Changes in Fish Consumer Behavior during the COVID-19 Pandemic in Bandung City

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Case Study

ABSTRACT

This research was conducted in Cicendo District, Bandung City, West Java. To analyze factors that influence changes in fish consumers behaviour and preference before the COVID-19 pandemic. Case study with quantitative and qualitative data analysis was employed and an accidental sampling technique method using 100 respondents. The results showed changes in factors during the COVID-19 pandemic are the system and place of purchase, the frequency of fish consumption, the amount of consumption of fish and products consumed, and the price of fish. Based on binary logistic regression analysis, before and after the Covid-19 pandemic, the Wald test showed that income, education and age variables had an influence on preferences between fresh fish and processed fish. Preferences between fresh freshwater fish and marine fish before and after the COVID-19 pandemic, the Wald test shows that employment and income variables have an influence.

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1. INTRODUCTION

At the beginning of 2020, the world was shocked by a new virus, name the Coronavirus disease 2019 (COVID-19). This virus originated from Wuhan, China. The increase in the number of virus cases is quite fast and has spread to various countries, including Indonesia. In connection with this virus, the Minister of Health issued a Decree of the Minister of Health Number HK.01.07 / MENKES / 104/2020 concerning the determination of Novel Coronavirus Infection (2019-nCoV Infection) as a type of disease that can cause outbreaks and efforts to Control Them. The spread of COVID-19 has many impacts on political, social, cultural, security, public welfare, and especially economic aspects [1].

During the pandemic, the Ministry of Marine Affairs and Fisheries (KKP) through the Directorate General of Strengthene the Competitiveness of Marine and Fishery Products (PDSPKP) and continues to monitor the availability, development of fish supply and prices in Indonesia. The Ministry of Maritime Affairs and Fisheries recommends that people continue to consume fish, even more. Community needs other than staple food and also need other nutrients, protein. Protein is divided into two, namely vegetable protein and animal protein. One of the animal proteins is fish. Fish is part of food which is a source of animal protein which is very useful for health because it contains complete essential amino acids. Fish contains 18% of protein consists of essential amino acids, the fat content of 1-20% is fat that is easly digested and directly used by body tissues. Other elements fish protein, vitamins, minerals and omega-3. That protein in fish the body needs to growth and healthy. Fish is a high protein, low-fat food that provides a range of health benefits. Benefits of eat fish in pandemic situation is increase immunity and maintain a healthy body because fish has a complete nutrition [2].

Nationally, the target of fish consumption in 2020 is 56.39 kg/capita year. But given the tendency during the pandemic the demand for fish is decreasing, it is possible that the target will be missed. According to the Head of the West Java Marine and Fisheries Service, the selling price of fish has dropped dramatically by 50% due to a lack of demand from consumers. Even before the pandemic, the tendency for fish demand has increased. Specifically for the city of Bandung, the local government has set a target in 2019 with a fish consumption figure of 37.95 kg/capita and a realization of 37.90 kg/capita [3].

COVID-19 has an indirect impact on change demand of consumers, market access and logistical problems related to uninterrupted delivery of products, both export and local trade [4]. The closure of all airports and ports due to the work from home policy and social impacts that impacted fishing activities. Because there is a decrease in demand, the price of fish tends to fall due to the accumulation of catches in several ports in Indonesia [5]. This has happened in several regions in Indonesia, one of which is in Java. In addition, Covid-19 has a small impact on fisheries, industries such as the closure of fish processing factories, processed fish exports have stopped also, while decrease in captured fisheries production which resulted in the disruption of supply chain, cold chains, and the decline in the price of catch fish commodities were also observed [6].

COVID-19 pandemic has made people change about many things, one of which is consumption patterns. The consumption pattern of the people changes according to conditions that require people to do activities at home with a new lifestyle called stay at home lifestyle. The Covid-19 pandemic has also had an impact on the country's economy which invariably impacted people financially handicap so they are more selective in choosing their needs. With everything done at home, activities like shopping also tend to stop in modern markets or online. The consumption pattern of fishery products is also possible with changes in purchases with consumers who tend to buy fresh fish products or processed fish.

Bandung City is one of the cities that has considerable potential for commodities in the fisheries sector. Cicendo sub-district is one of the sub-districts of 30 sub-districts in the city of Bandung. The population in Cicendo District is 96,008 people, therefore the potential for purchasing power for fish products before and after the pandemic in Cicendo District is quite frequent [7]. Cicendo sub-district is one of the districts affected by Covid-19 with the highest number of positives and has been included in the red zone [8]. Therefore, Cicendo District was

used as the study area to reflect changes in consumer behavior towards purchasing fishery products before and after the Covid-19 pandemic. It is hoped that this can provide information on people's consumption patterns that changed before and after the Covid-19 pandemic in Bandung.

2. MATERIALS AND METHODS

2.1 Time and Place

This research was conducted in Cicendo District, Bandung City, Jawa Barat Province, Indonesia within the period of February - March 2021.

2.2 Types and Data Sources

The methods used in this study are primary data and secondary data. Primary data is based on direct observations and interviews with structured questionnaire fillouts by respondents. Questionnaire is a data collection technique that is done by giving a set of questions or written statements to respondents for answering [9]. Secondary data were obtained from literature, documents and information from various relevant agencies.

2.3 Sampling Techniques

The sampling technique used in this study is accidental sampling. Accidental sampling is a method of collecting data based on accidental resources. The number of respondents in this study is one hundred (100) fish consumers.

2.4 Data Analysis Methods

The data was collected after getting answers from the questionnaire interviews then entered to excel. Then, data processing and analysis was carried out with the help of Statistical Products and Solution Services (SPSS) Version 26.

Descriptive analysis is a statistic used to analyze data by describing the data that has been collected. Respondent data in this research is needed to find out the background of the respondents which can be used as input to explain the results obtained from the research. The data needed are gender, age, education level, occupation, income, number of family members and tribe.

Logistic regression is a regression used to test the extent to which the probability of the dependent variable is predicted by the independent variable. Logistic regression can be divided into 2, but only binary logistic regression is used in this study. The formulas used in this technique are [10]:

$$\pi_1(1/0) = \frac{e^{(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4)}}{1 + e^{(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4)}}$$

Description:

π_1 (1/0) = Preference, fresh fish dummy variable 1; processed fish 0
β_0 = Constant
β_1 - β_5 = Regression coefficient
x_1 = Gender (male = 1 / female = 0)
x_2 = Number of Family Members
x_3 = Work
x_4 = Income
x_5 = Education
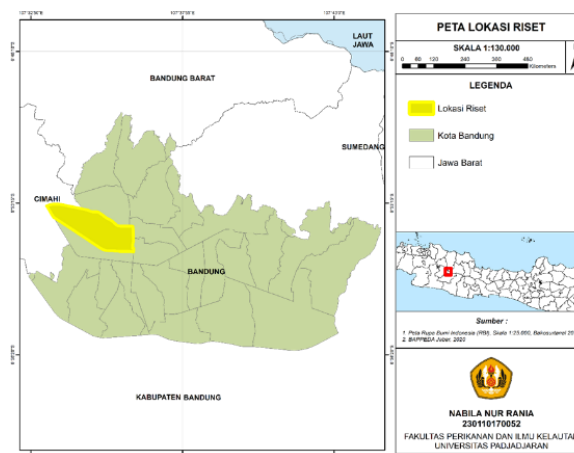x_6 = Original Term
x_7 = Age

Fig. 1. Map of research location

2.5 Test Parameters

1. Model Feasibility Test

Model feasibility test (goodness of fit) was conducted to assess the feasibility of the logistic regression model used. The model feasibility test was assessed using the Hosmer and Lemeshow's Goodness of Fit Test Goodness as measured by the Chi-square value. Significant means that the relationship that occurs can apply to the population [11]. Hosmer and Lemeshow's testing with the following hypotheses:

H_0: the hypothesized model is fit with the data
H_1: the hypothesized model does not fit the data

This test is carried out with a significant level of 5%. With the test results if H0 if the p-value (probability value) is> 5% significant level, and will reject H0 if the p-value (probability value) is <5% significant level.

