

## Determinants of Fish Consumption in East Kalimantan, Indonesia: Health Knowledge, Socio-Economic Factors, and Sustainable Fishing and Culturing Practices

Nurul Ovia Oktawati<sup>id</sup> and Handayani Boa\*<sup>id</sup>

Faculty of Fisheries and Marine Sciences, Mulawarman University, Jalan Gunung Tabur, Kampus Gunung Kelua, Samarinda, East Kalimantan, Indonesia

\*Corresponding author's e-mail: [boahandayani123@gmail.com](mailto:boahandayani123@gmail.com)

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### ABSTRACT

**Background:** Fish consumption preferences vary among communities. The issue of fish consumption achievement of East Kalimantan residents which has decreased compared to 2019 has encouraged the government to intensify programs, especially considering socio-economic factors for liking to consume fish. In this study, the issue of fish consumption is also associated with the residents' knowledge of the benefits of fish nutritional content for health.

**Aims:** This recent study aims to investigate the appreciation of East Kalimantan residents for the health of fish consumption benefits and to analyze factors which influence the fish consumption of East Kalimantan residents.

**Methods:** Data collection was done through a questionnaire completed by 160 people in 10 regency and city sites in East Kalimantan with purposive random sampling method during January to March 2024. Also employing Multiple Linear Regression (MLR) is in data analysis.

**Results:** Most of East Kalimantan residents (85%) appreciate the benefits of fish consumption for their health, even though there are still residents (15%) who lack information and knowledge about its benefits. The residents' understanding and knowledge cover fish as a rich source of omega-3 fatty acids, high-quality protein, and related with reducing risk of heart disease, stroke, and certain types of cancer. The most residents (90%) approve that the fish protein content is of high quality of protein and vitamins-mineral. In the analysis, all variables that build this model have amounting to 82% ( $R^2$ ) affected into fish consumption residents. Partially, age, income, fish price, ethnic, education, and fish substitute variables significantly influence the fish consumption of East Kalimantan residents at  $p < 0.05$ . Except, the status at the family variable, it has not influence partially to fish consumption of residents.

**Conclusion:** Residents who understand and know of fish consumption benefit for health are high. The research findings indicate that various variables (age ( $X_1$ ), income ( $X_2$ ), fish price ( $X_3$ ), ethnic ( $D_2$ ), education ( $D_3$ ), and fish substitute ( $D_4$ ) variables) significantly influence the fish consumption of East Kalimantan residents. Hence, to stimulate awareness of fish consumption, the government has to support the residents through more measurable programs for the increase of fish consumption such as socializing the benefit of fish consumption for health and fish eating program.

**Keywords:** *Fish consumption, Health knowledge, Socio-Economic factors, Sustainable fishing & culturing practices.*

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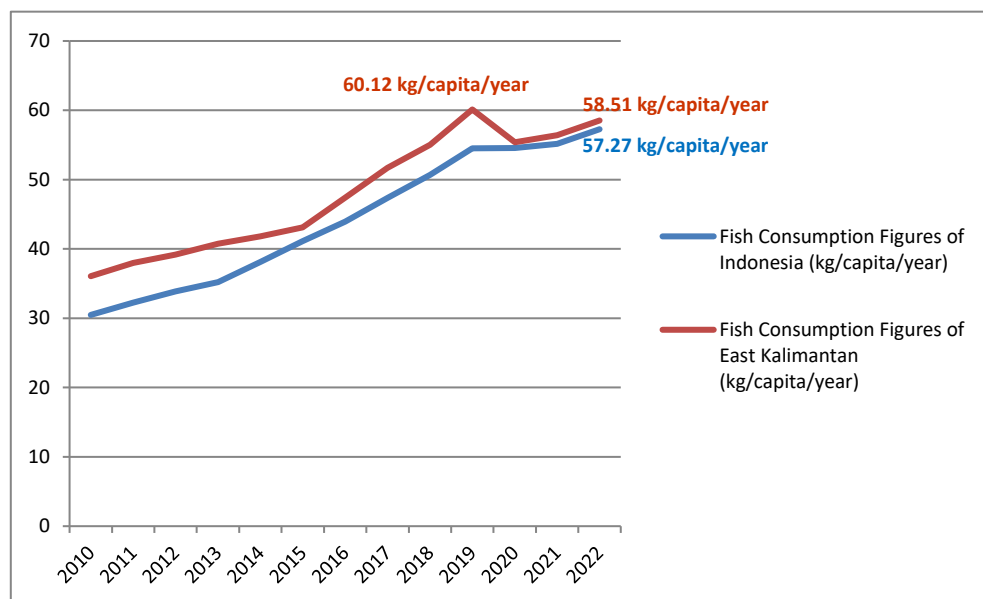
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## 1. Introduction

