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Perception, Frequency and Preference in Livestock-Origin Food Consumption During the COVID-19 Pandemic in Indonesia

Endang Sulastrri and Annisa' Qurrotun A'yun

Department of Livestock Socio-Economics, Faculty of Animal Science,
Gadjah Mada University, 55281 the Special Region of Yogyakarta, Indonesia

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Corresponding Author:

Endang Sulastrri

Department of Livestock
Socio-Economics, Faculty of
Animal Science, Gadjah Mada
University, 55281 the Special
Region of Yogyakarta,
Indonesia

Email: endangs@ugm.ac.id

Abstract: Coronavirus disease 2019 (COVID-19) is a contagious respiratory that produces mild gastrointestinal illness. The infection rate of COVID-19 increases in individuals with low immunity. In an effort to prevent this disease transmission, the Government advocates increasing the immunity level along with consuming healthy and balanced diets. The present study discusses the consumption of livestock-origin foods with high nutrient contents that can bolster immunity and invigorate heart condition. In addition, we have discussed the perception, frequency and preference of Indonesians with respect to the consumption of livestock-origin foodstuff during the COVID-19 pandemic. The consumers' perception was determined based on the aspects of livestock-origin food, COVID-19 and livestock-origin food consumption. This study was conducted during August to October 2020 on 305 respondents. The data were collected from online questionnaires in a Google Doc™ form. Indonesian consumers demonstrated a positive perception of livestock-origin food consumption in strengthening body immunity to prevent COVID-19 infection; this result was significantly affected by the health status ($p \leq 0.10$). Health status also significantly influenced the consumers' assessment of livestock-origin food consumption ($p \leq 0.10$). Furthermore, the income level influenced the livestock-origin food aspect, while gender and level of education influenced the COVID-19 aspect. In terms of purchase frequency, the consumers purchased eggs more frequently during the pandemic, because they were more readily accessible and affordable. Consumers also demonstrated a positive perception with respect to the consumption frequency of meat, milk and eggs ($p \leq 0.05$). Consumers' preference suggested that eggs attained priority during the pandemic period the survey was taken. The income level affected the consumers' preference for meat, milk and eggs ($p \leq 0.05$). Preference for meat was specifically influenced by gender ($p \leq 0.10$), for which men showed a strong preference. The consumers' perception positively influenced the consumption frequency of all livestock-origin food items (meat, eggs and milk).

Keywords: Livestock-Food Origin, Consumption, COVID-19 Pandemic

Introduction

Coronavirus disease 2019 (COVID-19) pandemic has been a huge challenge in the global community health field. This pandemic also sent a shockwave on the welfare and economy in all affected countries, including Indonesia (Olivia *et al.*, 2020). As the fourth-most populous country

in the world, Indonesia is predicted to struggle with the pandemic for a long time (Djalante *et al.*, 2020).

COVID-19 infection is caused by SARS-CoV-2 virus and results in respiratory and mild gastrointestinal illnesses. This disease is contagious, with an average incubation period of 5 days, while the symptoms appear within 12 days in the infected individuals (Lauer *et al.*,

2020). Some of the more common symptoms of COVID-19 include fever, cough, sore throat, dyspnea and pneumonia. The rate of infection increases among people in advanced age (>70 y.o.) and/or with immune-compromised conditions. COVID-19 infected individuals experience reduced immune functions that can lead to respiratory failure, resulting in death and long-term effects caused by damaged respiratory organs (Li *et al.*, 2020; Petrosillo *et al.*, 2020; Wang *et al.*, 2020a; Yang *et al.*, 2020).

