Covid-19 cases								
High	1138 (88.4)	603 (46.8)	644 (50.0)	270 (21.0)	574 (44.6)	623 (48.4)	195 (15.1)	918 (71.3)
Moderate-Low	1828 (86.8)	1493 (70.9)	813 (38.6)	554 (26.3)	1225 (58.2)	1435 (68.1)	560 (26.6)	1703 (80.9)
P value	0.186	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

Note: * = significant (p<0.05), value in N(%)

Table 4.
Multivariate Analysis on Sociodemographic Variables and Eating Habits

Respondents Characteristics	Staple food consumption in every meal	Animal-based protein consumption in every meal	Plant-based protein consumption in every meal	Fruit consumption in every meal	Vegetable consumption in every meal	Consuming enough water	Sugar, salt, oil/fat restriction	Food supplement consumption
Age groups								
15-25	Reference	Reference	Reference	Reference	Reference		Reference	
26-35	1.54 (1.16-2.04)*	1.32 (1.07-1,62)*	1.13 (0.92-1.38)	1.24 (0.95-1.62)	1.36 (1.01-1.69)*		1.09 (0.85-1.41)	
36-45	1.71 (1.25-2.35)*	1.46 (1.16-1.85)*	1.57 (1.26-1.96)*	1.74 (1.31-2.31)*	1.54 (1.21-1.95)*		1.21 (0.92-1.58)	
46-55	1.86 (1.18-2.92)*	1.42 (1.04-1.94)*	1.52 (1.12-2.05)*	2.15 (1.49-3.09)*	2.00 (1.46-2.75)*		2.07 (1.47-2.92)*	
>56	2.12 (0.88-5.35)	0.48 (0.43-1.49)	1.56 (0.86-2.84)	6.03 (3.19-11.39)*	2.89 (1.55-5.40)*		3.11 (1.64-5.88)*	
Sex								
Male	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Female	1.46 (1.17-1.83)*	1.92 (1.63-2.26)*	1.48 (1.26-1.74)*	2.44 (1.97-3.02)*	2.13 (1.81-2.51)*	1.59 (1.35-1.87)*	1.24 (1.02-1.51)*	1.73 (1.44-2.07)*
Education level								
Low	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Medium	3.01 (1.43-6.32)*	2.75 (1.31-5.74)*	3.65 (1.49-8.98)*	4.97 (1.43-17.19)*	7.12 (2.98-17.03)*	5.09 (2.26-11.47)*	2.36 (0.87-6.41)	2.58 (1.32-5.07)*
High	3.90 (1.89-8.02)*	4.65 (2.25-9.57)*	4.51 (1.86-10.97)*	6.07 (1.77-20.82)*	6.62 (2.79-15.65)*	6.89 (3.10-15.33)*	3.05 (1.14-8.16)*	4.40 (2.28-8.52)*
Employment status								
Unemployed				Reference	Reference	Reference		Reference
Employed				1.77 (1.28-2.45)*	1.53 (1.19-1.96)*	1.69 (1.35-2.12)*		1.56 (1.22-1.99)*
Number of Covid-19 case								
High		Reference	Reference	Reference	Reference	Reference	Reference	Reference
Moderate-Low		2.77 (2.34-3.22)*	0.61 (0.53-0.70)*	1.33 (1.12-1.58)*	1.74 (1.51-2.02)*	2.26 (1.95-2.61)*	2.12 (1.77-2.56)*	1.66 (1.40-1.96)*

Note: * = significant ($p<0.05$), value in OR (95% CI)

diseases, consuming fruits and vegetables also helps increase immunity (Gibson et al., 2012).

The respondents rarely consumed protein-rich foods, specifically plant-based protein. According to some literature, legumes have anti-inflammatory effects that can prevent chronic diseases. Inflammatory biomarkers were also low in plant-based diet studies with high BMI subjects (Sidor & Rzymski, 2020). A study on adults during quarantine in Poland showed that increased BMI was associated with lower consumption of legumes, vegetables, and fruit as well as increased meat, dairy products, and fast-food consumption. Similarly, this study found that most respondents rarely limit the consumption of food or drinks with high sugar, salt, and oil/fat content (77.8%). Data collected before the Covid-19 pandemic showed a similar trend, where Indonesians, at least once a day, consume high-sugar drinks (61.2%), high-sugar foods (40.1%), salty foods (29.7%), and fatty foods (41.7%) (Frank et al., 2019). These types of diets can trigger various degenerative diseases, thereby increasing the risk of Covid-19 and worsening the impact or the severity of symptoms.

