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Abstract

Purpose – Complementary feeding practices was more difficult during the COVID-19 pandemic due to economic instability, especially for animal source foods (ASFs) consumption. According to the problem, the purpose of the present study was to determine the economic impact of COVID-19 pandemic on ASFs consumption and ASFs consumption related factors on complementary feeding in Indonesia.

Design/methodology/approach – This cross-sectional study was targeted to mothers of child aged 6-23 months during pandemic. A total of 574 respondents were obtain through online questionnaire.

Findings – This study found that flesh food including fish/seafood, organ meat, meat, poultry, and processed meat were associated with all economic impact of COVID-19 pandemic, in contrast, those economic impacts did not affect the dairy product and egg consumption. Multivariate analysis showed children with older age (AOR: 1.13, 95%CI: 1.04-3.26), meet minimum dietary diversity (AOR:2.17, 95%CI: 1.56-5.44), and from high income level household (AOR: 1.14, 95%CI: 1.09-2.10) were contributed to ASFs consumption.

Practical implication – Other strategies aimed at enhancing food security to increase ASFs consumption on complementary feeding. The government may consider short-term emergency purchasing subsidies and macro-control of the ASFs market. Nutrition education is also required to improve knowledge related to importance of ASFs consumption for children.

Originality/value – This study reveals the association between each food group of ASFs consumption on complementary feeding and the economic impact of COVID-19 pandemic.

Keywords: COVID-19 pandemic, complementary feeding, animal source foods household income

Introduction

Malnutrition is a problem that occurs in most developing countries. In Indonesia, nutrition problems are still quite high, including stunting 30.8%, wasting 10.2% and underweight 17.79% in 2018 (National Institute of Health Research and Development, 2018). On the other hand, the world is currently facing the COVID-19 pandemic which is predicted to increase child malnutrition problems. One of the main reasons of malnutrition during the pandemic is due to socioeconomic problems (Ntambara and Chu, 2021). Physical distancing, necessary for population protection, has severely damaged the economic sector, including household employment status, such as layoffs, reduced working hours, or reduced salaries. Many people experience a decrease in household income which has a negative impact on purchasing power, food availability, and a decrease in the level of household food security (Nofitasari *et al.*, 2023). Lower household food security directly affects food consumption and nutritional intake of household members at different levels (Rozaki, 2021).

Prevention of malnutrition can be started from 1000 days of life by the fulfillment of optimal nutrition (Nyarko *et al.*, 2023). The World Health Organization recommends that infants should be exclusively breastfed for the first six months of life and an appropriate complementary feeding with a diverse diet starting from six months. Complementary feeding practice should meet the minimum dietary diversity. Animal Source Foods (ASFs) is one of the food groups on eight type of food group that can be met from various food sources including eggs, poultry, meat, fish, and milk (WHO and UNICEF, 2021). ASFs are a source of high-quality protein, high density, high bioavailability of nutrients, vitamin A, vitamin B12, heme iron, zinc, calcium, and other minerals (Wood *et al.*, 2024). In addition, ASFs can significantly improve nutritional status and cognitive function, especially in children because ASFs provide high concentrations of macronutrients and micronutrients that are needed to meet their daily needs (Pokharel *et al.*, 2023). Based on research conducted in several developing countries, known that consumption of ASFs reduced the odds of all form of malnutrition in children and showed a positive relationship with weight-for-age, weight-for-length, and BMI-for-age z-scores (Khaliq *et al.,* 2023; Kittisakmontri *et al.*, 2022).

Based on research conducted in Iran and China, it is known that because of economic problems during the pandemic, household tend to buy food at affordable prices. There has been a shift to increased consumption of carbohydrate foods and decreased consumption of ASFs. ASFs tend to be more expensive than other food groups (Nikooyeh *et al.,* 2022; Shen and Zhong, 2023).

Given the importance of consuming ASFs in complementary feeding to prevent malnutrition during COVID-19 pandemic, this study aims to determine the economic impact of COVID-19 pandemic on ASFs consumption and ASFs consumption related factors on complementary feeding in Indonesia.

Materials and Methods

Study Design and Participants

This study was a cross-sectional study using convenience sampling during the COVID-19 pandemic in Indonesia. Data was obtained through an online survey due to the government's physical limitations strategy to prevent disease transmission, which includes limiting access to essential public places such as healthcare centers, workplaces, and markets. This research was part of the Indonesian Complementary Feeding Quality (ICFQR) Study which was conducted for 6 weeks (April-May) 2022. We performed a self-administered online questionnaire using the Google Forms tool. Participants were mothers of healthy children aged 6 to 23 months live in Indonesia who had been introduced to solid foods to their child. Participants were limited to those having a computer or smartphone and internet connection for practical reasons. All criteria were verified by the answers given to the corresponding survey questions.

