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Changing of Balanced Nutrition Behavior and the Immune System during the New Normal Era of COVID-19 in South Sulawesi, Indonesia

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Abstract

BACKGROUND: The COVID-19 cases in Indonesia have increased during the new normal era of COVID-19. In addition to implementing health protocols, balanced nutrition to support the immune system is essential for preventing the further impact of COVID-19 contraction.

AIM: This study identified the pattern of balanced nutrition behavior before and during implementing the new normal concept in South Sulawesi.

METHODS: A cross-sectional survey of people aged 15 and above living in the province of South Sulawesi was conducted from November to December 2021 using online questionnaires. The survey was carried out through WhatsApp by spreading the link of the questionnaire. Data processing and analysis were performed by SPSS v.16.0 software. Differences in balanced nutrition patterns before and during the new normal era were analyzed using the Wilcoxon signed-rank test with a significant level of 0.05.

RESULTS: The study shows that the community consumption patterns were significantly declined during the implementation of the new normal concept, especially the composition of dishes ($p = 0.000$), animal-sourced foods ($p = 0.000$), vegetables ($p = 0.000$), fruit ($p = 0.000$), and milk ($p = 0.000$).

CONCLUSIONS: The implementation of the new normal behavior reduced public awareness in consuming balanced nutrition in South Sulawesi. Thereby, it might be contributing to a decrease in the immune system.

Background

The COVID-19 pandemic is a global health issue that has impacted many aspects of life. The human cost of COVID pandemic could be extraordinary. We find ourselves in a time of great economic, social, and medical uncertainty. The pandemic demands action on many fronts, from prevention to testing to the treatment [1]. The Government of the Republic of Indonesia continuously mitigates the negative impacts of COVID-19 on the national economic situation by implementing the policy to encourage people to implement the new normal behavior. The new normal behavior concept refers to a new order, habit, and behavior to perform healthy and clean behaviors when interacting with other people, including wearing a mask when leaving the house, washing hands with soap, keeping social and physical distance, and avoiding crowds [2].

Since implementing the new normal policy, the COVID-19 cases have been elevated significantly compared to the previous situation. The South Sulawesi province is the number one province in Indonesia outside Jave with the highest number of COVID-19 cases, especially since the implementation of the new normal. Adjusted by population, this province is the highest in Indonesia [3].

Since the information regarding the COVID-19 mechanism is still limited in the medical field, boosting the immune system might be the best way to prevent infection and break the chain of transmission in the communities. Maintaining an optimal nutritional status is essential for boosting the immune systems to avoid or reduce the impact of infections [4]. The basic principles to boost the immunity to fight against the coronavirus are with the following mechanisms: (1) Strengthening the body defense (natural immunity), (2) stimulating the immunoglobulin M (IgM) and IgG production, (3) blocking the virus from binding to the ACE-2 receptor, (4) reducing the intensity of cytokine storms, and (5) lowering the speed rate of virus replication [5].

The immune system can be strengthened by increasing macronutrient consumption, such as protein and fat. Protein plays a pivotal role in the formation of Igs. The Igs involved in the body defense mechanism

against the SARS-Cov 2 virus are IgM and IgG [6]. Meanwhile, fat in the form of polyunsaturated fatty acids (PUFA) is needed to prevent inflammation due to an infection [7]. In addition, carbohydrate is required to provide bodies with the energy and to maintain and improve the nutritional status. Malnutrition might be associated with immunosuppression, leading to increased susceptibility to infection [8].

Vitamins and minerals function to increase the immune system through several mechanisms. Evidence in the literature shows that micronutrient deficiencies increase the risk of acute respiratory infections [9]. Therefore, it is more likely that COVID-19 might also be affected by nutritional deficiencies [10]. The European Food Safety Authority concluded that six vitamins have essential roles in supporting the healthy immune system, such as Vitamin A (β-carotene), B6, folate, B12, C, and Vitamin D. Studies have shown a positive association between the intake of these vitamins and immune system [11], [12], [13]. Besides, a few minerals, including zinc, copper, iron, and selenium, are also involved in supporting the immune system [4], [14].