2. Overall Test

This test is to determine whether the independent variable in logistic regression simultaneously affects the dependent variable as in the F test in linear regression. Or it can be called testing the parameters in the model as a whole. With the following hypothesis:

H_0: $\beta i = 0$ (income, education, occupation, age, gender, number of family members and ethnicity of origin have no influence on the decision to choose the type of processed fish).

H_1: $\beta i \neq 0$ (income, education, occupation, age, gender, number of family members and ethnicity of origin have an influence on the decision to choose the type of processed fish).

3. Wald Test

Wald test is used to test each independent variable on the dependent variable. This test aims to determine the role of each independent variable in the model individually. And, it can be called the Wald test to test whether or not the independent variables influence the dependent variable partially by comparing it with the Chi-square value with a significant level of 5%.The hypothesis used is as follows:

H_0: $\beta i = 0$ (the ith independent variable has no effect on the dependent variable)

H_1: $\beta i \neq 0$ (the ith independent variable affects the dependent variable)

If H0 is rejected, then there is a significant influence between the ith independent variable on the dependent variable. And, on the other hand, if H1 is rejected, then there is no significant effect between the independent ith variable on the dependent variable.

4. The coefficient of determination

The coefficient of determination uses Nagelkerke R Square (R^2) with tests carried out to measure the goodness of the model by showing how much variation of the independent variables affects the dependent variable. Nagerlkerke R Square (R^2) is a modification of the Cox and Snell R Square coefficients to ensure that the values are 0 to 1. Verbally, R^2 measures the proportion or presentation of the total variation in Y described by the regression model. According, there are 2 characteristics of R^2 that need to be known, namely as follows [12]:

a. The magnitude is never negative
b. The limit is $0 \leq R^2 \leq 1$

If the value of R^2 is 1, then the line suitability is correct or it can be said that the stronger the model explains between the independent variable and the dependent variable. On the other hand, if R^2 is zero, then the weaker between the independent variable and the dependent variable.

5. Odds Ratio

Odds Ratio is a measure to determine the risk of a category's tendency to other categories. Odd can also be expressed in logistic regression as probability or chance. This ratio determines whether a factor has more or less chances compared to other groups. Odds ratios are tested by a set of odds divided by other odds. To compare the average probability of the expected occurrence of 2 events with different conditions, the SDS ratio is used.

3. RESULTS AND DISCUSSION

Respondent data in this research is needed to determine the background of the respondents which can be used as input to explain the results obtained from the research. Respondents in this research are people in Cicendo District who

consume and know fishery products, both fresh fish, sea fresh fish or processed fish.

3.1 Descriptive Analysis of Respondents Data

Respondent in Cicendo District are generally female with 64% and there is a tendency of high female role in the process of household decision making related to daily food needs.

Between 30-59 years old who have been included in the adult category. This means that most of the respondents tend to be able to think rationally in choosing fishery product purchasing decisions.

The level of education among respondents in this study showed that 67% were bachelor. This shows that respondent have a high level of education. According from the theory, the higher a person's education, the higher one's knowledge will be [13].

Forty eight percent (48%) of respondents work as government employees/private employees. This type of work will affect the level of income a person receives, the higher the income, the

proportion of expenditure or consumption patterns and they tend to pay more attention to nutritional and health values [14].

Thirty six percent (36%) of the respondent has an average income of Rp.5.000.000-Rp.6.500.000.

The income of respondents is classified as moderate because most of the respondents are employees who receive salaries according to the minimum wage in Bandung.

Sixty nine percent (69%) respondents in Cicendo District as a family size of 3 – 5 people. this case, the number of family members greatly influences the fishery product purchasing decisions related to the quantity to be purchased. The more family members, the greater the need in the family so that consumers will buy fishery products in larger quantities [15].

Tribe in Cicendo District has a dominant is Sundanese. Cicendo sub-district which is used as a research location in the city of Bandung. Bandung city is a province of West Java which is dominated by the Sundanese tribe.
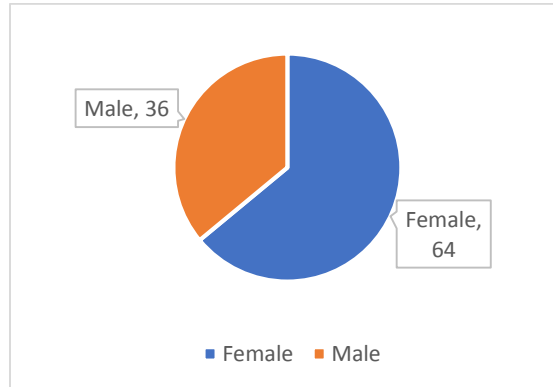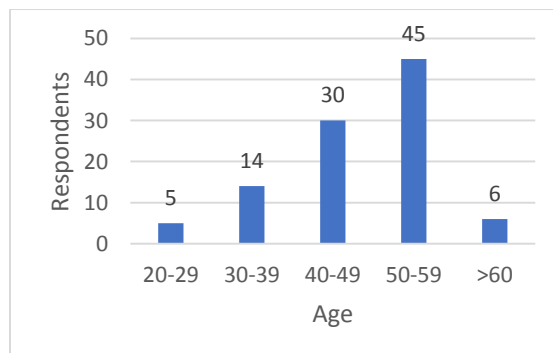

Fig. 2. Frequency distribution of gender

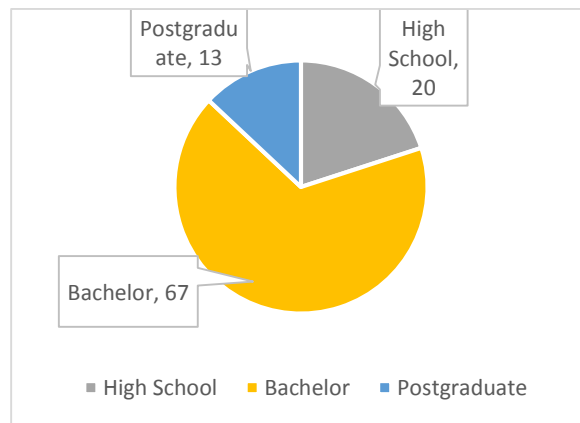**Fig. 3. Frequency distribution of age**
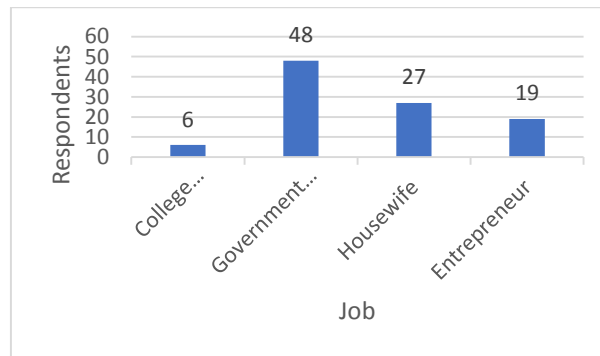
Fig. 4. Frequency distribution of level education