East Kalimantan is one province in Indonesia that has length of coastline amounting to 3.893,15 km (DKP-Kaltim, 2022), having the Mahakam river area and length are around 980 km and 85.236 km<sup>2</sup>, as well as, having several the lakes (BPS-Kukar, (2023); BPS-Kaltim, (2023)) that provide fishery production. Here, the natural resources used by a community also describe their socio-economic situation.

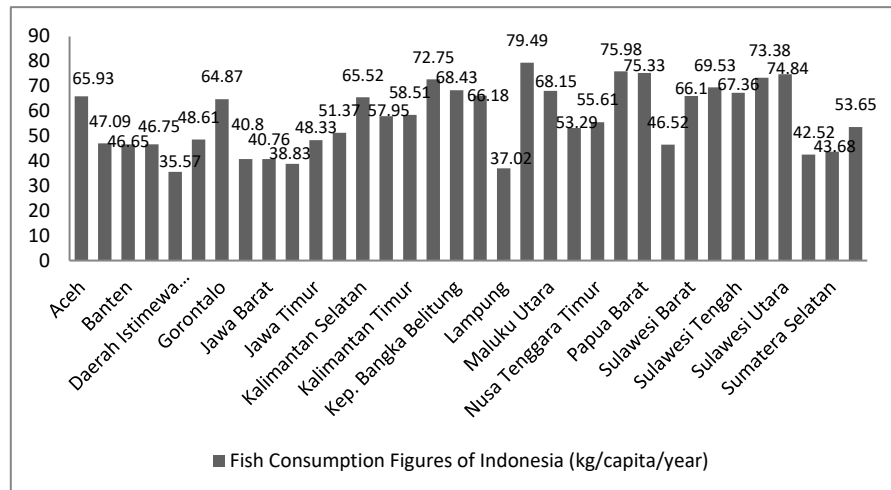
Boa et al. (2023) also assessed that culturing potency (ponds) in East Kalimantan provide still production and profitable in the next 25 years. Hence, based on this potential area provided for fisheries sector growth, the societies in East Kalimantan have a big opportunity to consume fishes at their daily meals. According to Tran et al. (2017), fast aquaculture growth can be increasing of fish consumption because there was the install of fish supply. To make it happen, environmental factors have to support. Environmental factors for fish production can be determined from the quality of the aquatic environment, water volumes and discharge regimes, the degree of pollution from industrial and domestic effluents, pond type (or reservoir), including the proposed methods and technological recommendations (Olena et al., 2021), as well as, climatic situation that related by temperature and oxygen levels (Osei et al., 2021). Then, fisheries policies that have benefits for fisheries or for the marine ecosystems upon which fisheries depend are realized (Stewart, 2016). As well as, fish market accessibility can be a fish consumption reason even though far from water areas and fisheries.

Recently, residents' fish consumption level in provinces of Indonesia in 2022 is shown at Fig. 1, namely 57.27 kg/capita/year. In East Kalimantan, there was a drastic decline in the level of fish consumption from 2019 to 2020, even the current level of fish consumption in 2022 (58.51 kg/capita/year) increased but it was still below that of 2019 (60.12 kg/capita/year), and this figures is contrary to the government's expectations regarding the improvement in fish consumption figures which should continue every year.



**Figure 1.** Fish Consumption Figures of East Kalimantan and Indonesia, 2022

In Fig. 2, provinces in Java Island are lower than other provinces in Indonesia; particularly Daerah Istimewa Yogyakarta with the lowest level of fish consumption, 35.57 kg/capita/year. It has been noted that the highest residents' fish consumption level is in Maluku province, amounting to 79.49 kg/capita/year. Such as provinces in Kalimantan island, residents' fish consumption level are also high, those fish consumption figures (kg/capita/year) are 51.34, 65.52, 57.95, 58.52, and 72.75 for West Kalimantan, South Kalimantan, Central Kalimantan, East Kalimantan, and North Kalimantan, respectively (KKP-RepublikIndonesia, 2023).