Contracting with COVID-19 will induce the immune system to work and fight back to reduce the further impact of COVID-19. However, during the adaptation of the new normal behavior, the COVID-19 cases were still increased, especially in the South Sulawesi province, leading this province as one of the provinces with the highest cases in Indonesia. This phenomenon has not been understood well.

The prolonged COVID-19 pandemic not only impacts people health globally but also generates socioeconomic problems. The number of people who got layoffs was increased, leading to a decline in family income. As a result, this situation might alter people's dietary patterns, subsequently affecting their immunity. Therefore, this study aims to determine changes in the consumption pattern of balanced nutrition after the implementation of the new normal concept in South Sulawesi Province.

Methods

Study design and participants

This study was a cross-sectional survey carried out from November to December 2021. This survey was aimed to describe the balanced nutrition behavior pattern and the efforts to increase immunity during the implementation of the new normal Era. Data were collected using a questionnaire, which was distributed online using WhatsApp. The personal information of the study participants was unidentified.

The inclusion criteria of the study participants were 17 years and above, currently living in South Sulawesi Province. It was expected to obtain 1000 participants; yet, we collected data from 1236 participants. A total of 1225 completed data from participants are eligible to be analyzed.

Study instrument

The questionnaire was developed by the research team, adjusting the study objectives. It comprises information about characteristics, the COVID-19 health protocol implementation, behavior related to the increase of immune system, and balanced nutrition consumption patterns during the COVID-19 pandemic and the new normal era. Information on consumption patterns includes the composition of meals, consumption of animal food, vegetable side dishes, vegetables, fruits, and milk. These data were collected using a food frequency questionnaire. The questionnaire has closed-ended questions, except for age. Each question in the questionnaire has the choices of answers in an ordinal scale form. The questionnaire was compiled using the Google Form and distributed online through WhatsApp.

Potential Bias: Online survey has limitations to probe and confirm the responses from the participants. To reduce this bias effect, more participants were observed.

Data processing and analysis

Data processing and analysis were performed using the SPSS v.16.0 software. Differences in balanced nutrition patterns and efforts to increase the immune system during the new normal were analyzed using the Wilcoxon Signed-rank test with a significant level of 0.05.

Ethical clearance

This study obtained ethics approval from the Center for Health Research Ethics Health Polytechnic of the Ministry of Health, Makassar; 00714B/KEPK-PTKMKS/X/2020. We received consent from the participants before collecting the data.

Results

Table 1 shows about participants characteristics such gender, educational level, and occupation. In gender, the highest presentation in female (80.3%), education level in higher education (64.4%), and occupation was in student (46.4%).

According to Table 2 after the implementation of the new normal, a few behaviors to boost the

immune system were significantly decreased, including sunbathing in the morning (p = 0.000), consuming herbal drinks (p = 0.000), taking supplements (p = 0.000), and consuming honey (p = 0.000).

Table 1 : Participant characteristics

Variable	Criteria	n (%)	
Gender	Male	241	19.7
	Female	984	80.3
Education Level	Elementary School	3	0.2
	Junior High School	18	1.5
	Senior High School	415	33.9
	Higher Education	789	64.4
Occupation	Student	569	46.4
	Health workers	157	12.8
	Civil servant/Employee (i)	287	23.4
	Entrepreneur	120	9.8
	Laborer/farmer/fisherman	9	0.7
	Housewife	53	4.3
	Not working	30	2.4
Age (years old)	Mean ± SD	29.44 ± 11.87	

Table 3 shows that the consumption patterns were significantly changed during the new normal compared to the beginning of the COVID-19 pandemic (p < 0.001). This is shown by composition of dishes, consumption of animal-sourced foods, consumption of vegetable side dishes, vegetables and fruit consumption, and milk consumption.

Discussion

Coronavirus disease is a global pandemic that has led to radical changes in lifestyle habits, including dietary habits. Ten studies conducted between March and May 2020 were included in the study. There is an increase in the number of meals and snacks during home confinement as well as unhealthy food such as fast food, sweets and chocolate, sugar-added drinks, and processed meat, while fruit and vegetable consumption was reduced. Very few studies reported that participants had increased fruit and vegetable intake. In conclusion, collateral effects of this pandemic include an environment that is not favorable to healthy dietary habits, which could have a lasting impact on health. The long-term health effects are unknown and worth investigating [15]. Most of the participants had made efforts to increase their immune systems in the early days of the COVID-19 pandemic by consuming honey and herbal drinks (e.g., turmeric, ginger, and curcuma), and taking supplements. Although it is difficult to do every day, the participants put forth the effort. However, many of these behaviors were only implemented by the participants in the early days of the pandemic or about 4–5 months after the COVID-19 outbreak arise in Indonesia. Therefore, after the implementation of the new normal, a few behaviors to boost the immune system were significantly decreased, consuming herbal drinks, taking supplements, and consuming honey.