Immune condition is a determining factors in mitigating the infection as well as in disease transmission (Abukabda and Razzaque, 2021). One of the efforts to prevent the disease spread by the Indonesia Government has been to emphasize the importance of a strong body immunity by practicing clean habits and maintaining a healthy lifestyle, such as balanced nutrient intake, physical activity of at least 30 min, sufficient rest and consumption of traditional herbal medicine. Balanced nutrition is important to maintain a healthy body that can shield itself from infections by virus, bacteria and other parasites. The changes in immunity is strongly influenced by the nutritional status of individuals (Pereira, 2003). From the nutrition perspective, protein consumption plays an important role in strengthening the body's immune system and much of the foodstuff with high protein content comes from domesticated animals, such as meat, milk and eggs.

Healthy diet is highly recommended to meet the nutritional needs during quarantine, lockdown and/or public-activity restriction (Yousfi *et al.*, 2020). A recommended weekly schedule for livestock-origin food consumption should consist of once or twice consumption of red meat and twice or thrice consumption of poultry meat, accompanied with milk or eggs (Khayyat-zadeh, 2020). A past study revealed that sources of proteins such as meat, milk and eggs positively affect healing in COVID-19 patients, specifically owing to the benefits of fresh milk intake on improved health and immunity as well as that of egg consumption on the maintenance of health and heart condition (Cobre *et al.*, 2021). Meat, which is high in iron, zinc and vitamin B12, also positively influences the long-term health of the patients when it is consumed in the right portion (Baars *et al.*, 2019; Lesnierowski and Stangierski, 2018; McAfee *et al.*, 2010; Mutungi *et al.*, 2008; Verruck *et al.*, 2019).

Perception is a cognitive process in which an individual selects, manages, interprets and responds to the information received from his surrounding (Kotler *et al.*, 2015). In terms of marketing, perception is an important aspect that influences the consumers to purchase as well as utilize products and/or services. Consumer perception is a critical issue that can determine profitability. A positive perception is expected to encourage a preferential reaction toward products and action for repeat purchases (Kotler *et al.*, 2015). Based on these studies, it is deemed necessary to analyze the perception and frequency of and preference for

the consumption of livestock-origin food among Indonesians during the COVID-19 pandemic. To the best of our knowledge, this article is the first one in Indonesia to discuss the specific effect of COVID-19 pandemic on the consumption of livestock-origin food to be examined from the consumers' perception, frequency and preference.

Materials and Methods

Sampling and Data Collection

Indonesian citizens with the age range of 20–60 years were acquired as respondents by judgment sampling. The data were collected from closed questionnaires involving the perception of, frequency of and the preference for livestock-origin food consumption, as well as the respondents' characteristics. A closed questionnaire offers definitive answers and, therefore, involves the benefits of direct data processing because of predetermined codes (Bryman, 2012). The questionnaire was disseminated online in the form of Google Doc™ from August to October 2020. A total of 305 respondents met the required criteria who came from Java, Bali, Sumatra and Kalimantan islands of Indonesia.

Measuring the Perception of Livestock-Origin Food Consumption and the Effects of Consumer Characteristics

The consumers' perception was measured by using the Likert scale, which is also known as item analyses. The first steps consisted of determining the statements relevant to the responses to be analyzed and each item reflected either agreement or disagreement from the respondents (Cooper *et al.*, 2016).

Respondents' perception was analyzed based on the predetermined aspects consisting of livestock-origin food, COVID-19 and livestock-origin food consumption. The subjects were asked to choose responses that were scored based on a 4-point scale to statements on the aforementioned aspects. The responses were grades as follow: 1 For strongly disagree, 2 for disagree, 3 for agree and 4 for strongly agree (Table 1). The total score for each respondent was the sum of all scores of their responses on all statements. The next step was to arrange the total scores from the highest to the lowest order to determine the perspective category (Cooper *et al.*, 2016).

The perception levels were further categorized as high, medium and low. The range of scores from each category was calculated with the following formula.