Fig. 5. Frequency distribution of job

Table 1. Frequency distribution of income

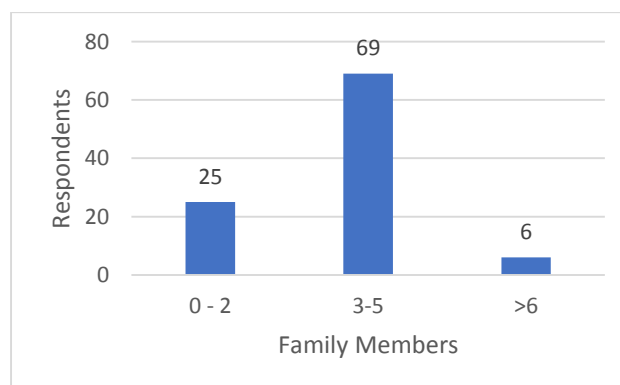| Income	Frequency	Percentage
≤ 3.500.000	7	7%
3.500.000 - 5.00.000	8	8%
5.000.000 - 6.500.000	36	36%
6.500.000 - 8.000.000	13	13%
8.000.000 - 9.500.000	15	15%
> 9.500.000	21	21%
Total	100	100%

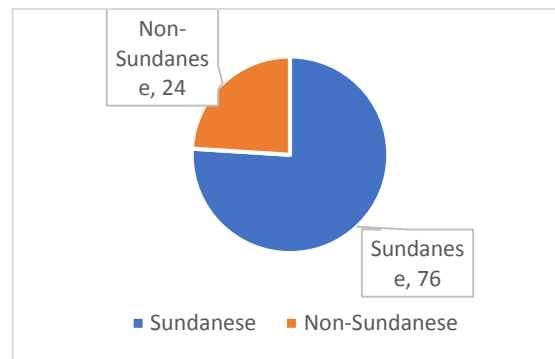**Fig. 6. Frequency distribution of number family members**

Fig. 7. Frequency distribution of tribe

3.2 Overview of Consumer Preferences for Fishery Products in the City of Bandung

3.2.1 Respondents purchasing system

The frequency distribution of respondents based on the purchasing sysrem is presented in Fig. 1. There was a higher percentage of repondents 93% that operate offline purchasing system before Covid-19. While 87% of respondents operate purchasing system after Covid-19. Traditional market in Bandung City has apply an online shopping system for PSBB in Bandung City. This makes people tend to shop online because its safer, reduces the risk of contracting viruses and is easier.

3.2.2 The place of purchase of the respondents

The frequency distribution of the place of purchase respondents is presented in Fig. 2. The results showed that 84% of the respondents shop at traditional markets before Covid-19 pandemic while 73% shop at supermarkets after Covid-19 pandemic. Impact of Covid-19 Indonesians tend to shop at supermarkets, this is because consumers consider shopping at supermarkets to be safer because they have health protocols that are sticker than traditional markets [16].

3.2.3 The reason respondents chose online purchasing system

The majority of respondents revealed that shopping online was easy and safe. Respondents feel safe and prices tend to be cheaper with varoious kinds of discount on products. Respondents' responses regarding the online purchasing system were for security reasons because many were still worried and has the fear contracting Covid-19 so more respondents preferred to stay at home and shop online.

3.2.4 The reason respondents chose offline purchasing system

Respondents feel more satisfied when buying offline because they can see and feel the texture of the product they are buying. The majority of respondents reasoned that they shop offline because they can hold the product directly, this is very different when consumers shop online.

3.2.5 Fish frequency per week

The distribution frequency of fish frequency per week in Cicendo District during before and after Covid-19 pandemic is presented in Fig. 3. The results showed that 42% of respondents consumed fish at least two times in a week before Covid-19 pandemic while 43% consumed fish at least once in a week after the Covid-19 pandemic. The level of consumption of the respondents has decreased from 2 times to 1 time a week. The government has carried out a "Movement to Popularize Eating Fish" during the Covid-19 pandemic because it will have a good impact on society because fish consumption can also increase body resistance [17]. In accordance with recommendations from the World Health Organization (WHO) that fish intake is at least two servings per week [18].

3.2.6 The amount of fish consumed per week

The distribution frequency of the amount of fish consumed per week in Cicendo District before and after Covid-19 pandemic is presented in Fig. 4. The results showed that 61% of the respondents consumed fish at least < 1 kg in a

week before pandemic while 59% consumed fish at least same < 1 kg in a week after Covid-19 pandemic. It means that consumers eat fish on weekly basis. At present, the national level of fish consumption in Indonesia has reached 54.49 kg / capita, but in particular the island of Java still has the lowest level of fish consumption. This indicates that there is a disparity in the supply and fulfillment of community nutrition from fish which is still not evenly distributed in Indonesia and it is very unfortunate because the potential for fish resources in Indonesia reaches 9.9 million tons and the potential area of cultivation area is 83.6 million hectares that can be optimized. With this potential, the government should be able to increase the availability of fisheries, consume fish protein sources for the community and create a program to like to eat fish in a new way to attract people to understand the benefits of consuming fish [19].

3.2.7 The reason consumers weekly fish consumption

Respondents chose the reason, name the importance of fish consumption before the Covid-19 pandemic and chose the same reason after Covid-19 pandemic. Respondents chose this reason because of the importance of fish consumption during the Covid-19 Pandemic. Fish as a source of protein for the community, highly nutritious and good for body health. Importance of fish consumption increase because importance to consume fish during this pandemic.

3.2.8 The reason for the respondent consume less fish per week

Respondents chose the reason, consume less fish per week with the primary reason of decreased income before the Covid-19 pandemic and chose the same reason after the Covid-19 pandemic. This reason was chosen by respondents was because the respondents income decreased due to the Covid-19 pandemic factor as many people lost their jobs and some were temporarily laid off.

3.2.9 Fish products frequently consumed by respondents

The distribution frequency of fish products which are most frequently consumed by respondents in Ciceno District before and after Covid-19 pandemic is presented in Fig. 5. The results showed that 88% of the respondents consumed

fresh fish before Covid-19 pandemic, and 78% consumed fresh fish too after Covid-19 pandemic. At the time before and after Covid-19 pandemic, the same respondents consume fresh fish more often. Respondents from the research prefer fresh fish to processed fish because fresh fish tastes better, fresh fish contains better nutrition and can be served into various types of dishes [20].

3.2.10 The reason respondents chose fresh fish products

The majority of respondents choose fresh fish and its products because they taste better. Fresh fish is preferred because it tastes better because fresh fish contains better nutrition than processed fish, and various types of fresh fish can be used as various dishes that can be processed as desired by the public.