The population was children aged 6–23 months, living in Indonesia. Sample size was determined by using a single population proportion formula. The prevalence (P) of complementary feeding practices was taken as 13% (Widyaningrum *et al.,* 2021), with 95% of confidence level and 5% margin of error (d), then minimum sample was 174. However, to anticipate the missing data, we added 20% as our required sample size estimation, so the minimum sample size was 209. The survey was completed by 574 mothers of children aged 6-23 months.

The questionnaire online links distributed through social media to several target groups in Indonesia, such as Instagram, Whatsapp, Line, Facebook, and Twitter. Data were collected from local communities such as Indonesian Breastfeeding Mothers' Association for easily reach respondents quickly and efficiently. In addition, we used all community member from each province to have more representative sample of Indonesian children.

Data Collection

The questionnaire was developed Alma Ata University's research members, which included a dietitian with experience in infant nutrition research (YP) and two researchers (HKR, HDH). The tool was modified in terms of vocabulary formulation, vocabulary removal,

and adding new vocabulary. The Cronbach's alpha of the study sample was 0.81, indicating a high level of consistency and can be depended on in the field due to the reliability of its results. The questionnaire contained three parts: socio-demographic characteristics, data related to the impact of the COVID-19 pandemic on household economic aspects, and data related to complementary feeding. Socio-demographic data include place of residence (Java or outside Java); maternal age (18-25 years, 26-35 years, or 36-40 years); mother's education (basic, secondary, or high); mother's occupation (housewife, government employees, or private employees); father's occupation (no occupation, government employees, or private employees); household income level (low < IDR 1.500.000, middle IDR 1.500.000-2.500.000, or high IDR >2.500.000); family size (large 7-10 people, middle 4-6 people, or small 2-3 people); child's age (6-11 months, 12-17 months, or 18-23 months); and the sex of the child (male or female).

Data related to the impact of the COVID-19 pandemic on household economic aspect include the impact on household income (decreased income, no change income, or increased income), the impact on household food purchases (impacted or not impacted), the impact on mother's employment status (impacted or not impacted), and the impact on father's employment status (impacted or not impacted). Data related to ASFs consumption were asked in complementary feeding section. ASFs consumption in complementary feeding is defined as children 6-23 months who have consumed each of the food groups 4, 5, or 6 on the previous day based on recommendations from IYCF 2021 (WHO and UNICEF, 2021). Food group 4 is diary group, including milk from animals such as fresh, canned, or powdered milk; yogurt drink; yogurt, other than yogurt drinks; and hard or soft cheese. Food group 5 is flesh food group, including organ meats such as liver, kidney, heart; processed meats such as sausages, canned meats; other meats such as beef, pork, lamb, goat, chicken, duck; and fresh or dried fish or shellfish. Food group 6 is eggs, including chicken, eggs, and duck eggs.

As a secondary outcome of interest, we analyzed the Minimum Dietary Diversity (MDD) of complementary feeding. Based on the recommendations from IYCF 2021, minimum food group consumed in complementary feeding is five groups on eight food group in total. The eight food groups including breast milk; grains, roots, and tubers; legumes, nuts, and seeds; dairy products; flesh food; eggs; vitamin A-rich fruits and vegetables; and other fruits and vegetables.

Statistical Analysis

Sociodemographic and consumption of ASFs were analyzed using a descriptive analysis for frequency distribution. A binary logistic regression model was used to find out the

association between each food group on ASFs and economic impact of COVID-19 pandemic. Bivariate analysis was conducted using Pearson's Chi Square test ($p<0.05$). Multivariate analyses were analyzed using multiple logistic regression tests to know the factor associated with ASFs consumption. We adjusted for all socio-demographic confounders in the fully adjusted models. Data analysis was done using IBM SPSS Statistics for Mac version 26.0 (IBM Corp, Armonk, New York, USA).

Ethical Consideration

Ethical approval (with the number KE/ AA/ VI/ 10832/ EC/ 2022) was obtained from the ethics committee of the Faculty of Health Sciences, Universitas Alma Ata which complied with the Helsinki Declaration. Information about the background, purpose, and scope of the questions was informed at the beginning of the study. Participants had received a written explanation regarding this research before filling out informed consent. Informed consent from participants was obtained on the online form. The participants were also informed that all data collected would be used for research purposes to be published.