Categorical Range = Maximal Score Total–Minimal Score Total
The maximal score total was the sum of the highest score (i.e., 5), which is in accordance with the number of statements. The minimal score total was the

sum of the lowest score (i.e., 1), which is in accordance with the number of statements. The results of these calculations are presented in Table 2. Multiple Ordinary Least Square (OLS) Regression analyses were conducted to determine the effects of the respondents' characteristics on the perception of livestock-origin food consumption. This method was used to investigate the correlations of multiple independent variables, identify any significant correlations and, in turn, predict the values of dependent variable (s). The analyses of the effects from multiple independent variables are very useful in social sciences, wherein multiple sources of information are required to develop sufficient predictions (Hutcheson, 2011). The Multiple OLS Regression formula used in this study is given below:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6$$

Y is a dependent variable (i.e., the scores of each aspect evaluated in perception and perception of livestock-origin food consumption), while X is the independent variables (i.e., respondents' characteristics). X_1 represented gender, consisting of male (1) and female (0), X_2 represented age in years, X_3 is the level of education in years, X_4 is the income level, X_5 is the employment status, consisting of employed (1) and unemployed (0), while X_6 is health status (with medical history), consisting of present (1) and absent (0). $\beta_{1,2,3,4,5,6}$ are regression coefficients of each independent variable and α is a constant of Y $\beta_{1,2,3,4,5,6}$ equal to zero.

Frequency Evaluation

The frequency in this study was defined as the number of times of livestock-origin food consumption in a week.

The livestock-origin food was categorized into (1) meat, (2) eggs and (3) milk. The effects of perception on the consumption frequency were determined using the OLS regression. This method is a common linear modeling approach that can be used for single response variable study employing interval scales. OLS regression can also be used in single or multiple explanatory variables as well as categorical explanatory variables that have been accurately coded (Hutcheson, 2011). The OLS regression formula used in this study was as below:

$$Y = \alpha + \beta X$$

Where:

Y = The frequency of livestock-origin food consumption

X = The total score of consumers' perceptions

α = The Y value when X is zero

β = The regression coefficient (increasing or decreasing value)

Preference Evaluation

Preference indicates the main choice of livestock-origin food consumption during the pandemic and the characteristic factors affecting it. The effects of these characteristics were analyzed with multinomial logistic regression, which is a simple extension of binary logistic regression that can be employed to predict the dependent variables with more than two categories. The independent variables could be dichotomous (binary) and continuous (interval or ratio scale). In addition, multinomial logistic regression was similar to binary logistic regression that uses the maximum likelihood estimation to evaluate the probability of the member category (Chan, 2005; Starkweather and Moske, 2002).

Table 1: Aspects in consumers' perception evaluations

Aspects	Statements	Strongly Agree (4)	Agree (3)	Disagree (2)	Strongly Disagree (1)
Livestock-origin food	1 Livestock-origin food, comprising of meat, milk and eggs, are sources of high protein nutrition.				
	2 Livestock-origin food is rich with amino acids that are suitable for human's nutritional needs.				
	3 Livestock-origin food has positive effects on health.				
	4 Proteins from livestock-origin food function as antibodies to protect individuals from illnesses caused by microorganisms.				
	5 Antibodies in the proteins from livestock-origin food can fight early illness symptoms or be antigens for the body.				
COVID-19	1 COVID-19 is an acute respiratory illness with symptoms of cough, sore throat, pneumonia and failures of some organs.				
	2 COVID-19 is worse on people with chronic illnesses.				
	3 The length of COVID-19 infection depends on the body's immunity status.				
	4 Prevention of Sars-CoV-2 infection is by maintaining the body's good immunity.				
	5 I feel the need to care for my body's immunity during the COVID-19 pandemic.				
Consumption of Livestock-origin food	1 Consumption of livestock-origin food is important during the COVID-19 pandemic.				
	2 Consumption of livestock-origin food is a part of prevention from Sars-Cov-2 infection.				
	3 Consumption of livestock-origin food can maintain the body's immunity or antibody level.				
	4 Consumption of livestock-origin food helps maintain healthy organs.				
	5 I feel healthier by consuming livestock-origin food.				

