Food consumption patterns among university students in Indonesia during the transition period in new Normal Era of Covid-19 Pandemic

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Abstract. The Covid-19 outbreak that occurred in Indonesia affected all aspects of community life, including students, especially in food consumption patterns. Our study aims to investigate the differences in eating habits of health and non-health students during the transition period to the new normal era. This study used a cross-sectional design with a sample of 5,924 students. The questionnaire was in the form of an e-survey with a google form. The students' diet was obtained using a food frequency questionnaire (FFQ). The Mann Whitney test was used to analyze the differences in dietary patterns between health and non-health majors. There was a significant difference in student consumption patterns including daily eating habits (p = 0.002), consumption of animal side dishes (p = 0.000), vegetable consumption (p = 0.000), water consumption (p = 0.000), changes in eating frequency (p = 0.013) and changes in the amount of food consumed (p = 0.008). There were differences in consumption patterns between students majoring in health and non-health during the transition period. A good diet is needed in increasing immunity in students during the transition period.

1. Introduction
At the end of December 2019 in Hubei, China, several cases of pneumonia were found, and the cause was unknown [1]. The pathogen has been identified as a new RNA Betacoronavirus 2 and named as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which bears phylogenetic similarities to SARS-CoV patients [2]. This disease has its main clinical symptoms, such as fever, dry
cough, fatigue, myalgia, and pneumonia [3]. The World Health Organization (WHO) recently declared the Coronavirus Disease 2019 (COVID-19) a public health emergency of international concern. This disease spread throughout the world quickly. WHO declared that COVID-19 is a global pandemic with a devastating effect on death. Several cases of death occurred in several countries experienced a significant increase [4].

The COVID-19 pandemic spread rapidly in various countries, in developed and developing countries. According to WHO, the highest case over the world was in May when the United States hit a total of 1,477,516 cases. Indonesia ranks 36 out of 215 countries with 18,496 cases [4]. The COVID-19 epidemic is a public health emergency of international concern and has socio-economic effects in every country, including food consumption [5]. One of its significant effects is about food security that will affect the level of diet consumption [6]. Changes in food production and supply processes result in changes in diet [5]. Also, the implementation of lockdowns in various places has affected the lifestyles, especially their diet and physical activity [7,8].

During the pandemic, the community becomes more active in the house; this also occurred among college students. Previous studies have shown that most students at home have an impact on less physical activity and more sedentary activity [9]. This can be exacerbated by unhealthy eating habits that lead to weight gain and obesity. A study conducted by Yilmaz et al. (2020) shows that most students have significant changes in habits, such as in snack purchasing before and after the pandemic. Student food consumption has increased significantly and is not following the recommended balanced diet [10]. This study aims to investigate the food consumption patterns of college students in Indonesia during the transition in the new normal era of COVID-19 pandemic.

2. Methods
The design in this study was a cross-sectional study and was conducted in August 2020. This study involved 5,924 students from all provinces in Indonesia using the snowball sampling technique. This research has received ethical approval by the Health Research Ethics Committee (KEPK) of the Mataram Health Ministry of Health Poltekkes No. LB.01.03/1.1/2208/2020. The questionnaire was distributed with the google form application via social media, including WhatsApp, Facebook and Instagram. The pattern of student food consumption was obtained by the food frequency questionnaire (FFQ). Data analysis used Microsoft office 2010 and SPSS version 25 for windows. The Mann-Whitney different test was applied to analyze the differences in the food consumption patterns among students at α=0.05.

3. Results and discussion
The total number of students involved was 5,924 people who filled out the questionnaire completely. Based on student characteristics, it showed that most of the respondents aged over 19 years, 69.9% were majoring in health, and 30.1% were majoring in non-health. Most respondents were female, and about 72.5% were majoring in health. Most respondents studied at public universities with an undergraduate level. During this transitional period, most students stay at their parents' home. Their food expenditure was mostly Rp. 15,000 - 20,000 per day. Besides, non-food expenditure was higher than food expenditure, about Rp. 30,000 per day.

| Characteristic       | Health | Non – Health | Total |
|----------------------|--------|--------------|-------|
|                      | N      | %            | N     | %     | N    | %    |
| Age                  |        |              |       |       |      |      |
| <19 years            | 1798   | 64.2         | 1001  | 35.8  | 2799 | 100  |
| ≥19 years            | 2184   | 69.9         | 941   | 30.1  | 3125 | 100  |
| Sex                  |        |              |       |       |      |      |
| Male                 | 300    | 35.5         | 545   | 64.5  | 845  | 100  |
| Female               | 3682   | 72.5         | 1397  | 27.5  | 5079 | 100  |
| Institution status   |        |              |       |       |      |      |
| Public               | 3481   | 72.0         | 1351  | 28.0  | 4832 | 100  |
Table 2 shows a significant difference in the dietary patterns of health and non-health majors. Significant differences occurred in student food consumption patterns, specifically daily consumption (p = 0.002), animal side dishes (p = 0.000), vegetables (p = 0.000), water (0.000), changes in eating frequency (p = 0.013), and changes in the amount of dietary (p = 0.008). However, significant difference in the student’s diet of cereal consumption (p = 0.098), vegetable side dishes (p = 0.697), and fruit (p = 0.973) were not found.