3.2.11 The reason respondents chose processed fish

The majority of respondents chose to consume processed fish because it was easily available to obtain due to the value addition due to processing. Fish is a source of animal protein which is widely consumed by the public, especially processed fish.

3.2.12 Types of fresh fish most often consumed by respondents

The distribution frequency of types of fresh fish most often consumed by respondents in Cicendo District before and after Covid-19 pandemic is presented in Fig. 6. There was higher percentage of respondents 72% that consumed fresh fish water before Covid-19 pandemic and 69% consumed fresh fish water too after Covid-19 pandemic. This is because Cicendo District is located in Bandung City, where Bandung City is surrounded by mountains and geographically the city is located in the middle of West Java Province. This means that the city of Bandung is far from the coast so that more fresh fish is marketed than sea fresh fish. The availability of fresh sea fish in Bandung is still there, but the condition of the fish after arriving at the point of sale is usually not too fresh.

3.2.13 Types of processed fish often consumed by respondents

The distribution frequency of types of processed fish often consumed by respondents in Cicendo

District before and after Covid-19 pandemic is presented in Fig. 7. The results showed that 45% of the respondents consumed jelly fish before Covid-19 pandemic and 46% consumed jelly fish too after Covid-19 pandemic. Respondents like processed jelly fish because it is easier to cook, Families, especially children, like fish balls, fish nuggets because they can be eaten immediately without having to separate the spines from fresh fish.

3.2.14 Respondents observations fish product in the market rare to find

The distribution frequency of observations respondent fish product in the market rare to find in Cicendo District before and after Covid-19 pandemic is presented in Fig. 8. The results showed that 96% of the respondents easy to find in market before COVID-19 pandemic and 85% easy to find after COVID-19 pandemic. When the COVID-19 Pandemic occurred, Ministry of Marine Affairs and Fisheries to make efforts to coordinate with related parties to ensure that logistics supply traffic and business support facilities could continue to run smoothly, for example fisheries distribution in Indonesia. The Ministry of Maritime Affairs and Fisheries also made a strategy to continue to monitor the availability, supply and price developments of fish in Indonesia during the COVID-19 Pandemic. The implementation of the strategy is to carry out cooperation between agencies such as the distribution of raw and processed fish raw materials through non-cash food assistance, part of which can be used to buy fresh fish.
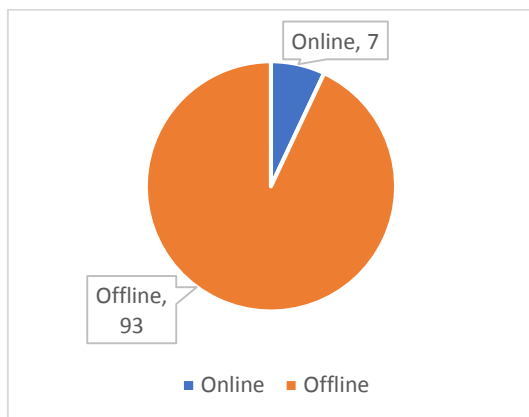
3.2.15 Respondents observations regarding the increase in fish prices

The distribution frequency of observations respondents regarding the increase in fish prices in Cicendo District before and after COVID-19 pandemic is presented in Fig. 9.The results showed that 55 people chose not experience an increase in fish prices before Covid-19 pandemic while 63% of people chose experiencing price increases after COVID-19 pandemic. The existence of the COVID-19 pandemic makes it difficult for fishermen to fish because fishing time in the sea has been shortened to 3-4 days, resulting in fewer fish catches.

3.2.16 Consumers knowledge about the benefits of fish consumption

The distribution frequency of knowledge respondents about benefits of fish consumption in Cicendo District before and after COVID-19 pandemic is presented in Table 1. The results show that 95 people know the benefits of fish consumption. In this case it can be seen that the respondents knowledge in Kecamatan Cicendo is quite high regarding the benefits of fish consumption, because the majority of respondents in Kecamatan Cicendo are highly educated, it can be seen in the descriptive analysis of respondent data. Based on the results of the interview, the average respondent knows the benefits of fish consumption, namely a source of protein, containing vitamins, omega-3. Protein sources are good for growth and body health, such as reducing the risk of heart disease, stroke, and good for brain and eye development.
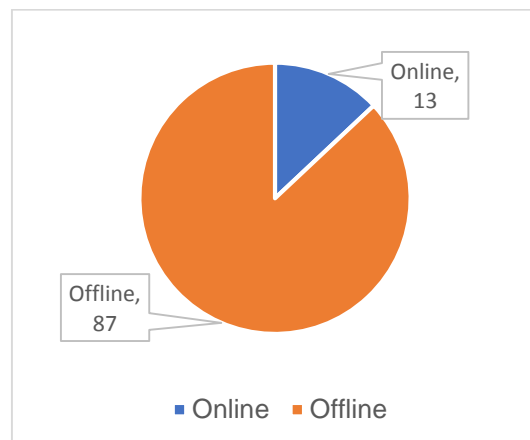

Fig. 8a. Frequency distribution of the purchasing system before COVID-19 pandemic

Fig. 8b. Frequency distribution of the purchasing system after COVID-19 pandemic
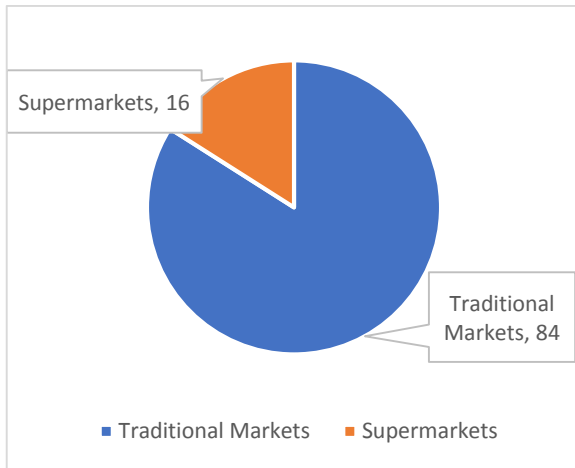
Fig. 9a. Frequency distribution of places of purchase before COVID-19 pandemic

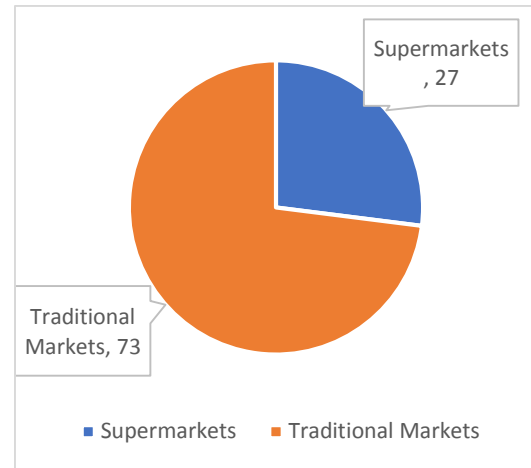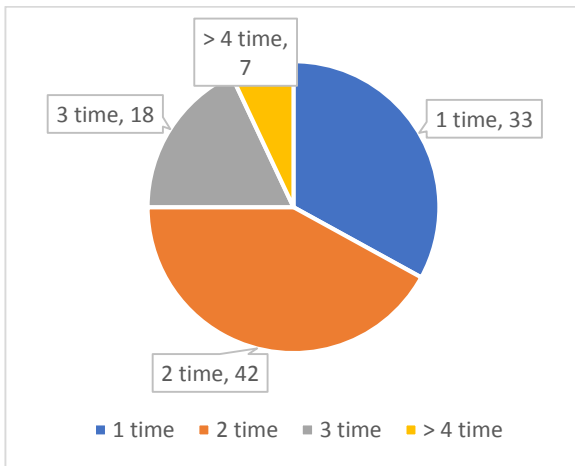**Fig. 9b. Frequency distribution of places of purchase after COVID-19 pandemic**