Table 2: Calculations of the categorical score of consumers' perception

Item	Minimal score total	Maximal score total	Range of negative categorical scores	Range of positive categorical scores
Livestock-origin food aspect	5	20	5 to 12.50	13 to 20
COVID-19 aspect	5	20	5 to 12.50	13 to 20
Immunity aspect	5	20	5 to 12.50	13 to 20
Consumers' perception	15	60	15 to 37.50	38 to 60

Statistical Analysis

Perception, frequency and preference in livestock-origin food consumption data were all analyzed with Multiple OLS Regression analyses, using Stata™ Software, version 16. The statistical significance was based on $p = 0.05$ and $p = 0.10$.

Results

The result of consumers' perception regression analyses is as below:

$$Y = 50.79 - 0,52X_1 + 0,042X_2 + 0,29X_3 + 0,34X_4 - 0,26X_5 + 1,70X_6$$

Note:

- Y = Consumers' perception
- X_1 = Gender (male)
- X_2 = Age
- X_3 = Level of education
- X_4 = Income
- X_5 = Employment status (employed)
- X_6 = Health status (with medical history)

The result of consumption frequency regression analyses is as below:

- 1) $Y_1 = 1.92 - 0,11X$
- 2) $Y_2 = 0.12 - 0,08X$

$$3) Y_3 = 1.42 + 0.08X$$

Note:

- Y_1 = Consumption frequency of meat
- Y_2 = Consumption frequency of eggs
- Y_3 = Consumption frequency of milk
- X = Consumers' perception

The result of consumers' preference regression analyses is as below:

- 1) $Y_4 = 2.32 + 1.50X_1 - 0.00X_2 - 0.46X_3 + 0.65X_4 - 1.06X_5 - 1.37X_6$
- 2) $Y_5 = 1.50 + 1.06X_1 + 0.02X_2 - 0.43X_3 + 0.52X_4 - 0.42X_5 - 0.71X_6$
- 3) $Y_6 = 2.80 + 0.94X_1 - 0.03X_2 - 0.30X_3 + 0.64X_4 - 1.13X_5 - 1.12X_6$

Note:

- Y_4 = Preference of meat
- Y_5 = Preference of eggs
- Y_6 = Preference of milk
- X_1 = Gender (male)
- X_2 = Age
- X_3 = Level of education
- X_4 = Income
- X_5 = Employment status (employed)
- X_6 = Health status (with medical history)

Table 3: Consumers' Perception

Aspects	Positive (%)	Negative (%)
Livestock-origin food	98.69	1.31
COVID-19	99.34	0.66
Livestock-origin food consumption	93.77	6.23
Consumers' perception	99.67	0.33

Note: Total number of respondents is 305

Table 4: Results of multiple Ordinary Least Square (OLS) regressions on consumers' perception

Aspect	Coefficient	Standard error	t	p-value
Livestock-origin food				
Gender (male)	-0.14	0.25	-0.56	0.57
Age	0.01	0.02	0.35	0.72
Level of education	0.04	0.14	0.26	0.79
Income	0.19	0.08	2.26	0.03**
Employment status (employed)	-0.17	0.37	-0.45	0.66
Health status (with medical history)	0.40	0.40	1.02	0.31
Constant	17.17	0.48	35.66	0.00
COVID-19				
Gender (male)	-0.57	0.19	-3.02	0.00**
Age	0.01	0.01	0.95	0.35