Results

A total of 574 mothers of children aged 6-23 months participated in this study. Most of the mothers live in Java (70.21%), 26-35 years old (61.15%), had secondary education (62.89%), and more than half were housewife (60.97%). Nearly half of household had high income level (48.08%). Most fathers work in private employees (70.73%) and have family categorized as middle size (66.38%). Half of the mothers had daughters (50%) and half sons (50%), with most children aged 6-11 months (40.94%) and 12-17 months (41.12%). The COVID-19 pandemic has caused most families to experience a decrease in household income (63.59%). In addition, the outbreak also had a major impact on the household's ability to provide food (73.52%), mother's employment status (55.57%), and father's employment status (76.48%) (Table 1).

Table 1. Respondent's Characteristics (N=574)

Variable	Frequency (%)
Child characteristic	
Child's age	
6-11 months	235 (40.94)
12-17 months	236 (41.12)
18-23 months	103 (17.94)
Sex of child	
Female	287 (50.00)
Male	287 (50.00)
Mother and household characteristic	

Place of residence	
Outside Java	171 (29.79)
Java	403 (70.21)
Family size	
Large	45 (7.84)
Middle	381 (66.38)
Small	148 (25.78)
Mother's age	
18-25 years	179 (31.18)
26-35 years	351 (61.15)
36-40 years	44 (7.67)
Mother's education level	
Low	12 (2.09)
Middle	361 (62.89)
High	201 (35.02)
Mother's occupation	
No occupation/ housewife	350 (60.97)
Government employees	82 (14.30)
Private employees	142 (24.73)
Father's occupation	
No occupation	3 (0.53)
Government employees	165 (28.74)
Private employees	406 (70.73)
Household income level	
Low	71 (12.37)
Middle	128 (22.30)
High	375 (65.3)
Minimum Dietary Diversity (MDD)	
No (<5 food groups)	77 (13.41)
Yes (>=5 food groups)	497 (86.59)
COVID-19 pandemic impacts on household income	
Decreased income	365 (63.59)
No change income	192 (33.45)
Increased income	17 (2.96)
COVID-19 pandemic impacts on household ability to provide food	
Impacted	422 (73.52)
Not impacted	152 (26.48)
COVID-19 pandemic impacts on mother's employment status	
Impacted	255 (44.43)
Not impacted	319 (55.57)
COVID-19 pandemic impacts on father's employment status	
Impacted	439 (76.48)
Not impacted	135 (23.52)

Figure 1 showed that most of the children met the MDD (86.6%) and consumed any type of ASFs in complementary feeding (92.2%). The most ASFs given to complementary foods were eggs (65.9%) and dairy (61.7%). While other ASFs consumed was processed meat (54.9%), fish or seafood (53%), meat (43.9%), and poultry (34.7%). Only 26.8% children

consumed organ meat. Children who consume ASFs during previous day tend to meet the minimum dietary diversity recommendations (MDD). Based on the data, it is known that 92.6% of children who consume ASFs have met the MDD, compared to children who do not consume ASF, only 6.6%.

The results regarding the association of economic impact of COVID-19 pandemic on each type of ASF consumption on complementary feeding are described in Table 2. Economic impact of COVID-19 pandemic (household income change, ability to provide food, mother employment status, and father employment status) had significant association with consumption of ASFs in overall and all type of food in food group 5 (flesh food). Meanwhile, food group 4 (dairy) and 6 (eggs) did not have a significant relationship with all economic impact of COVID-19 pandemic.

Table 2. Economic impact of COVID-19 pandemic on each type of ASF consumption on complementary feeding[a]

COVID-19 pandemic impacts	ASFs consumption		Food group 4 consumption		Food group 5 consumption										Food group 6 consumption	
			Dairy products		Fish/ seafood		Organ meat		Meat		Poultry		Processed meat		Eggs	
	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value
Impacts on household income																
Increased income	13	0.013*	13	0.763	5	0.020*	4	0.011*	7	0.016*	8	0.020*	10	0.011*	9	0.679
	(2.3)		(2.3)		(0.9)		(0.7)		(1.2)		(1.4)		(1.7)		(1.6)	
No change income	174	0.189	148	0.312	84	0.184	39	0.547	71	0.601	51	0.184	99	0.547	125	0.242
	(30.3)		(25.8)		(14.6)		(6.8)		(12.4)		(8.9)		(17.2)		(21.8)	
Decreased income	342		267		215		111		174		146		206		244	
	(59.6)		(46.5)		(37.5)		(19.3)		(30.3)		(25.4)		(35.9)		(42.5)	
Impacts on household ability to provide food																
Not impacted	133	0.015*	109	0.346	56	<0.001**	19	<0.001**	39	<0.001**	28	<0.001**	70	<0.001**	90	0.055
	(23.2)		(19.0)		(9.8)		(3.3)		(6.8)		(4.9)		(12.2)		(15.7)	
Impacted	396		319		248		135		213		177		245		288	
	(69.0)		(55.6)		(43.2)		(23.5)		(37.1)		(30.8)		(42.7)		(76.2)	
Impacts on mother's employment status																
Not impacted	286	0.015*	222	0.346	149	<0.001**	67	<0.001**	118	<0.001**	85	<0.001**	156	<0.001**	198	0.332
	(49.8)		(38.7)		(26.0)		(11.7)		(20.6)		(14.8)		(27.2)		(34.5)	
Impacted	243		206		155		87		134		120		159		180	
	(42.3)		(35.9)		(27.0)		(15.2)		(23.3)		(20.9)		(27.7)		(31.4)	
Impacts on father's employment status																
Not impacted	410	0.047*	103	0.597	57	0.004**	30	0.016*	42	<0.001**	35	0.004**	64	0.028*	81	0.102
	(71.4)		(17.9)		(9.9)		(5.2)		(7.3)		(6.1)		(11.1)		(14.1)	
Impacted	119		325		247		124		210		170		251		297	
	(20.7)		(56.6)		(43.0)		(21.6)		(36.6)		(29.6)		(43.7)		(51.7)	