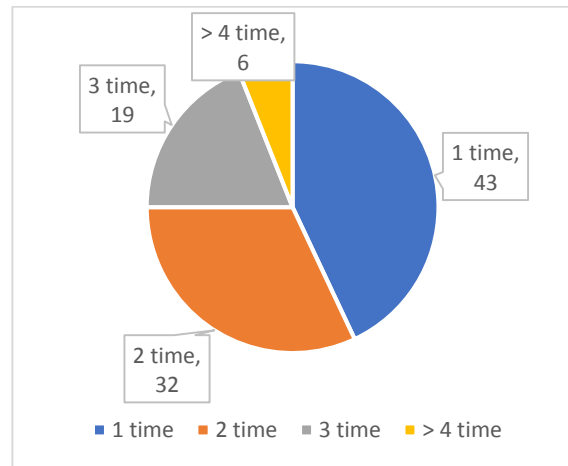**Fig. 10a. frequency distribution of consuming fish in one week before COVID-19 pandemic**

Fig. 10b. frequency distribution of consuming fish in one week after COVID-19 pandemic
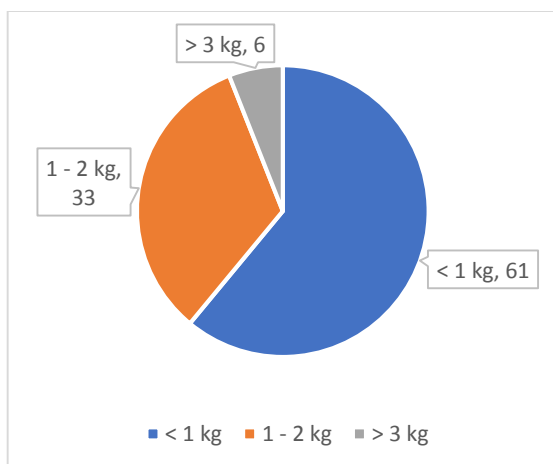
Fig. 11a. The amount of fish consumption in one week before COVID-19 pandemic
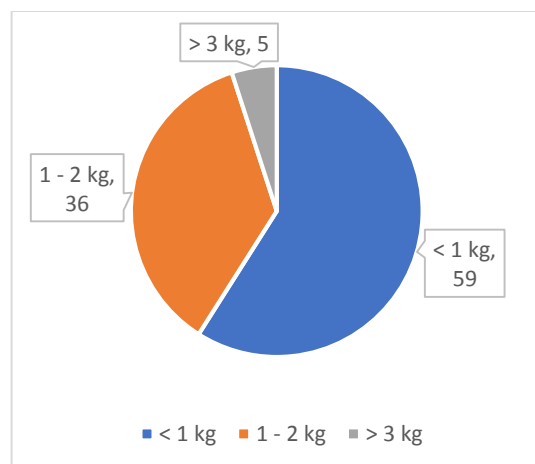
Fig.11b. The amount of fish consumption in one week after COVID-19 pandemic
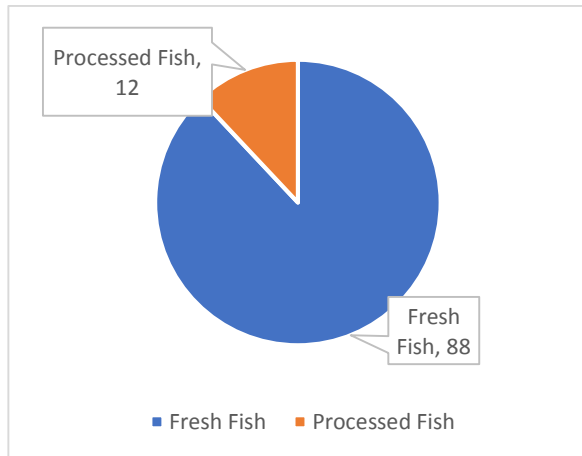
Fig. 12a. Frequency distribution based on fish products consumed more often before COVID-19 pandemic
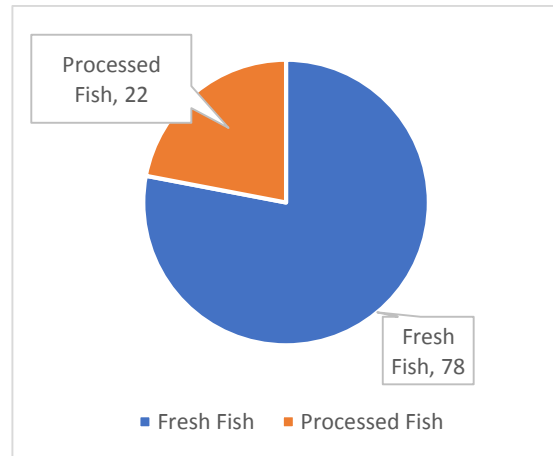
Fig. 12b. Frequency distribution based on fish products consumed more often after COVID-19 pandemic
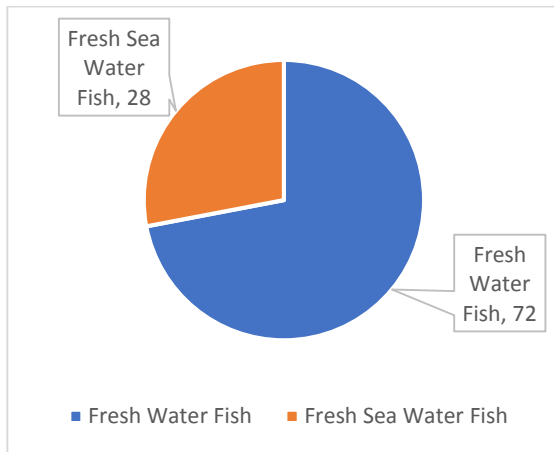
Fig. 13a. Frequency distribution based on the types of fresh fish often consumed before COVID-19 pandemic
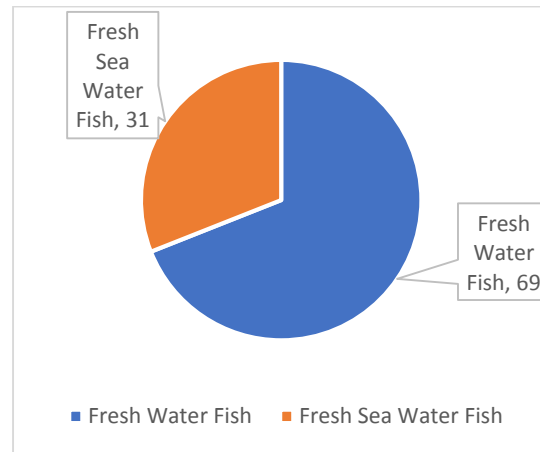
Fig. 13b. Frequency distribution based on the types of fresh fish often consumed after COVID-19 pandemic
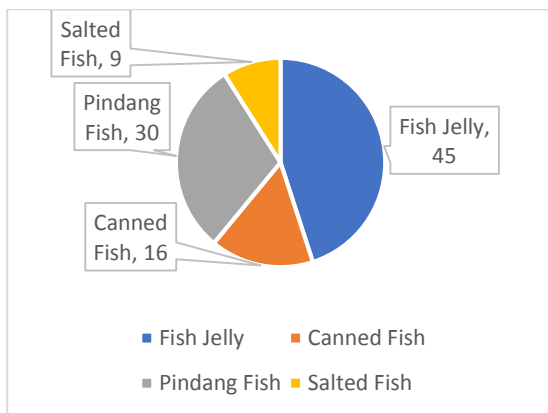
Fig. 14a. Frequency distribution by type of processed fish often consumed before COVID-19 pandemic