Table 4: Continue

Level of education	0.19	0.10	1.86	0.06*
Income	-0.03	0.06	-0.43	0.67
Employment status (employed)	-0.15	0.28	-0.53	0.60
Health status (with medical history)	0.47	0.30	1.58	0.12
Constant	18.41	0.36	51.18	0.00
Livestock-origin food consumption				
Gender (male)	0.20	0.32	0.62	0.54
Age	0.03	0.02	1.36	0.18
Level of education	0.06	0.17	0.35	0.73
Income	0.17	0.11	1.64	0.10
Employment status (employed)	0.06	0.47	0.12	0.90
Health status (with medical history)	0.83	0.50	1.67	0.10*
Constant	15.21	0.60	25.19	0.00
Consumers' perception				
Gender (male)	-0.52	0.63	-0.82	0.41
Age	0.04	0.04	1.12	0.27
Level of education	0.29	0.34	0.85	0.40
Income	0.34	0.21	1.61	0.11
Employment status (employed)	-0.26	0.93	-0.28	0.78
Health status (with medical history)	1.70	0.98	1.73	0.09*
Constant	50.79	1.19	42.54	0.00

** $p = 0.05$; * $p = 0.10$

Note: Total number of respondents is 305

Table 5: Consumption frequency of meat, milk and eggs

No.	Livestock-origin food	Consumption frequency average (times)	Effects of perception				
			Constant	Coefficient	Standard error	t	p -value
1.	Meat	3.72	1.92	0.11	0.03	3.68	0.000**
2.	Eggs	4.50	0.12	0.08	0.03	2.92	0.004**
3.	Milk	3.04	1.42	0.08	0.03	2.92	0.004**

** $p = 0.05$; * $p = 0.10$

Note: Total number of respondents is 305

Table 6: Results of multinomial logistic regression on consumers' preference

Preference	Coefficient	Standard error	z	p value
Meat				
Gender (male)	1.50	0.84	1.79	0.07*
Age	-0.00	0.05	-0.04	0.97
Level of education	-0.46	0.38	-1.21	0.22
Income	0.65	0.26	2.49	0.01**
Employment status (employed)	-1.06	0.97	-1.08	0.28
Health status (with medical history)	-1.37	0.92	-1.49	0.14
Constant	2.32	1.5	1.54	0.12
Eggs				
Gender (male)	1.06	0.83	1.27	0.20
Age	0.02	0.05	0.45	0.65
Level of education	-0.43	0.38	-1.15	0.25
Income	0.52	0.26	2.03	0.04**
Employment status (employed)	-0.42	0.98	-0.43	0.67
Health status (with medical history)	-0.71	0.89	-0.80	0.43
Constant	1.50	1.50	1.00	0.32
Milk				
Gender (male)	0.94	0.84	1.12	0.26
Age	-0.03	0.05	-0.49	0.62
Level of education	-0.30	0.38	-0.78	0.43
Income	0.64	0.26	2.45	0.01**
Employment status (employed)	-1.13	0.97	-1.17	0.24
Health status (with medical history)	-1.12	0.91	-1.23	0.22
Constant	2.80	1.51	1.86	0.06

** $p = 0.05$; * $p = 0.10$

Note: Total number of respondents is 305

Discussion

Perception of Livestock-Origin Food Consumption and Influencing Characteristic Factors

The discussion on perception in this study was based on the aspects of livestock-origin food, COVID-19 and livestock-origin food consumption. The first aspect described the consumers' responses on the health benefits from the nutrient contents of livestock-origin food. The results showed that 98.69% of the consumers responded positively (Table 3), which indicated that the consumers were aware of the high protein contents and the positive health effects of the livestock-origin food. Proteins obtained from the livestock-origin food functioned to maintain immunity that protected the body from illnesses.