[a] Total sample size was 574, [b] the number of children who consumed each food group type on previous day, *Statistically significant at p-value <0.05, ** Statistically significant at p-value < 0.01

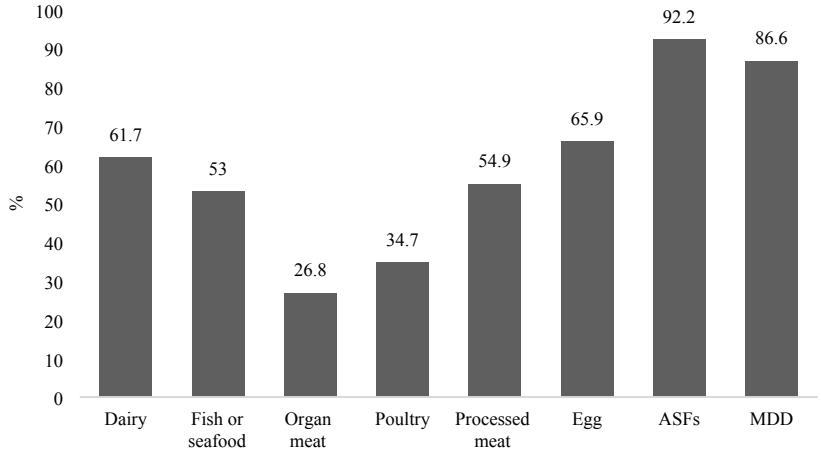

Figure 1. Percentage children that consumed ASFs on complementary feeding

In the multivariate analysis (Table 3), showed an association between the consumption of ASF on complementary feeding with child's age (p=0.010; OR=1.26; 95% CI=1.22-2.22), MDD (p=0.010; OR=1.26; 95% CI=1.22-2.22), and household income level (p=0.010; OR=1.26; 95% CI=1.22-2.22). Meanwhile, there were no association between ASFs consumption with all the COVID-19 pandemic impact on economic aspects.

Table 3. Multivariate analysis with logistic regression on ASFs consumption

Variable	ASFs Consumption		COR (95% CI)	AOR[a] (95% CI)
	No, n(%)	Yes, n(%)		
Child's age				
6-11 months (ref)	27 (11.5)	208 (88.5)		
12-17 months	16 (6.8)	220 (93.2)	1.40 (0.10-4.91)	1.23 (0.65-3.61)
18-23 months	2 (1.9)	101 (98.1)	1.27 (1.03-2.21)*	1.13 (1.04-3.26)*
Sex of child				
Male (ref)	22 (7.7)	265 (92.3)		
Female	23 (8.0)	264 (92)	1.05 (0.57-1.92)	
Place of residence				
Java (ref)	22 (12.9)	149 (87.1)		
Outside Java	23 (5.7)	380 (94.3)	2.44 (1.32-4.51)*	1.01 (0.39-2.60)
Family size				
Large (ref)	5 (11.1)	40 (88.9)		
Middle	25 (6.6)	356 (93.4)	1.56 (0.72-1.92)	
Small	15 (10.1)	133 (89.9)	1.62 (0.61-2.23)	
Mother's age				
18-25 years (ref)	16 (8.9)	163 (91.1)		
26-35 years	25 (7.1)	326 (92.9)	1.30 (0.43-3.93)	
36-40 years	4 (9.1)	40 (90.9)	1.01 (0.32-3.21)	
Mother's education level				
Low (ref)	1 (8.3)	11 (91.7)		
Middle	28 (7.8)	333 (92.2)	1.02 (0.71-7.84)*	1.12 (0.54-6.77)