Fig. 14b. Frequency distribution by type of processed fish often consumed after COVID-19 pandemic

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Fig. 15a. Frequency distirbution fish product in the market is rare to find before COVID-19 pandemic

Fig. 15b. Frequency distirbution fish product in the market is rare to find after COVID-19 pandemic

Table 2. The Benefit of fish consumption

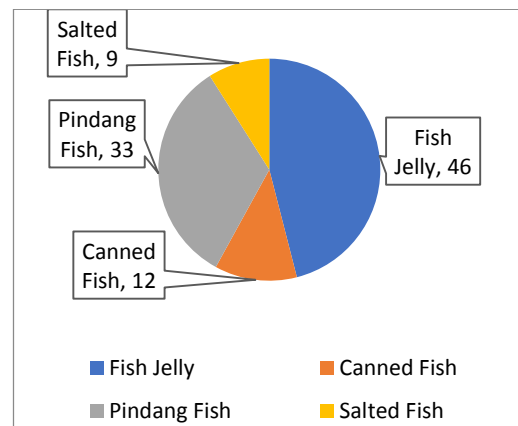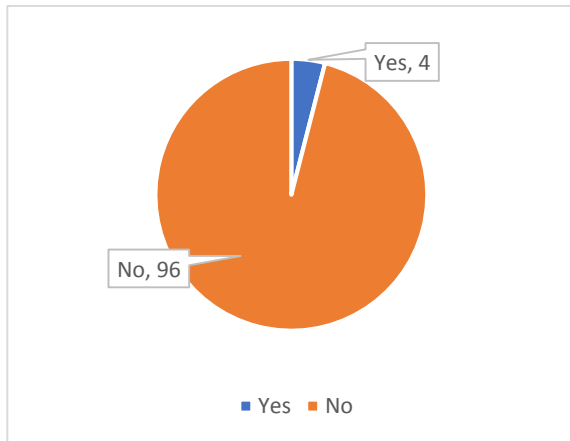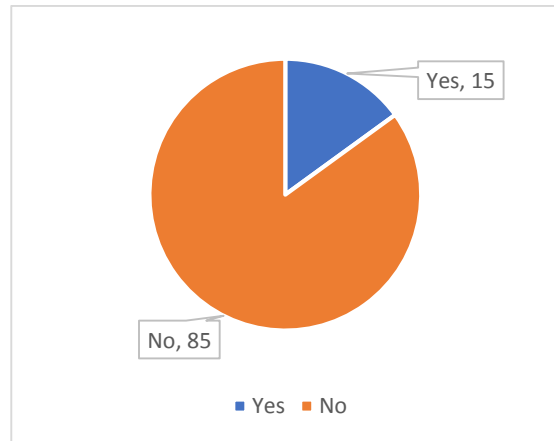| The Benefit of Fish Consumption	Frequency	Percentage
Don't know	5	5%
Know	95	95%
Amount	100	100%

3.3 Preference between Fresh Fish and Processed Fish

The influence of gender, number of family members, occupation, income, education, ethnicity of origin and age on preferences between fresh fish and processed fish in this study were calculated using Binary Logistic Regression analysis.

3.3.1 Logistic regression model

The logistic regression model was formed the Probability Logit Model before the Covid-19 pandemic as follows:

$$\pi(x) = \frac{e^{19,212-3,681\,X1-1,435\,X2+20,555\,X3+3,017\,X4-2,590\,X5+6,379\,X6+0,211\,X7}}{1+e^{19,212-3,681\,X1-1,435\,X2+20,555\,X3+3,017\,X4-2,590\,X5+6,379\,X6+0,211\,X7}}$$

The logistic regression model was formed the Probability Logit Model after the Covid-19 pandemic as follows:

$$\pi(x) = \frac{e^{12,270-0,682\,X1-0,175\,X2-0,611\,X3+1,121\,X4+0,835\,X5-0,356\,X6-0,102\,X7}}{1+e^{12,270-0,682\,X1-0,175\,X2-0,611\,X3+1,121\,X4+0,835\,X5-0,356\,X6-0,102\,X7}}$$

3.3.2 Hosmer and lemeshow goofness of fit test

Results of Hosmer and Lemeshow Test are presented before and after Covid-19 pandemic in

Table 2 and Table 3. The results of the Hosmer and Lemeshow calculations show the significance value of the Goodness-of-Fit (Chi-square) test of 1 before Covid-19 pandemic. The Hosmer and Lemeshow calculation shows the significance value of the Goodness-of-Fit (Chi-square) test of 0.504 after Covid-19 pandemic. Significance value> 0.05 means that the model is good enough (fit model) to be used in predicting preferences for fresh fish and processed fish in Cicendo District before the Covid-19 pandemic and after the COVID-19 pandemic.

3.3.3 Overall model fit test

Results of Overall Model Fit Test are presented before and after Covid-19 pandemic in Tables 4 and 5. The Chi-square test statistic in Cicendo District before the Covid-19 pandemic, the Chi-square value = 20.305> Chi-square table = 15.507, the result is that H0 is rejected and accepts H$_1$, which means that there is at least one independent variable which significantly affects the dependent variable while after Covid-19 pandemic shows the calculated Chi-square value = 67.002> Chi-square table = 15.507, the result is that H$_0$ is rejected and accepts H$_1$, which means that there is at least one independent variable which significantly affects the dependent variable. From the results above, it can be

concluded that in the District of Cicendo before and after the Covid-19 pandemic together the independent variables, namely gender, number of family members, education, income, occupation, ethnicity of origin and age have a significant (significant) effect on preferences between fish. fresh and processed fish.

3.3.4 Nagelkerke R square

Results of Nagelkerke R Square are presented before and after Covid-19 pandemic in Tables 4 and 5. The coefficient of determination shown by Nagelkerke R Square for the model studied before the Covid-19 Pandemic had a value of 0.659. This shows that in Cicendo District before the Covid-19 pandemic, gender, number of family members, education, income, occupation, ethnicity of origin and age influenced preferences between fresh fish and processed fish by 65.9%, while the rest was 34, 1% is influenced by other factors not included in the research. At the time after the Covid-19 pandemic in Cicendo District the coefficient of determination shown by Nagelkerke R Square for the model under study, had a value of 0.282. This shows that gender, number of family members, education, income, occupation, ethnicity of origin and age affect preferences between fresh fish and processed fish by 28.2%, while the remaining 71.8% is influenced by other factors. which were not included in the research model. Food preferences are influenced by other factors such as personal, biological, psychological, cultural, religious and regional factors, meaning that the reasons for choosing food or preferences are strongly influenced, one of which is consumer knowledge [21].