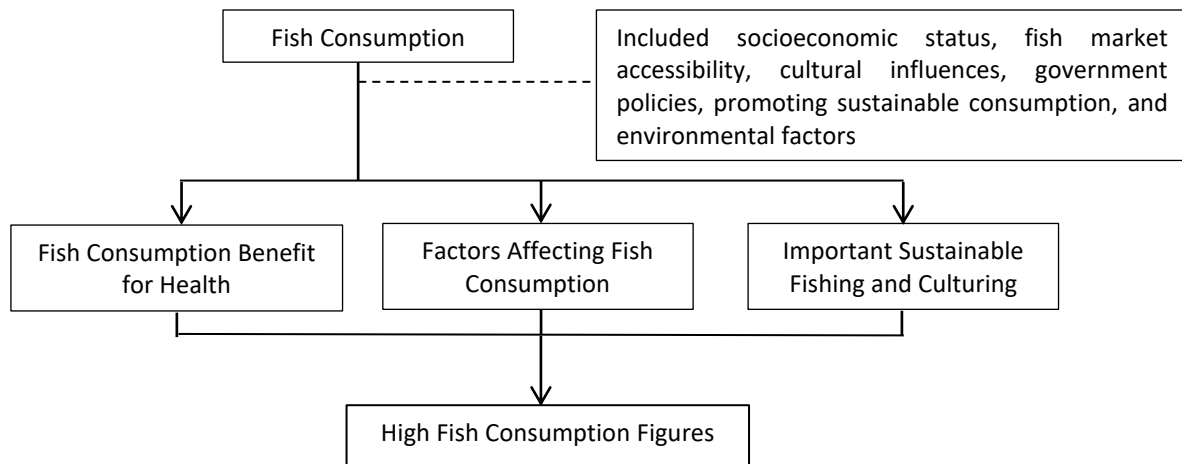
**Figure 2.** Fish Consumption Figures of Indonesia each Province, 2022

The Jawa ethnic's fish consumption level in this Jawa island is one of assumptions of the study as the lack fish consumption group in Indonesia, as well as, Jawa ethnic is the highest population density in Indonesia knew. Even, in the certain Jawa region, the younger generation tend not to want to consume fish due to marine pollution reason (Anyanwu et al., 2023). The recent study in Yogyakarta mentioned that six factors of fish consumption barriers, which are the preferences of family members, processing methods of fish, distribution and availability, myths and knowledge, costs or prices, and tastes (Wijaya et al., 2022), convenience, accessibility, healthy concern (Wenaty et al., 2018), where nutritional benefits and availability are the most common reasons to eat locally caught fish (Shaw et al., 2023).

The current review from Panchakarla et al. (2023); Qayoom et al., (2020) stated that nutritional benefits of fish on human health are important for metabolism and hormone function because the essential elements found in fish such as Omega-3 fatty acids, iodine, selenium, vitamin D, taurine, and carnitine, also, vitamins (fat soluble vitamins and several members of vitamin B complex), and minerals (Phogat et al., 2022), it means that fish are a significant source of nutrients (Naeem & Selamoglu, 2023). Particularly, fish freshwater consumption can reduce cardiovascular disease rates and certain types of cancer (Mielcarek & Socha, 2022). Because fish nutrition and its benefits are really important, people must know about the food preference chosen, then, they develop habits and behavior in their daily lives to consume healthy food, such as eating fish. Supported by the recent research result, it is known that the factor related to the subject's eating habits is nutritional knowledge, because knowledge is the basis for forming attitudes (Jauziyah et al., 2021; Ratih et al., 2022).

Against the background of the relatively high potential for fish availability and production in East Kalimantan from the production of fish cultivation and fishing activities, increasing public knowledge about the benefits of fish for health, supporting government programs regarding fish-eating programs, as well as, to increase fish consumption figures of East Kalimantan, that a study of fish consumption in the people of East Kalimantan is deemed necessary.

The research objectives are 1) to investigate the appreciation of East Kalimantan residents for health of fish consumption benefits and 2) to analyze factors that influence the fish consumption of East Kalimantan residents. In this study, there is high consumption on fish predicted basis on several factors of the socioeconomic status affecting. Their consumption on fish is due to their well knowledge on fish benefit for health predicted that supported by important sustainable fishing and culturing where important sustainable fishing and culturing is discussed. The conceptual framework of the study is as shown in Fig. 3. I have displayed it below, where the research of this study can bring down a recommendation for improvement of fish consumption figures in East Kalimantan.