**Table 2. Differences in food consumption patterns of health and non-health students**

| Food pattern                  | Health |       |       |       |       |       |       |       |
|-------------------------------|--------|-------|-------|-------|-------|-------|-------|-------|
|                               | N      | %     | N     | %     | N     | %     |        |       |
| Meals in a day                |        |       |       |       |       |       |       |       |
| 1 time                        | 128    | 53.6  | 111   | 46.4  | 239   | 100   | 0.002 |       |
| 2-3 times                     | 3636   | 67.8  | 1728  | 32.2  | 5364  | 100   |       |       |
| >3 times                      | 218    | 67.9  | 103   | 32.1  | 321   | 100   |       |       |
| Meals frequency changes       |        |       |       |       |       |       |       |       |
| Less often                    | 655    | 65.6  | 343   | 34.4  | 998   | 100   |       |       |
| The same                      | 2405   | 66.6  | 1208  | 33.4  | 3613  | 100   | 0.013 |       |
| More often                    | 922    | 70.2  | 391   | 29.8  | 1313  | 100   |       |       |
| Food amount changes           |        |       |       |       |       |       |       |       |
| Less                          | 686    | 64.7  | 374   | 35.3  | 1060  | 100   |       |       |
| The same                      | 2473   | 67.1  | 1215  | 32.9  | 3688  | 100   | 0.008 |       |
| More                          | 823    | 70.0  | 353   | 30.0  | 1176  | 100   |       |       |
| Cereals                       |        |       |       |       |       |       |       |       |
| 1 time                        | 359    | 62.8  | 213   | 37.2  | 572   | 100   |       |       |
| 2-3 times                     | 3187   | 67.7  | 1519  | 32.3  | 4706  | 100   | 0.098 |       |
| >3 times                      | 436    | 67.5  | 210   | 32.5  | 646   | 100   |       |       |
| Animal-based protein source side dishes |       |       |       |       |       |       |       |       |
| Never                         | 34     | 65.4  | 18    | 34.6  | 52    | 100   | 0.000 |       |
| 1 time                        | 705    | 56.1  | 552   | 43.9  | 1257  | 100   |       |       |

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Diet is a critical key to carrying out a healthy life [11]. During the pandemic, there are differences in the consumption of health and non-health majoring students. However, in general, health majors students have a better level of food consumption patterns than non-health majors students. COVID-19 pandemic affects people's daily lives, including the diet of students [12]. Commonly diet is 2-3 times a day, and it may increase more than three times a day, followed by changes in the eating frequency and the amount of food consumed, which showed significant differences. This is in line with previous research found that during the COVID-19 pandemic, there have been changes in diet, both food frequency and amount of food consumed [8].

There was no significant difference in cereal consumption among the two groups. This is different from previous studies which show that cereal consumption in the community will become higher [13]. Cereal described as a staple food, source of energy, so it is always mandatory and usually stored in the kitchen as a daily stock. Besides, it was followed by the legume consumption, which made some people improve their mood. Usually, some cereal products are used as a snack, i.e., bread, soup, and several desserts [5].

The consumption of animal-based side dishes in students had a significant difference between health and non-health students. Meanwhile, there was no significant difference in the consumption of plant-based protein. This means that health major students care more about their health by consuming higher protein than non-health majors students. Those since health students may have good knowledge, attitudes, and practices in nutritional matters [14,15]. Consumption of plant-based and animal-based side dishes is a source of protein. Protein has an anti-inflammatory effect, and high biological value let it improves immunity [16]. Therefore, it is important during a pandemic that protein consumption is highly recommended according to the needs.

Fruits and vegetables are a source of vitamins and minerals essential for the body's need [17,18]. In general, health major students had a better fruit and vegetable consumption level than non-health majors students. The results showed that vegetable consumption was significantly different from fruit consumption. Vegetables and fruit are natural sources of antioxidants needed to boost the immune system [19]. Vegetables and fruit have a variety of colours, an indicator of antioxidant content [20]. Food components contain very high antioxidants include vitamin C, vitamin E, and phytochemicals such as carotenoid and polyphenol [21]. Fruit functions as an anti-inflammatory and can reduce oxidative stress so it may strengthen immunity [21,22].
Water has an important role in metabolism, transport of substrates across membranes, cellular homeostasis, temperature regulation, and circulatory function. [23]. Water consumption among students has a significant difference between health and non-health majors students. However, in general, it already met the health recommendations, more than 8 cups or 1.5 L per day [24]. Water consumption is an indicator used to see a person's hydration level [25]. Adequacy of water consumed is one of the important during the COVID-19 epidemic. Previous studies have shown that less hydration level is one of the risks to the death of COVID-19 patients, followed by age, sex, race, and congenital chronic diseases. Chronic suboptimal hydration in the weeks before exposure to COVID-19 lead to a greater abundance of angiotensin-converting enzyme 2 (ACE2) receptors in the lungs, which increases the likelihood of COVID-19 infection [26].

4. Conclusion
The COVID-19 pandemic affected the daily food pattern among university students in Indonesia during the transition period in the new normal era. Significant differences occurred in student food consumption patterns include daily eating habits, consumption of animal side dishes, vegetables, and water. It also influenced the changes in eating frequency and the amount of food consumed. There were differences in consumption patterns between health and non-health majors students during the transition period. Also, a good diet is needed in increasing immunity in students during the transition period.

5. References
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