3.3.5 Wald test

Results of Wald Test are presented before and after Covid-19 pandemic in Table 6 and Table 7. The results obtained are that the income variable before the Covid-19 pandemic has a Wald test value of 4.758 and a significance value of 3.84. The educational variable before the Covid-19 pandemic had a Wald test value of 6.582 and a significance value of 3.84. The age variable before the Covid-19 pandemic had a Wald test value of 4.524 and a significance value of 3.84. When compared with a significant level of 0.05 or (5%), the sig. (p-value) is smaller than α. This means that it can be denied that H0 is rejected, thus it is evident that the variables of income, education and influence on preferences between fresh fish and processed fish in Cicendo District

before the Covid-19 pandemic. Then, the results showed after the Covid-19 pandemic were that the income variable had a Wald test value of 4.083 and a significance value of 3.84. The educational variable after the Covid-19 pandemic has a Wald test value of 4.045 and a significance value of 3.84. The age variable after the Covid-19 pandemic has a Wald test value of 5.002 and a significance value of 3.84. When compared with a significant level of 0.05 or (5%), the sig. (p-value) is smaller than α. This means that it can be concluded that H0 is rejected, thus it is evident that the variables of income, education and age have an effect on the preference between fresh fish and processed fish in Cicendo District after the Covid-19 pandemic. From the results that explain the variable there are significant similarities before and after Covid-19 pandemic, it means that no change in preferences between fresh fish and processed fish. Reason that preferences has no change because respondents keep eating fish they often eat as in fresh fish. The size of the family income is very influential on consumption patterns [22]. In accordance with the theory explains that the higher a person's education, the higher one's knowledge will be. This means that the higher a person's knowledge, the higher his knowledge, especially regarding nutritious food. The majority of respondents in Cicendo District are> 50 years old, so that older people have the awareness to buy fishery products that fish has good benefits for the body and health, so the age variable affects the preference between fresh fish and processed fish.

3.3.6 Odd ratio

Based on the results of the Wald test, a significant variable has an opportunity such as income having an odd ratio of 20,426, this means that if the respondent's income increases by 1 rupiah, then he has the opportunity to choose 20,426 times fresh fish compared to processed fish. The education variable has an odd ratio value of 0.075, this means that if the respondent's education increases by one year, then they have the opportunity to choose fresh fish 0.075 times compared to processed fish. The age variable has an odd ratio value of 1,235, this means that if the respondent's age increases by 1 year, then they have the opportunity to choose fresh fish 1,235 times compared to processed fish in Cicendo District before the Covid-19 pandemic. Then, after Covid-19 pandemic income has an odd ratio value of 3.069, this means that if the respondent's income increases

by 1 rupiah, then he has the opportunity to choose fresh fish 3.069 times compared to processed fish. The education variable has an odd ratio value of 0.434, this means that if the respondent's education increases by one year, then they have the opportunity to choose fresh fish 0.434 times compared to processed fish. The age variable has an odd ratio value of 0.903, which means that if the respondent's age increases by 1 year, there is a chance for fresh fish to be 0.903 times compared to processed fish in Cicendo District after the COVID-19 pandemic.

Table 3. Hosmer and lemeshow test preference between fresh fish and processed fish before COVID-19 pandemic

Step	Chi-square	Df	Sig.
1	.247	8	1.000

Table 4. Hosmer and lemeshow test preference between fresh fish and processed fish after COVID-19 pandemic

Step	Chi-square	Df	Sig.
1	7.306	8	.504

Table 5. Overall model fit test and nagelkerke r square preference between fresh fish and processed fish before COVID-19 pandemic

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	20.305 [a]	.262	.659

Table 6. Overall model fit test and nagelkerke r square preference between fresh fish and processed fish after COVID-19 pandemic

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	67.002 [a]	.161	.282

Table 7. Wald test preference between fresh fish and processed fish before COVID-19 pandemic

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Gender_X1	-3.681	1.901	3.747	1	.053	.025
	Number of Family Members_X2	-1.435	.983	2.131	1	.144	.238
	Profession_X3	20.555	6779.098	.005	1	.998	845190
	Income_X4	3.017	1.383	4.758	1	.029	20.426
	Education_X5	-2.590	1.009	6.582	1	.010	.075
	Tribe_X6	6.379	3.341	3.644	1	.056	589.320
	Age_X7	.211	.099	4.524	1	.033	1.235
	Constant	19.212	12.632	2.313	1	.128	22059.4

Table 8. Wald test preference between fresh fish and processed fish after COVID-19 pandemic

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Gender_X1	.682	.708	.928	1	.335	1.977
	Number of Family Members_X2	-.175	.387	.204	1	.651	.840
	Profession_X3	-.611	.691	.782	1	.376	.543
	Income_X4	1.121	.555	4.083	1	.043	3.069
	Education_X5	-.835	.415	4.045	1	.044	.434
	Tribe_X6	-.356	.670	.282	1	.596	.701
	Age_X7	-.102	.046	5.002	1	.025	.9033
	Constant	12.270	9.163	1.793	1	.181	213134.580

3.4 Preference between Fresh Fish and Fresh Sea Fish

3.4.1 Logistic regression model

The logistic regression model was formed the Probability Logit Model before the Covid-19 pandemic as follows:

$$\pi(x) = \frac{e^{-9,292-0,294\,X1+0,375\,X2-1,219\,X3\,+0,975\,X4+0,004\,X5+0,742\,X6+0,023\,X7}}{1+e^{-9,292-0,294\,X1+0,375\,X2-1,219\,X3\,+0,975\,X4+0,004\,X5+0,742\,X6+0,023\,X7}}$$

The logistic regression model was formed the Probability Logit Model after the Covid-19 pandemic as follows:

$$\pi(x) = \frac{e^{-9.913-0,043\,X1+0,430\,X2-1,328\,X3\,+1,108\,X4+0,422\,X5+1,294\,X6-0,005\,X7}}{1+e^{-9.913-0,043\,X1+0,430\,X2-1,328\,X3\,+1,108\,X4+0,422\,X5+1,294\,X6-0,005\,X7}}$$

3.4.2 Hosmer and lemeshow goodness of fit test

Results of Hosmer and Lemeshow Test are presented before and after Covid-19 pandemic in Table 8 and Table 9. The results of the Hosmer and Lemeshow Test calculations before the Covid-19 pandemic showed a significance value of the Goodness-of-Fit test of 0.430. The calculation of the Hosmer and Lemeshow Test after the Covid-19 pandemic shows a significance value of the Goodness-of-Fit test of 0.141. The significance value> 0.05 means that the model is good enough (fit model) to be used in predicting preferences between fresh bream and fresh sea fish in Cicendo District before and after the COVID-19 Pandemic.