**Figure 3.** The Conceptual Framework of the Study

## 2. Methods

### *Study Site and Time*

The study site is in East Kalimantan. Data collection was 3 months in 2024, namely from January to March.

### *Sampling Technique*

Respondent were taken 160 people, where the sample that taken using the purposive random sampling method in all regency and city sites in East Kalimantan province, namely 10 regency and city sites. Nasution, (2003) conveyed that purposive sampling involves selecting samples based on the researcher's judgment, where the purposive random sampling method is often chosen due to considerations such as time, labor, and budget constraints (Arikunto & Suharsimi, 2010). In this study, amounting to 16 people randomly was taken in each one regency or city sites. They were selected accidentally when buying fish at fish peddlers, grocery store, and traditional night market in weekend, where weekend was the day to gather with family (family days) assumed and became the limitation of research respondents.

### *Data Collection Method*

Primary and secondary data are employed for this study. The primary data is gathered from East Kalimantan's residents through a questionnaire and in-depth interviews (online and offline). The secondary data are collected from relevant statistical data of the related government and private institution sources, and the research reports.

### *Analytical Techniques*

The Multiple Linear Regression (MLR) is applied to estimate strength of correlation between dependent and independent variables of fish consumption of East Kalimantan's citizen. Residents' fish consumption (Y) is dependent variable, and age ( $X_1$ ), income ( $X_2$ ), fish price ( $X_3$ ), status in the family ( $D_1$ ), ethnic ( $D_2$ ), education ( $D_3$ ), and fish substitute ( $D_4$ ) are independent variables.  $D_1$ ,  $D_2$ ,  $D_3$ , and  $D_4$  are dummy variables particularly to cover the influence of the characteristics of the residents in this study. Where, the dummy variables have 2 categories, namely 1 and 2. The dummy variables consist of status at the family (1 = husband/wife, 0 = child/other), ethnic (1 = non Jawa, 0 = Jawa), education (1 = high at SMU and more, 0 = elementary school and junior high school), and fish substitute (1 = fresh/non-processed food, 0 = processed food), where 1 shows the influence of the dummy variables toward the fish consumption.

### **Operational Definitions**

To support the research, operational definitions in this study scope are below.

1. Fish consumed are all types of fish, including shrimp, shells, crabs, and squid, including canned fish, dried fish, smoked fish, salted fish, bekasam, and pindang fish
2. Residents have a salary or income, and older than 18
3. Husband or wife at the family category are the person who takes a decision at their family or household for fish consumption
4. Ethnic category basis on fish consumption figures history in Indonesia for low and high figures group particularly in Jawa and outside Jawa island area compered
5. Having education 9 years are low level group (elementary school and junior high school), otherwise those with more than 9 years are high level
6. Fish substitute displays information on non-processed foods and processed foods of Indonesian foods such as fresh meat, eggs, chicken, duck, bird, canned meat, tempeh, tofu, frozen food (meat ball, sausage, nuggets, etc.), side dishes, etc.
7. Non-processed food of fish substitute is non-fish products without canning, salting, fermentation, drying, freezing, pasteurizing, smoking, heating, and cooking for production, otherwise, processed foods of fish substitute refer to any food that's changed from its natural state (there is process steps) before cooking or eating by residents.

## **3. Results and Discussion**

### **Socioeconomic Status of Residents and Driving Fish Consumption**

Overall resident ages are in productive ages included (19-62 years) who distribute in regency of Berau, West Kutai, Kutai Kartanegara, East Kutai, Mahakam Ulu, Paser, Panajam Paser Utara, Balikpapan, Bontang, and Samarinda city. In Table 1, amounting to 54% of residents in this study are female, and the maintaining 45% male. Their dominant ethnic are non Jawa (non-Javanese) (79%) such as Bugis, Banjar, Kutai, Makassar, Paser, Dayak, Mandar, Madura, Minahasa, Manado, Batak, Minang, Buton, Banua, Bajau, and Melayu Berau. Then, most education of them (75%) is high level (from senior high school and more), where, the amount of husband and wife (their status at the family) are 25% respectively, 43% child, and 7% the others. Also, they populate area of near river, lake, coastal, and the markets (68%), where their access gets fish for consumption are easier than the other places assessed. The average income this study is approximately IDR4.4 million/month, which is still higher than regional minimum wage of East Kalimantan province (IDR3.01 million/month) determined by government (BPS-Kaltim, 2023).