Table 2: Efforts to increase immune system before and during the new normal era

Variable	Criteria	Before the New Normal		During New Normal		p
		n	%	n	%	
Herbal Drink Consumption	Often	369	30.1	197	16.1	<0.001
	Sometimes	422	34.4	468	38.2	
	Seldom	233	19.0	320	26.1	
	Never	201	16.4	240	19.6	
Multivitamin Consumption	Often	523	42.7	311	25.4	<0.001
	Sometimes	452	36.9	551	45.0	
	Seldom	135	11.0	219	17.9	
	Never	115	9.4	144	11.8	
Honey Consumption	Often	341	27.8	0	0	<0.001
	Sometimes	335	27.3	634	51.8	
	Seldom	301	24.6	323	26.4	
	Never	248	20.2	268	21.9	

Table 3: Implementing balanced nutrition behavior before and during the new normal

Variable	Criteria	Before the new normal		During new normal		p
		n	%	n	%	
Composition of dishes	Very complete	739	60.3	636	51.9	<0.001
	Complete	426	34.8	503	41.1	
	Not enough	42	3.4	66	5.4	
	Very Less	18	1.5	20	1.6	
Consumption of animal-sourced foods	Every Meal	571	46.6	539	44.0	0.001
	Everyday	340	27.8	342	27.9	
	> 4 times a week	101	8.2	128	10.4	
	1–3 times a week	206	16.8	210	17.1	
	Never	7	0.6	6	0.5	
Consumption of vegetable side dishes	Every Meal	271	22.1	249	20.3	<0.001
	Everyday	313	25.6	302	24.7	
	> 4 times a week	242	19.8	242	19.8	
	1–3 times a week	388	31.7	416	34.0	
	Never	11	0.9	16	1.3	
Vegetable consumption	Every Meal	370	30.2	345	28.2	<0.001
	Everyday	440	35.9	415	33.9	
	> 4 times a week	177	14.4	184	15.0	
	1–3 times a week	226	18.4	273	22.3	
	Never	12	1.0	8	0.7	
Fruit consumption	Every Meal	83	6.8	57	4.7	<0.001
	Everyday	310	25.3	284	23.2	
	> 4 times a week	244	19.9	235	19.2	
	1–3 times a week	543	44.3	602	49.1	
	Never	45	3.7	47	3.8	
Milk consumption	Often	337	27.5	307	25.1	<0.001
	Sometimes	497	40.6	510	41.6	
	Seldom	271	22.1	281	22.9	
	Never	120	9.8	127	10.4	

The community's efforts to boost the immune system and avoid being contracted COVID-19 before the new normal are decent. Most of them realized that taking herbal drinks, honey, and multivitamins could boost their immunity. Herbal drinks, for example, are believed to boost the body's immune system. Supported by some studies reported that the immune response increased after administration of nanocurcumin [16], curcuma [17], and ginger [18]. Honey consumption behavior was only implemented by a small number of participants, either before or during the new normal. It is probably because honey was sometimes difficult to find, and the price was relatively high.

Interestingly, participants' awareness of taking supplements is relatively good. However, the number of participants who consumed supplements during the new normal period has decreased. It can be assumed that current food consumption patterns have not met nutritional requirements for optimal immunity to prevent COVID-19. The current behaviors should be combined with multimicronutrient supplementation that is beneficial to support the immune system. The previous studies have reported that multimicronutrient supplementation can increase Vitamin A levels and reduce the risk of zinc and iron deficiency of which these nutrients are crucial for the normal development of immunity [19], [20].