High	16 (8.0)	185 (92.0)	1.03 (0.54-1.95)*	1.29 (0.83-1.98)
Mother's occupation				
Housewife (ref)	20 (5.7)	330 (94.3)		
Government employees	12 (14.6)	70 (85.4)	1.87 (0.71-6.04)	
Private employees	2 (1.4)	140 (98.6)	1.59 (0.55-1.94)	
Father's occupation				
No occupation (ref)	3 (100)	0 (0.0)		
Government employees	15 (9.0)	150 (91.0)	1.22 (0.53-4.93)	
Private employees	12 (30.0)	394 (70.0)	1.55 (0.52-2.21)	
Household income level				
Low (ref)	14 (19.7)	57 (80.3)		
Middle	7 (5.5)	121 (94.5)	1.16 (0.36-1.43)*	1.08 (0.22-1.23)
High	24 (12.6)	351 (87.4)	1.26 (1.22-2.22)*	1.14 (1.09-2.10)*
Minimum Dietary Diversity (MDD)				
No (ref)	38 (49.4)	39 (50.6)		
Yes	7 (1.4)	490 (98.6)	1.90 (1.86-2.66)*	2.17 (1.56-5.44)*
COVID-19 pandemic impacts on household income				
Decreased income (ref)	23 (6.3)	342 (93.7)		
No change income	18 (9.4)	174 (90.6)	1.97 (1.28-3.01)*	1.67 (0.30-1.96)
Increased income	4 (23.5)	13 (76.5)	4.57 (1.38-6.15)*	1.88 (0.54-2.06)
COVID-19 pandemic impacts on household ability to provide food				
Impacted (ref)	26 (6.2)	396 (93.8)		
Not impacted	19 (12.5)	133 (87.5)	1.46 (1.24-1.85)*	1.15 (0.38-3.51)
COVID-19 pandemic impacts on mother's employment status				
Impacted (ref)	12 (4.7)	243 (95.3)		
Not impacted	33 (10.3)	286 (89.7)	2.43 (1.21-2.84)*	0.67 (0.26-1.73)
COVID-19 pandemic impacts on father's employment status				
Impacted (ref)	29 (6.6)	410 (93.4)		
Not impacted	16 (11.9)	119 (88.1)	1.53 (1.27-2.00)*	1.24 (0.36-4.17)

[a]Derived by using multiple logistic regression *Statistically significant at p-value <0.05

Discussion

COVID-19 pandemic has made most people in Indonesia experience problems in the economic aspects which can lead to a decrease in household income levels. It is widely reported that the pandemic condition will affect the food security of the family (Kakaei *et al.,* 2022). Household who has a high level of food security will affect the quality of the food given to children, especially on complementary feeding (Nurhayati *et al.,* 2020). A decrease in household income will have a major impact on purchasing power, in addition to the price of the main food ingredients, ASFs, which is relatively more expensive than other food groups (Ahmed *et al.,* 2022). Our study evaluated the effects of the COVID-19 pandemic especially related to economic impact with the ASFs consumption on complementary feeding. To the best of our knowledge, this is the first study using a representative sample of children Indonesia. Our study showed an overall high ASFs consumption in the study sample, though there was a reduction in consumption in some low-level economic household due to pandemic situation

related to household income change, impact on ability to provide food, impact on mother and father employment status.

Among all the ASFs type, flesh food including fish/seafood, organ meat, meat, poultry, and processed meat had a significant relationship with all economic impact of COVID-19 pandemic in this study. Flesh food is containing a higher in iron zinc, choline, vitamin B12, and vitamin B6 than other type of ASFs, also have high nutrient density and bioavailability food source that children need (Hawthorne *et al.,* 2022). Household that had no economic impact or higher income level during pandemic tended to have high socioeconomic levels. This circumstance would increase their ability to give flesh food to their children. In general, the flesh food price is quite expensive and has also increased due to food supply chain problem during pandemic, especially ASFs which required a long production process (Rahimi *et al.,* 2022).

The study finding indicated that eggs had no significant relationship with economic impact during pandemic. High food prices caused economic impacted household had limited access to ASFs. Meanwhile, eggs are still reasonably priced in comparison to other ASFs sources, making them affordable for all household income levels. Based on Indonesian Central Bureau of Statistics the price of egg per kilograms was thrice the price of flesh food for example meat (Indonesian Central Bureau of Statistics, 2022). Eggs contain amino acids, protein, selenium, vitamin A, choline, vitamin B12, and other important nutrients which contain more than other types of ASFs (Puglisi and Fernandez, 2022). Consumption of egg can improve growth, nutritional biomarkers, and gut microbiota (Suta *et al.*, 2023). Eggs are a nonperishable food item that is easy to store, making them easily accessible. In addition, as an alternative to ASFs, the processing methods of eggs are quite easy and varied (boiled, fried, scrambled, and was frequently eaten mixed with other food, particularly porridge). It is more preferred by mothers when cooking, as well as the taste and texture of the eggs is accepted by most children (Faber *et al.,* 2022).