**Table 1.** Socioeconomic Status of East Kalimantan Residents in the Field

| No | Characteristics                                | Amount               | Percentage |
|----|--|----------------------|------------|
| 1. | Gender   |                      |            |
|    | - Male   | 74                   | 45%        |
|    | - Female                                       | 86                   | 54%        |
| 2. | Ethnic   |                      |            |
|    | - Non Jawa                                     | 126                  | 79%        |
|    | - Jawa (Javanese)                              | 34                   | 21%        |
| 3. | Education                                      |                      |            |
|    | - High (senior high school/university/diploma) | 120                  | 75%        |
|    | - Low (primary school/junior high school)      | 40                   | 25%        |
| 4. | Status at the family                           |                      |            |
|    | - Husband                                      | 40                   | 25%        |
|    | - Wife   | 40                   | 25%        |
|    | - Child  | 70                   | 43%        |
|    | - The others                                   | 10                   | 7%         |
| 5. | Residence                                      |                      |            |
|    | - Near river, lake, coastal, and market area   | 109                  | 68%        |
|    | - The others                                   | 51                   | 23%        |
| 6. | The average of Income                          | IDR4.4 million/month |            |

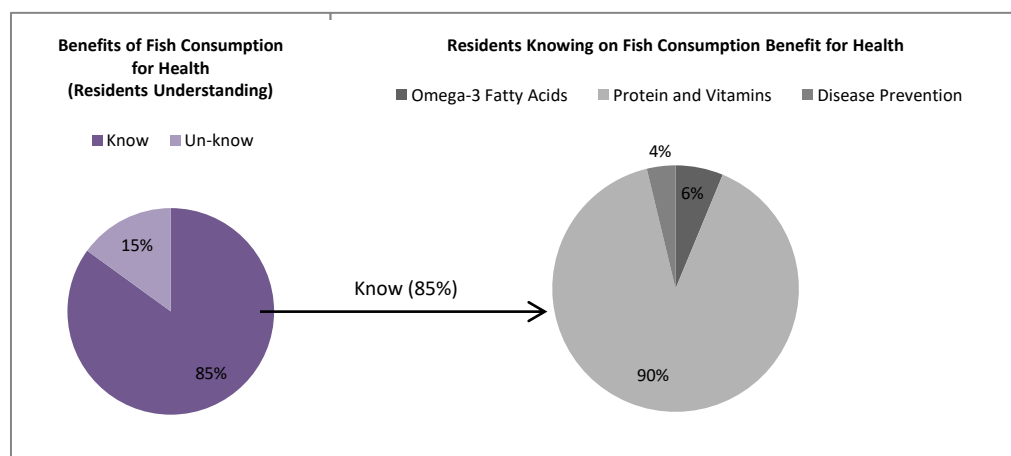
Fish market accessibility is well facilitated, and there are fish peddlers, grocery store, and traditional night market provided. Also, this situation is profited by topography of East Kalimantan that crossing sea and coastal, river, ponds, and lake as potency of fish production central. Coastal length of East Kalimantan is 3,925 km, and the length of the Mahakam River is 920 km. The three largest lakes in East Kalimantan are Jempang, Melintang, and Semayang Lake, covering an area of ±15,000 ha, ±11,000 ha, and ±13,000 ha, respectively.

In the field, suffering from worms parasites and itching are cultural influences trusted by Javanese if consume fish, added fishy smell to fish push Jawa ethnic’s people to reduce fish consumption. This is interesting to discuss because the Javanese are the largest tribe in Indonesia, while on the other hand the fish eating campaign is being promoted by government and other institutions. In case of Jawa ethic in East Kalimantan, they tend to adapt to the surrounding community and environment. Based on this situation, integrated projects and policies are needed to encourage sustainable fish consumption and support sustainable fishing and aquaculture activities.