The study shows that the consumption patterns were significantly changed during the new normal compared to the beginning of the COVID-19 pandemic ($p < 0.001$). Before the implementation of the new normal, most of the participants (60.3%) had a complete dish composition adhering to the Indonesian principles of balanced nutrition, consisting of staple foods, side dishes (animal/vegetable-sourced), vegetables, and fruits. However, the dish composition was decreased during the new normal period, indicated by the reduction of fruit in daily dishes. This is shown by the frequency of fruit consumption, which was significantly reduced ($p < 0.001$). The frequency of green vegetables was also decreased during the implementation of new normal ($p < 0.001$). The level of vegetable consumption was very high (94.5%) because vegetables are widely available in Indonesia. It is only that the fruit consumption was low (33.2%). This finding is in line with a study that showed that the average consumption of vegetables and fruit for the Indonesian population is still low compared to the balanced nutrition recommendation for vegetables and fruits [21].

Vegetables and fruits are vitamins- and mineral-rich foods that can act as antioxidants that support the immunity to fight against and prevent infections. For example, Vitamin A (carotenoids) activates immunomodulators-modulation to maintain homeostasis in the immune system. This nutrient plays a role in the cytotoxic production and activity of a lymphocyte subset that stimulates the release of certain cytokines. Carotenoid is also capable of phagocytizing neutrophils/macrophages [22]. The deficiency of Vitamin A may cause serious mucosal immune disorders and impaired adaptive responses [23]. Findings in several countries with suboptimal Vitamin A status were associated with COVID-19 proportion and mortality [4].

Moreover, Vitamins C can be easily found in many fresh fruits and vegetables, also act as an antioxidant. Studies showed that Vitamin C, along with Vitamin B6, Vitamin E, and omega-3 fatty acids, can control chronic inflammation. The combination of these three vitamins along with omega-3 can reduce cytokines in patients with COVID-19 [24], [25]. Although low Vitamin C intake has a weak correlation with the prevalence of COVID-19, its correlation with mortality was present. It means that Vitamin C consumption has a positive effect on fighting infection after a person contracted with SARS-CoV-2 [4]. Similarly, Vitamin D plays an important role in suppressing the inflammatory cytokine response that causes severe acute respiratory distress in COVID-19 patients [26]. Several studies have reported a high mortality risk in COVID-19 patients with low Vitamin D levels [27], [28].

The present study shows that most participants (74.4%) consumed animal-sourced food every day in the early days of the COVID-19 pandemic. However, there was a significant decline during the new normal ($p = 0.001$). Different consumption habits were also observed in vegetable side dish consumption. Those who consumed vegetable side dishes were <50%, significantly lower than the consumption frequency during the new normal ($p = 0.000$). Likewise, the habit of drinking milk experienced a significant decrease before and during the new normal ($p < 0.001$). These three food groups are the sources of protein and micronutrients (e.g., iron, zinc, and selenium). A study concluded that these nutrients are the most important compounds in stimulating the immune system facing COVID-19. At cellular levels, zinc (Zn) can inhibit the replication of the coronavirus or other RNA viruses [6], [29]. Meanwhile, selenium (Se) and iron (Fe) have the potential to suppress the viral mutation [30]. Combining these nutrients can help patients recover from and prevent the infection with COVID-19 [5].

In addition to being fed up with the challenging situations during the pandemic, people may misinterpret the new normal principles imposed by the government, saying that “All aspects of life must be able to continue and return to normal in the adaptation of new habits” [31]. People believe that the COVID-19 pandemic will end soon and they will resume their normal lives and activities. The adaptation to new habits (New normal) refers to a changing behavior that requires people to apply the COVID-19 health protocol (e.g., wearing masks and washing hands) all the time during their regular days and activities to prevent the transmission of COVID-19 [32]. People should be able to live side by side with COVID-19 with or without the large-scale social restrictions policy. People knowledge and awareness of following health protocols and boosting their respective immune systems are essential to limit the chance of contracting COVID-19.

Some limitations are identified in this study. First, data were collected online; thus, the answers or responses from the participants could not be reconfirmed. Second, the consumption patterns were collected at the same time (cross-sectional), which are more likely determined by the participants’ memory.

Conclusions

Activities to boost the immune system decreased during the implementation of the new normal, including sunbathing in the morning, consuming honey, herbal drinks, and multivitamins. The pattern of balanced nutrition was also decreased after the implementation of the new normal.

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