Another food group that had no significant association with economic impact during pandemic was dairy product. This finding is contrast with previous study from China which reported that dairy consumption was significantly associated with economic impact of COVID-19 pandemic. Dairy products are being promoted and advertised more often which are believed to strengthen the body's immunity during pandemic (Chen *et al*., 2024). Dairy product is rich in calories, calcium, vitamin A, riboflavin, vitamin B12, and high-quality proteins for children, as well as a growth-related hormone (Haile and Headey, 2023). Besides that, this different result might be due to the classification of food group that cause different outcomes. We did

not differentiate between each food type in the dairy group. Milk powder or formula milk were included in dairy group in this study. Among 61,7% children who consumed dairy group, mostly 69,8% were reported formula-feeding children. This might due limited access to lactation support services because of physical restriction during pandemic. In general, formula milk is chosen by mothers with all economic level who have problem with breastfeeding, such as insufficient human breast milk production issue or difficulties with breastfeed while infected with the Covid-19 virus (Fry *et al*., 2021).

Based on this study, the odds of ASFs consumption on complementary feeding were increased 1.26 times if household have high income level. These results are similar with research conducted in Ethiopia on complementary feeding practice which found that ASFs consumption increased by 20% in household with high economic status (Gebretsadik *et al.,* 2022). During the pandemic, there is an increase of food price in market. All household adapt to meet their daily food intake. Among all food group, healthy food generally has a higher price. This condition was related to consumer demand for healthy foods because of panic buying behavior that occurs in some people due to increased awareness of people related to health during pandemic (Chua *et al.,* 2021; Nurhayati *et al.*, 2023). As a result of the high food prices, there is a shift in food choice, especially household with low- and middle-income economic status. People tend to choose foods with low-priced sources of calories and generally nonperishable ingredients such as starchy food (Janssen *et al.,* 2021). ASFs is one of healthy food source, high in protein and rich in amino acids, which are needed to increase immunity during a pandemic. However, people will tend to reduce the portion or even have no ASFs due to economic reasons (Jafri *et al.,* 2021). The quality of the food purchased can be very different, usually worse, when household income decreases (Nikooyeh *et al.,* 2022). However, household can continue to give their children ASFs in the appropriate portion, but as a consequence the proportion of other household expenses will be reduced (Borger *et al.*, 2021).

Other factor related to ASFs consumption in this study was child age. Higher odds of ASFs consumption were found on older child aged 18-23 months. Similarly study in Ethiopia, ASFs consumption increased with age category (Gebretsadik *et al.,* 2022). The need for calories and feeding skills may increase as children become older. In addition to eating more frequently as they become older, children are exposed to a wider variety of foods (Miller *et al.,* 2023).

Children who consume ASFs were 2.17 time had higher odd to meet MDD. ASFs are the most expensive food group compared to other food group in dietary diversity component,

especially during the pandemic. Children are more likely to fulfill other food group in the MDD excluding the ASFs, because it is easier for households to access. Furthermore, ASFs consumption will increase the odd to achieve MDD (Gibson *et al.,* 2020).

Our study has some limitations that need to be considered. This study's convenience sampling, which might have been indicative of the broader population. The study's generalizability is impacted by selection bias stemming from the recruitment of respondents via social media and community groups. We used self-administered online questionnaires due to physical restriction during pandemic, so only respondent those who have access to the internet included in this study.

Conclusion

The findings of this study reveal that most children consumed ASF in complementary feeding (92.2%). All type of food group 5 or flesh food including fish/seafood, organ meat, meat, poultry, and processed meat were associated with all economic impact of COVID-19 pandemic, but not with dairy product and egg consumption. Determinant factor of ASFs consumption in complementary feeding were older age children, meet minimum dietary diversity, and from high income level household.

The possibility that the COVID-19 pandemic or similar phenomena could occur again in the future cannot be ignored. If such conditions happen, we already know that consumption of food groups such as flesh food can be decreased by the economic impacts. Since ASFs is a highly nutritious food group that is beneficial for children's growth and development, we need to take preventive steps to prevent a decrease in consumption of this food group and maintain the quality of complementary feeding. Household income loss is a key factor in ASFs consumption. To increase the consumption of ASFs on complementary feeding, other policies targeting improvements in food security should be considered. The government may take into account short-term emergency purchasing subsidies, macro-control of the ASFs market, and prevent unreasonable high price fluctuation.