3.4.3 Overall model fit test

Results of Overall Model Fit Test are presented before and after Covid-19 pandemic in Table 10 and 11. Chi-square test statistics in Cicendo District before the Covid-19 Pandemic, namely the calculated Chi-square value = 106,435> Chi-square table = 15,507, then the result H0 is rejected and accepts Ha means that there is at least one independent variable which significantly affects the dependent variable. Table 33 shows the calculated Chi-square value = 106.652> Chi-square table = 15.507, then the result H0 is rejected and accepts Ha, which means that there is at least one independent variable that significantly affects the dependent variable. From the results above, it can be concluded that in the District of Cicendo before and after the Covid-19 pandemic together the

independent variables, namely gender, number of family members, education, income, occupation, ethnicity of origin and age have a significant (significant) effect on preferences between fish. fresh and processed fish.

3.4.4 Nagelkerke R square

Results of Overall Model Fit Test are presented before and after Covid-19 pandemic in Table 10 and 11. The coefficient of determination shown by Nagelkerke R Square for the model studied before the Covid-19 pandemic had a value of 0.165. This shows that in Cicendo District before the Covid-19 Pandemic, gender, number of family members, education, income, occupation, ethnicity of origin and age influenced preferences between fresh fish and processed fish by 16.5%, while the rest was 83, 5% is influenced by other factors not included in the research. Then, at the time after the Covid-19 pandemic in Cicendo District the coefficient of determination shown by Nagelkerke R Square for the model studied had a value of 0.222. This shows that gender, number of family members, education, income, occupation, ethnicity of origin and age affect preferences between fresh fish and processed fish by 22.2%, while the remaining 77.8% is influenced by other factors. which were not included in the research model. Other factors that were not included in the research, such as taste, price, product color, type of packaging and packaging color. These factors are included in the consideration of respondents in buying fishery products [23].

3.4.5 Wald test

Results of Wald Test are presented before and after Covid-19 pandemic in Table 12 and Table 13. The occupational variable before the Covid-19 pandemic had a Wald test value of 4.131 and a significance value of 3.84. The income variable before the Covid-19 pandemic had a Wald test value of 5.494 and a significance value of 3.84. When compared with a significant level of 0.05 or (5%), the sig. (p-value) is smaller than α. This means that it can be concluded that H_0 is rejected, thus it is evident that job and opinion variables have an effect on preferences between fresh water fish and sea fresh fish in Cicendo District before the Covid-19 pandemic.

While, after the Covid-19 pandemic the occupational variable had a Wald test value of 4.989 and a significance value of 3.84. The income variable after the Covid-19 pandemic has

Table 9. Hosmer and lemeshow test preference between fresh and sea fish before COVID-19 pandemic

Step	*Chi-square*	Df	Sig.
1	15.977	8	.430

Table 10. Hosmer and lemeshow test preference between fresh and sea fish after COVID-19 pandemic

Step	*Chi-square*	Df	Sig.
1	12.226	8	.141

Table 11. Overall model fit test and nagelkerke R square preference between fresh and sea fish before Covid-19 pandemic

Step	-2 Log likelihood	Cox & Snell R Square	*Nagelkerke R Square*
1	106.435 [a]	.114	.165

Table 12. Overall model fit test and nagelkerke R square preference between fresh and sea fish after COVID-19 pandemic

Step	-2 Log likelihood	Cox & Snell R Square	*Nagelkerke R Square*
1	106.652 [a]	.158	.222

Table 13. Wald test preference between fresh and sea fish before COVID-19 pandemic

		B	S.E.	*Wald*	df	Sig.	Exp(B)
Step 1[a]	Gender_X1	-.294	.603	.238	1	.625	.745
	Number of Family Members_X2	.375	.279	1.810	1	.178	1.455
	Profession_X3	-1.219	.600	4.131	1	.042	.295
	Income_X4	.975	.416	5.494	1	.019	2.652
	Education_X5	-.004	.262	.005	1	.987	.996
	Tribe_X6	.742	.628	1.392	1	.238	2.099
	Age_X7	.023	.038	.364	1	.546	1.023
	Constant	-9.292	6.374	2.125	1	.145	.000

Table 14. Wald test preference between fresh and sea fish after COVID-19 pandemic

		B	S.E.	*Wald*	df	Sig.	Exp(B)
Step 1[a]	Gender_X1	-.043	.589	.005	1	.942	.958
	Number of Family Members_X2	.430	.279	2.377	1	.123	1.537
	Profession_X3	-1.328	.595	4.989	1	.026	.265
	Income_X4	1.108	.423	6.851	1	.009	3.030
	Education_X5	.422	.539	.612	1	.434	1.525
	Tribe_X6	1.294	.674	3.682	1	.055	3.647
	Age_X7	-.005	.036	.023	1	.880	.995
	Constant	-9.913	4.638	4.568	1	.033	.000

a Wald test value of 6.851 and a significance value of 3.84. When compared with a significant level of 0.05 or (5%), the sig. (p-value) is smaller than α. This means that it can be concluded that H0 is rejected, thus it is evident that the variables of employment and income have an effect on the preference between fresh water fish and sea fresh fish in Cicendo District after the Covid-19 pandemic. The results explain that are variables significant similarities before and after Covid-19 pandemic, it means that no change in preferences between fresh water fish and fresh

sea fish. Reason that preferences has no change because respondents keep eating fish they often eat as in fresh water fish.

Work and income are related to each other because work will affect the level of income a person receives, the higher the income, the proportion of expenditure, consumption patterns or consumer purchasing decisions tend to pay more attention to nutritional and health values. The amount of income received by the respondent will determine the purchasing power. Purchasing power will describe the number of products that consumers can buy [24].

3.4.6 Odd ratio

Based on the results of Wald's test, the occupational variable has an odd ratio value of 0.295, this means that if the respondent's job increases by one level, then he has the opportunity to choose fresh fish 0.295 times compared to fresh sea fish. The income variable has an odd ratio value of 2.652, this means that if the respondent's income increases by 1 rupiah, then he has the opportunity to choose fresh water fish 2,652 times compared to fresh sea fish in Cicendo District before the Covid-19 pandemic. Then, after the Covid-19 pandemic the occupational variable has an odd ratio value of 0.265, this means that if the respondent's occupation increases by one level, then it has the opportunity to choose fresh, fresh fish 0.265 times compared to sea fresh fish. The income variable has an odd ratio value of 3.030, which means that if the respondent's income increases by 1 rupiah, then it has the opportunity for fresh fish to be 3.030 times compared to fresh sea fish in Cicendo District after the Covid-19 pandemic.

4. CONCLUSION

The results changed, 84% of places people bought before the pandemic chose traditional markets, while after the pandemic 73% chose supermarkets. Changes 42% of respondents consumed fish twice a week before the Covid-19 pandemic, while 43% consumed fish once a week after the Covid-19 pandemic. Changes in fish price increases before the pandemic 55% of respondents didn't experience an increase in fish prices, while after the pandemic there was an increase in fish prices 63% of respondents. The factors that influence changes in fish purchases during the Covid-19 pandemic are the system and place of purchase, the frequency of fish consumption, the amount of consumption of fish

and products consumed, and the price of fish. Preferences respondents the type of fish that is often consumed is fresh fish water and processed fish is fish jelly. The results of the Wald test show that before and after the Covid-19 pandemic, the Wald test shows that income, education, and age variables affect preferences between fresh fish and processed fish. Preferences between fresh freshwater fish and marine fish before and after the Covid-19 pandemic, the Wald test shows that employment and income variables have an influence.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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