Milk is known to contain a high amount of nutrients, such as proteins for immunity and nutrient transportation and absorption, along with vitamins and essential minerals (Pereira, 2014). Red meat plays an important role in nutrient intake because of the presence of important substances such as iron, zinc, selenium, essential amino acids and vitamin B6. These nutrients from meat are needed by the body for antioxidative defense, anticancer, immune modulatory and antimicrobial activities (Di Bernardini *et al.*, 2011; Gerber, 2007). The same is true for poultry products, including meat and eggs (Farrell, 2013). The assessment of COVID-19 aspect yielded 99.34% respondents, indicating a positive response, which in turn suggests that the subjects had a good overall understanding of the risks posed by the disease and were aware of the necessity to maintain good immunity during the pandemic. The risks of COVID-19 are already known to result in acute respiratory issues such as cough, sore throat and pneumonia, which may lead to failures of some other organs. This condition can worsen in patients with poor medical histories. The prevention of Sars-CoV2 infections can be managed by maintaining healthy immunity. The severity of COVID-19 effects depends on the body's immunity status, which makes patients aged 70 years or older more vulnerable (Li *et al.*, 2020; Rothan and Byrareddy, 2020; Wang *et al.*, 2020b). The risks of infections increase in people with comorbidities of chronic illnesses, such as hypertension, coronary arterial/cardiovascular disease, chronic kidney disease and diabetes (Liu *et al.*, 2020; Wang *et al.*, 2020a).

The consumption of proper and healthy food can strengthen one's immune system that can contribute to the prevention of infections, including Sars-CoV2. Individuals who consume balanced diets are safer as they have better immunity and are less likely to be infected or experience chronic illnesses (Aman and Masood, 2020). A large percentage (93.77%) of respondents exhibited

positive responses toward the aspect of livestock-origin food consumption. This result indicated their agreement about the benefits of livestock-origin food consumption on the immunity during the COVID-19 pandemic. The respondents were also aware that the consumption of livestock-origin food can make them feel healthier.

The fulfillment of the nutritional needs is important to maintain a healthy immune system that can fight various viral infections. Optimal nutrient intake has positive effects on immunity through gene expressions, cell activations and gastrointestinal microbial composition (Aman and Masood, 2020; Aslam *et al.*, 2017). The evaluations of the three aspects produced a result indicating that 99.67% of the respondents (Table 3) demonstrated a positive perception on the consumption of livestock-origin food, which was beneficial in maintaining the body's immunity and, therefore, in preventing Sars-CoV2 infection in individuals. Consumers showed a favorable awareness in consuming livestock-origin food during the COVID-19 pandemic. One of the best approaches to survive the current pandemic is to maintain a healthy immune system. The COVID-19 pandemic had forced everyone to maintain healthy diets. The intakes of zinc, iron, essential amino acids as well as that of vitamins A, B12, B6, C and E must be sustained to preserve a good immune condition (Di Bernardini *et al.*, 2011; Yousafzai *et al.*, 2013).

The analyses of the respondent's characteristics (Table 4) indicated that income has a significant effect on the aspect of livestock-origin food ($p \leq 0.05$). The coefficient for income was positive (0.19), which indicated that higher income of the respondents corresponded with their more positive perception of livestock-origin food. Income is a significant factor as it is related to the consumers' capacity to purchase livestock-origin food. Furthermore, dairy, poultry and meat are considered luxury items in Indonesia. High income, thus, allows families to purchase more in quantity and frequency of these items (Khoiriyah *et al.*, 2020; Muzayyanah *et al.*, 2013). The familiarity of high-income consumers with meat, milk and eggs translates to a more positive response.

Gender and level of education are the characteristics that had significant effects ($p \leq 0.05$ and $p \leq 0.10$, respectively) on the consumers' assessment of COVID-19 aspect. For instance, with a coefficient value of -0.57 , it was predicted that male consumers perceive the disease of COVID-19 unfavorably. This result is in agreement with that of a previous study that showed men to be less knowledgeable, optimistic and safe toward COVID-19 relative to women (Al-Hanawi *et al.*, 2020). It is therefore important for male members of the society to be educated on COVID-19 through raising awareness or through psychological intervention. Women tended to be more informed about COVID-19, as indicated by the higher

number of women involved in practicing preventive actions, such as hand washing, social distancing and mask wearing, compared to men. This result also suggested that women exhibited a higher perception of risks from COVID-19 than did men (Haque *et al.*, 2020; Iorfa *et al.*, 2020; O'Connor *et al.*, 2020; Rattay *et al.*, 2021).