According to a hypothesis, sub-optimal hydration status in the weeks preceding infection may increase the risk of Covid-19 mortality. Patients with a high risk of mortality commonly experience hypertonicity, total body water deficit, and hypovolemia (Stookey et al., 2020). Dehydration significantly affects the transportation of various nutrients needed by the immune system. Some theories also state that a lack of body fluids results in a weaker cell membrane, minimizing its role in preventing viral infection due to dryness. Furthermore, dehydration potentially triggers inflammation due to oxidative stress (Horswill & Janas, 2011). Approximately 40% of respondents in this study consumed less water during the Covid-19 pandemic.

This study showed that the majority of respondents consumed food supplements every day. Some recent studies state that supplementation with vitamins, minerals, and probiotics does not treat or prevent Covid-19 infection, but it helps optimize the immune response, acting as an adjunct treatment. The European Food Information Council (EUFIC) mentioned the possibility of using supplements to meet dietary recommendations (EUFIC, 2020). However, dietary supplements should not be used as a substitute for a healthy and balanced diet (Zhang et al., 2020). It is only important when a person needs certain nutrients due to a specific condition that cannot be fulfilled from food (EUFIC, 2020). During the Covid-19 pandemic, when people consume more dietary supplements, more effective education about appropriate consumption of dietary supplements is needed (Hamulka et al., 2021).

Different eating patterns were identified based on sociodemographic variables assessed in this study. The older age group tended to consume more staple food, animal and plant-based protein, fruit, and vegetables better while restricting sugar, salt, and oil/fat. Similar to a report in Belgium, staple food, fruit, and vegetable consumption increased with age (Bel et al., 2019; Desbouys et al., 2019). According to a study conducted in Saudi Arabia and Belgium, young adults consumed significantly higher amounts of oils, fats, processed foods, and sugar-sweetened beverages, which decreased gradually with age (Desbouys et al., 2019; Moradi-Lakeh et al., 2017). The highest consumption of fruit and vegetables was in the >56 age group, who were also active in limiting the intake of sugar, salt, and oil, as well as staple food and protein. These data are in line with the results of previous studies. The Wellbeing Eating and Exercise for a Long Life (WELL) study in Australia showed that among 55- and 65-year-olds, the consumption of red meat, processed meat, white

bread, and hot chips was preferred by the younger men (Thorpe et al., 2016).

Older individuals tend to be more health-conscious, possibly due to the increasing importance of health-related topics as health condition declines. On the other hand, health-related issues are less important at a younger age. Unhealthy eating habits in the 15-25 age group could start after living independently. The transition of young adults from adolescence to adulthood usually begins with independent living and embarking on a higher education/employment. This period is also associated with unhealthy eating habits such as snacking, and skipping main meals (Hanbazaza & Mumena, 2020; Poobalan et al., 2014).

The results showed differences in eating habits based on gender during the Covid-19 pandemic. A previous study suggests that females select foods for their health benefits or maintain lower body weight, while males may perceive healthy eating or dieting as a feminine pursuit (Grech et al., 2017). Another study in Thailand also reported that females were more likely to consume sufficient fruit and vegetables (Grech et al., 2017). Based on a report from Saudi Arabia, females have better salt-related practices than males (Hanbazaza & Mumena, 2020). Females also consumed food supplements two times greater compared to males (Kamarli Altun et al., 2021). In contrast, a study among US adults showed females tended to eat more sugar-sweetened beverages than males (Park et al., 2018). Another study conducted in Riyadh showed that males drink more water daily than females (Park et al., 2018).