The study's findings revealed that even in economic situations impacted by pandemic, there were ASFs groups whose consumption remains high, such as eggs and dairy products. This result can be the additional information, particularly for the government that ASFs can be consumed by children with various economic backgrounds. This knowledge can be used as the consideration by the government for making policies to increase ASF consumption behaviour in various economic backgrounds, such as through campaigns or nutrition education.

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Table 1. Respondent's Characteristics (N=574)

Variable	Frequency (%)
Child characteristic	
Child's age	
6-11 months	235 (40.94)
12-17 months	236 (41.12)
18-23 months	103 (17.94)
Sex of child	
Female	287 (50.00)
Male	287 (50.00)
Mother and household characteristic	
Place of residence	
Outside Java	171 (29.79)
Java	403 (70.21)
Family size	
Large	45 (7.84)
Middle	381 (66.38)
Small	148 (25.78)
Mother's age	
18-25 years	179 (31.18)
26-35 years	351 (61.15)
36-40 years	44 (7.67)
Mother's education level	
Low	12 (2.09)
Middle	361 (62.89)
High	201 (35.02)
Mother's occupation	
No occupation/ housewife	350 (60.97)
Government employees	82 (14.30)
Private employees	142 (24.73)
Father's occupation	
No occupation	3 (0.53)
Government employees	165 (28.74)
Private employees	406 (70.73)
Household income level	
Low	71 (12.37)
Middle	128 (22.30)
High	375 (65.3)
Minimum Dietary Diversity (MDD)	
No (<5 food groups)	77 (13.41)
Yes (>=5 food groups)	497 (86.59)
COVID-19 pandemic impacts on household income	
Decreased income	365 (63.59)
No change income	192 (33.45)
Increased income	17 (2.96)
COVID-19 pandemic impacts on household ability to provide food	

Impacted	422 (73.52)
Not impacted	152 (26.48)
COVID-19 pandemic impacts on mother's employment status	
Impacted	255 (44.43)
Not impacted	319 (55.57)
COVID-19 pandemic impacts on father's employment status	
Impacted	439 (76.48)
Not impacted	135 (23.52)

Table 2. Economic impact of COVID-19 pandemic on each type of ASF consumption on complementary feeding[a]

COVID-19 pandemic impacts	ASFs consumption		Food group 4 consumption		Food group 5 consumption										Food group 6 consumption	
			Dairy products		Fish/ seafood		Organ meat		Meat		Poultry		Processed meat		Eggs	
	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value	n (%)[b]	p value
Impacts on household income																
Increased income	13	0.013*	13	0.763	5	0.020*	4	0.011*	7	0.016*	8	0.020*	10	0.011*	9	0.679
	(2.3)		(2.3)		(0.9)		(0.7)		(1.2)		(1.4)		(1.7)		(1.6)	
No change income	174	0.189	148	0.312	84	0.184	39	0.547	71	0.601	51	0.184	99	0.547	125	0.242
	(30.3)		(25.8)		(14.6)		(6.8)		(12.4)		(8.9)		(17.2)		(21.8)	
Decreased income	342		267		215		111		174		146		206		244	
	(59.6)		(46.5)		(37.5)		(19.3)		(30.3)		(25.4)		(35.9)		(42.5)	
Impacts on household ability to provide food																
Not impacted	133	0.015*	109	0.346	56	<0.001**	19	<0.001**	39	<0.001**	28	<0.001**	70	<0.001**	90	0.055
	(23.2)		(19.0)		(9.8)		(3.3)		(6.8)		(4.9)		(12.2)		(15.7)	
Impacted	396		319		248		135		213		177		245		288	
	(69.0)		(55.6)		(43.2)		(23.5)		(37.1)		(30.8)		(42.7)		(76.2)	
Impacts on mother's employment status																
Not impacted	286	0.015*	222	0.346	149	<0.001**	67	<0.001**	118	<0.001**	85	<0.001**	156	<0.001**	198	0.332
	(49.8)		(38.7)		(26.0)		(11.7)		(20.6)		(14.8)		(27.2)		(34.5)	
Impacted	243		206		155		87		134		120		159		180	
	(42.3)		(35.9)		(27.0)		(15.2)		(23.3)		(20.9)		(27.7)		(31.4)	
Impacts on father's employment status																
Not impacted	410	0.047*	103	0.597	57	0.004**	30	0.016*	42	<0.001**	35	0.004**	64	0.028*	81	0.102
	(71.4)		(17.9)		(9.9)		(5.2)		(7.3)		(6.1)		(11.1)		(14.1)	
Impacted	119		325		247		124		210		170		251		297	
	(20.7)		(56.6)		(43.0)		(21.6)		(36.6)		(29.6)		(43.7)		(51.7)	