The other characteristic that showed significant effects on the assessment of COVID-19 was level of education, with a coefficient value of 0.19. This result demonstrates that people with more level of education had more and better understanding of COVID-19. The level of education is very influential on the understanding of COVID-19 among community members in Indonesia. Individuals with higher education experience showed better understanding of COVID-19 than those with high-school education, as the former showed positive perception toward social distancing as a way to prevent COVID-19 dissemination (Rias *et al.*, 2020; Sulistyawati *et al.*, 2021; Yanti *et al.*, 2020). The relationship between health and level of education does not depend on the health status or healthy behavior, but well-educated people always demonstrate better health and healthier behavior (Cowell, 2006).

Health status is a characteristic that can be used to identify whether the respondents had poor medical histories that could be exacerbated by COVID-19 (i.e., a comorbidity). This characteristic had significant effects on the aspect of livestock-origin food consumption ($p \leq 0.10$) and on perception as a whole ($p \leq 0.10$), with coefficient values of 0.83 and 1.10, respectively. Based on these results, the consumers with poor medical histories exhibited higher awareness during the pandemic toward the consumption of livestock-origin food as a means to maintain good health, immunity and healthy organs. Individuals with co-morbidity showed a higher risk of Sars-CoV 2 infection (Felsenstein *et al.*, 2020) and, therefore, they must be more proactive toward its prevention (Iorfa *et al.*, 2020).

Consumption Frequency of Meat, Milk and Eggs

The consumption frequency of livestock-origin food was analyzed to characterize the number of times livestock-origin food consumed by respondents in a week during the pandemic (Table 5). Indonesians consumed eggs at the highest frequency of 4.50 times in a week. Egg is one of the foods that is highly recommended for consumption toward the maintenance of a healthy immune system for the prevention of Sars-Cov2 infection that causes COVID-19 (Aman and Masood, 2020). In some countries, the frequency of egg consumption exceeded those of vegetables, meat and baking products during the lockdown. The consumption of eggs proved to be positively beneficial for the recovery of COVID-19 patients (Batlle-Bayer *et al.*, 2020; Błaszczuk-Bębenek *et al.*, 2020; Cobre *et al.*, 2021). Egg is a complementary product, which means that it was consumed along with other

ingredients of a meal. However, egg can also substitute meat for a balanced diet (Khoiriyah *et al.*, 2020).

The consumption frequency of eggs was significantly influenced by consumers' perception ($p \leq 0.05$) (Table 5). Positive perception leads to increased frequency of consumption. In Indonesia, egg consumption is greater than that of other food originating from livestock as they are more accessible in both the rural and urban areas and are more affordable (Khoiriyah *et al.*, 2020; Nurmanaf, 2003). It can be described as the main reason for consumers to consume eggs more frequently due to market availability and positive consumer perceptions of eggs.

Meat was consumed at the frequency of 3.72 times per week, which is greater than that of milk consumption at 3.04 times per week (Table 5). Professional and authentic dietary guidelines recommend the consumption of red meat once or twice in a week, while poultry meat has been recommended at twice or three times in the same period. In addition, this regimen can be completed with the intake of milk and eggs during the COVID-19 pandemic (Aman and Masood, 2020). There are other detailed guidelines currently available for nutritional inputs during a pandemic; however, other studies expound the focus on diet recommendations to maintain a healthy immune system. Therefore, food intake must contain essential minerals and vitamins, including selenium, zinc and vitamins A, B6, B12, C and D (Coelho-Ravagnani *et al.*, 2021; Manson and Bassuk, 2020) and these substances are present in livestock-origin food in a high concentration.

Consumers' perception significantly influences the consumption frequency of all evaluated livestock-origin food ($p \leq 0.05$) (Table 5). There was an increase in the frequency with an increase in the consumers' positive perception. As previously mentioned, perception is a cognitive process in which an individual can choose, manage, interpret and respond to the information they gather (Kačániová, 2013; Kotler *et al.*, 2015); therefore, consumers must receive accurate information on the benefits of livestock-origin food in maintaining a good immune system. As shown in this study, consumers' perception would influence the trust on, purchase of and the subsequent consumption of livestock-origin food.