Based on the results, healthy eating practices increase as the education level rises. A study in Korea among older people showed that educational attainment was positively associated with animal protein intake (Kwon et al., 2020). Similarly, a study in Thailand and Bangladesh showed that increasing academic levels were associated with decreasing risk of low fruit and vegetable intake (Karim et al., 2017; Phulkerd et al., 2020). In Australia, lower education was associated with higher trans-fat, carbohydrate, total sugars, lower poly-unsaturated fat, and fiber intake (Livingstone et al., 2017). A survey among Italian students showed that dietary supplement consumption was more common among university than high school students (Sirico et al., 2018). Higher education may be associated with better knowledge of nutrition. As stated in a report, nutrition knowledge is associated with healthier food purchasing behavior or healthy eating habits, leading to consuming food groups rich in nutrients such as vitamins and fiber (Si Hassen et al., 2016).

The employed respondents tended to consume more fruit, vegetables, water, and food supplements than the unemployed. During the Covid-19 pandemic, the interest in immune -related compounds and foods increased rapidly. Improving immunity was the main objective of the supplementation and changes in the consumption of pro-health foods (Jadwiga Hamulka et al., 2021). By consuming more fruit, vegetables, and food supplements, workers can maintain immunity levels during external activities. Moreover, employment status may influence eating habits partly through workplace behavior and the social environment (Méjean et al., 2016).

To control the pandemic in some provinces/regions, the Indonesian government has implemented Large-Scale Social Restrictions (LSSR), specifically in areas with higher cases of Covid-19. The study showed that in the provinces with low cases of Covid-19, the respondents tended to practice better eating habits. The effect of LSSR in the provinces with a higher case of Covid-19 resulted in people having more activities at home. Some previous reports also showed that food consumption and

meal patterns were unhealthier during lockdown (Ammar et al., 2020; Ismail et al., 2020). People who live in high-case areas tend to eat more plant-based than animal-based protein.

This study has some limitations, first, due to the data collection method by an online-based survey, it was not clear whether the respondents were mainly from the targeted population, resulting in a selection bias. Second, the results cannot the generalized for the population due to the use of a non-probability sampling method. Third, this study cannot specify the type of food consumed in the questionnaire to minimize the filling time. This limitation might contribute to filling errors when the respondent is not careful in understanding the food types being asked.

CONCLUSIONS

In conclusion, this study evaluated the eating habits of Indonesians during the Covid-19 pandemic. Based on the results, the majority of the respondents have not implemented a balanced diet as recommended. The eating habits were also related to gender, age, education, and employment status. Respondents living in provinces with moderate-low cases of Covid-19 tended to have a better diet than those in provinces with higher cases. Additionally, the socio-demographic variables can be used as considerations for specific program interventions in certain groups to improve the diet patterns in the community.

ACKNOWLEDGEMENT

Thanks, and appreciation are conveyed to all participants who were involved and the Department of Health in Riau, Central Java, East Java, and Southeast Sulawesi, who have facilitated the data collection process in their respective provinces

FUNDING

This research was funded by the Magelang Health Research and Development Center, Ministry of Health of the Republic of Indonesia.

AUTHORS' CONTRIBUTIONS

Slamet Riyanto, design the study, formal analysis, methodology, writing the original draft, review and editing article and approved the final version to be published. Ika P. Asturiningtyas, Ismi Setianingsih, and Eka D. Machfutra acquired data, critically review the article and approved the final version to be published.

AUTHORS' INFORMATION

Slamet Riyanto, S.Gz, MPH is a researcher in Research Center for Public Health and Nutrition, National Research and Innovation Agency, Bogor, Indonesia, and Master of Public Health, Ika Puspita Asturiningtyas SKM, MPH is a epidemiologist in Magelang Unit for Health Research and Development, Master of Public Health, Ismi Setianingsih, S.Gz., M.Gizi is a practitioner in Magelang Unit for Health Research and Development, Master of Human Nutrition. Eka Denis Machfutra a researcher in Research Center for Public Health and Nutrition, National Research and Innovation Agency, Bogor, Indonesia.

COMPETING INTERESTS

The authors confirm that all of the text, figures, and tables in the submitted manuscript work are original work created by the authors and that there are no competing professional, financial, or personal interests from other parties.

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