[a] Total sample size was 574, [b] the number of children who consumed each food group type on previous day, *Statistically significant at p-value <0.05, ** Statistically significant at p-value < 0.01

Table 3. Multivariate analysis with logistic regression on ASFs consumption

Variable	ASFs Consumption		COR (95% CI)	AOR[a] (95% CI)
	No, n(%)	Yes, n(%)		
Child's age				
6-11 months (ref)	27 (11.5)	208 (88.5)		
12-17 months	16 (6.8)	220 (93.2)	1.40 (0.10-4.91)	1.23 (0.65-3.61)
18-23 months	2 (1.9)	101 (98.1)	1.27 (1.03-2.21)*	1.13 (1.04-3.26)*
Sex of child				
Male (ref)	22 (7.7)	265 (92.3)		
Female	23 (8.0)	264 (92)	1.05 (0.57-1.92)	
Place of residence				
Java (ref)	22 (12.9)	149 (87.1)		
Outside Java	23 (5.7)	380 (94.3)	2.44 (1.32-4.51)*	1.01 (0.39-2.60)
Family size				
Large (ref)	5 (11.1)	40 (88.9)		
Middle	25 (6.6)	356 (93.4)	1.56 (0.72-1.92)	
Small	15 (10.1)	133 (89.9)	1.62 (0.61-2.23)	
Mother's age				
18-25 years (ref)	16 (8.9)	163 (91.1)		
26-35 years	25 (7.1)	326 (92.9)	1.30 (0.43-3.93)	
36-40 years	4 (9.1)	40 (90.9)	1.01 (0.32-3.21)	
Mother's education level				
Low (ref)	1 (8.3)	11 (91.7)		
Middle	28 (7.8)	333 (92.2)	1.02 (0.71-7.84)*	1.12 (0.54-6.77)
High	16 (8.0)	185 (92.0)	1.03 (0.54-1.95)*	1.29 (0.83-1.98)
Mother's occupation				
Housewife (ref)	20 (5.7)	330 (94.3)		
Government employees	12 (14.6)	70 (85.4)	1.87 (0.71-6.04)	
Private employees	2 (1.4)	140 (98.6)	1.59 (0.55-1.94)	
Father's occupation				
No occupation (ref)	3 (100)	0 (0.0)		
Government employees	15 (9.0)	150 (91.0)	1.22 (0.53-4.93)	
Private employees	12 (30.0)	394 (70.0)	1.55 (0.52-2.21)	
Household income level				
Low (ref)	14 (19.7)	57 (80.3)		
Middle	7 (5.5)	121 (94.5)	1.16 (0.36-1.43)*	1.08 (0.22-1.23)
High	24 (12.6)	351 (87.4)	1.26 (1.22-2.22)*	1.14 (1.09-2.10)*
Minimum Dietary Diversity (MDD)				
No (ref)	38 (49.4)	39 (50.6)		
Yes	7 (1.4)	490 (98.6)	1.90 (1.86-2.66)*	2.17 (1.56-5.44)*
COVID-19 pandemic impacts on household income				
Decreased income (ref)	23 (6.3)	342 (93.7)		
No change income	18 (9.4)	174 (90.6)	1.97 (1.28-3.01)*	1.67 (0.30-1.96)
Increased income	4 (23.5)	13 (76.5)	4.57 (1.38-6.15)*	1.88 (0.54-2.06)
COVID-19 pandemic impacts on household ability to provide food				
Impacted (ref)	26 (6.2)	396 (93.8)		
Not impacted	19 (12.5)	133 (87.5)	1.46 (1.24-1.85)*	1.15 (0.38-3.51)
COVID-19 pandemic impacts on mother's employment status				
Impacted (ref)	12 (4.7)	243 (95.3)		
Not impacted	33 (10.3)	286 (89.7)	2.43 (1.21-2.84)*	0.67 (0.26-1.73)

COVID-19 pandemic impacts on father's employment status				
Impacted (ref)	29 (6.6)	410 (93.4)		
Not impacted	16 (11.9)	119 (88.1)	1.53 (1.27-2.00)*	1.24 (0.36-4.17)

[a]Derived by using multiple logistic regression *Statistically significant at p-value <0.05

Dairy	61.7
Fish or seafood	53
Organ meat	26.8
Poultry	34.7
Processed meat	54.9
Egg	65.9
ASFs	92.2
MDD	86.6