Consumers' Preference

Consumers' preference shows the priority of livestock-origin food items (i.e., meat, milk and eggs) to be consumed in the efforts to maintain a good immune system. Among the 305 respondents, 33.44% (102 individuals) chose eggs as priority, followed closely by 32.79% (100 individuals) choosing meat and 30.16% (92 individuals) choosing milk. There were 11 individuals (3.61%) who did not select a certain priority. These results demonstrated that egg was not only the most frequently consumed but also prioritized as the main item among livestock-origin food in Indonesia. A past study conducted in the province of Central Java indicated

that egg consumption exhibited the smallest reduction in response to increased prices when compared to the same phenomena on beef, chicken and milk (Rianti and Khoiriyah, 2021). As previously mentioned, eggs are the most readily accessible and affordable the prices (Nurmanaf, 2003); therefore, they are the favorite among consumers during the COVID-19 pandemic.

Consumers' preference on livestock-origin food was significantly influenced by income ($p \leq 0.05$) (Table 6). Income indicates the purchasing capacity of consumers. The coefficient values of income on all three items of livestock-origin food were positive, which indicated that higher the income, higher is the preference on these items. Various studies demonstrated that income significantly increased the consumption of livestock-origin food (Gandhi and Zhou, 2014; Ren *et al.*, 2018; Schneider *et al.*, 2011). In Indonesia, livestock-origin food is a luxury item (Muzayyanah *et al.*, 2013); thus, consumers' preference is not only influenced by the price but also by the income. The changes in income are also the most significant factor on the demand of livestock-origin food when compared to that for other commodities (Khoiriyah *et al.*, 2020; Rianti and Khoiriyah, 2021).

The other factor that significantly influenced consumers' preference was gender ($p \leq 0.10$) (Table 6), in which the male consumers showed significantly higher preference than the female ones. This result agrees with those from previous studies. The women exhibited a higher preference toward meatless meals than men in the US (Rimal, 2002), while men showed a stronger preference for meat consumption in Turkey and France (Rousset *et al.*, 2003; Schösler *et al.*, 2015).

Women, moreover, consume less meat and showed a tendency to become vegetarians for health reasons, while men consumed various meats (i.e., beef, poultry, pork, or lamb) more frequently (Rosenfeld and Tomiyama, 2021; Uzmay and Cinar, 2017). Animal welfare is also an issue that women use as a reason to consume less meat and feel the need for animal welfare attributes on meat products. Women are also skeptical toward red meat and meat consumption as well as demonstrate dissatisfaction with meat-inside-body and body feel after consuming meat (Blanc *et al.*, 2020; Kubberød *et al.*, 2002). Meanwhile, men view meat, especially red meat, as a masculine food. This notion claims that being a meat eater is an attribute for idealized men, mainly because an increased muscle mass is a result of meat intake (Rothgerber, 2013; Sobal, 2005).

Conclusion

The consumers' perceptions towards livestock-origin food, COVID-19 and consumption of livestock-origin food are generally positive. Those perceptions are influenced by gender, level of education, income and health status (with medical history). The perceptions are more positive from consumers with higher income and level of education. Consumers with a history of health challenges

tend to show high awareness to consume livestock-origin food during the COVID-19 pandemic to maintain immunity and organ health.

The consumers' perceptions towards livestock-origin food, COVID-19 and consumption of livestock-origin food positively affect the consumption frequency of meat, eggs and milk. The choices for the livestock-origin food to be consumed are significantly influenced by income level. A fascinating finding is observed in which males tend to choose meat over eggs and milk.

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Author's Contributions

Endang Sulastris: Designed and contributed in data analysis and wrote the paper.

Annisa' Qurrotun A'yun: Collected the data, analyzed and wrote the paper.

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