**Fish Consumption Benefit for Health**

High fish consumption has also been related with people's habits and behaviors, added a study also mentioned that creating those intentions toward fish consumption are started and determined from attitude, social norms, perceived behavioral control, information, and knowledge and habits (Arsil et al., 2019). The same thing also happened in the results of this study, where residents’ fish consumption in this study is relatively high, amounting to 58.1 kg/capita/year. Also, the residents’ fish consumption is higher than fish consumption of National figures, which are 57.27 kg/capita/year. Although, the fish consumption level is slightly below East Kalimantan figures (58.51 kg/capita/year), their consumption on fish is still comparable. Research result from Utri-Khodadady & Glabska, (2023) mentioned that female, older than 18, underweight, living in an urban environment, from a region far away from the sea and from comprehensive schools provided a higher share of correct answers than other subgroups (p<0.05) about knowledge concerning fish-consumption benefits.

Based on the survey, most residents approve the benefit of fish consumption (85%) and 15% of them is found un-known and the lack information the benefit of fish consumption for health in detail. Among those most residents who know the benefit of fish consumption for health, are 6% of them know fish as a rich source of omega-3 fatty acids, which are essential for heart, brain, and eye health, then, 90% of residents know fish provide high-quality protein, and important vitamins and minerals like vitamin D, vitamin B12, and selenium. As well as, 4% of them know that regularly eating fish linked to a reduced risk of heart disease, stroke, and certain types of cancer (Fig.1). It is line with Sajeev et al. (2021), the fish consumption variables are highly associated with health values with a note, there is the projects and policies integrated considered.



**Figure 1.** Residents Understanding and Knowing on Fish Consumption Benefit for Health

In addition, Eicosapentaenoic (EPA) and docosahexaenoic acid (DHA) and selenium (Se) and methylmercury (MeHg) at the selected fish species content are critical components of fish and having health benefit value positively (Cardoso et al., 2018). Contrary, besides those positive impacts for health, the other

research also mentioned any health risk from Cd (cadmium) intake from fish that having a potential risk for children health (Arifin & Falahudin, 2017), also getting the risk of Hg (mercury) intake when consumes the certain fish species. Nevertheless, from *Corriere della Sera* (Newspaper) information emphasizes health still benefits more than possible risks (Pasquare et al., 2013).

In the field, the residents consume the selected fish from both freshwater and saltwater especially that dominate East Kalimantan waters, those fishes types are snakehead, tilapia, goldfish, parrot fish, gourami fish, catfish, shrimp, and mujair. Then, milkfish, tiger shrimp, vannamei, white shrimp, mackarel tuna group, skipjack tuna, crab, anchovy, puffer fish, trakulu fish, layang fish, first fish, biji nangka fish, and squid are from the sea and brackish water consumed. About fish substitute, 85% of the residents selected higher consumption to meat, lamb, egg, tempe, tofu/tahu, chicken, and mushroom with fresh/non-processed food than the processed food.

### Factors Influencing of Residents' Fish Consumption

All variables in the model are important variables that having a influencing into fish consumption residents ( $R^2=82\%$ ). It can be seen in the ANOVA table that simultaneously all predictors are able to predict the resident fish consumption significantly ( $F=33.014$ ;  $p<0.05$ ). Significant differences in fish consumption are found among age group, income, fish price, ethnic groups, education groups, as well as between fish substitutes ( $p<0.05$ ) except status at the family variables has not influence partially to fish consumption. Then, basis on the positive linear relationship of the fish consumption equation at the coefficient ( $Y = -7.009 + .121 X_1 + .429 X_2 + .092 X_3 + .205 D_1 + 1.468 D_2 + 1.448 D_3 + 1.114 D_4$ ) (Table 2), where, if age, income, fish price are improvement to 1 year, 1 IDR/kg, and 1 IDR/month respectively hence the fish consumption increase 0.121, 0.428, and 0.092 kg/capita/year as well. Then, interpretation of dummy variables, are non-Jawa ethnic, high education (senior high school or university/diploma/collage), and fish substitutes (fresh/non-processed food) influence the fish consumption positively. About VIF (Variance Inflation Factor) is less than 10. The amount is expected, meaning there is no correlation among the independent variables ( $X_1, X_2, X_3, D_1, D_2, D_3, D_4$ ) at multiple regression model because multicollinearity case in regression must be avoided (in collinearity case is better). Then, there is no autocorrelation found because Durbin-Watson (DW) is 1.642 (between  $du$  and  $4-du$ , where in DW table;  $\alpha=5\%$ ,  $du = 1.8063$ ). Autocorrelation case must also be avoided even though the measurement of all variables is carried out simultaneously at the same time. Overall, age, income, fish price, status at the family, ethnic, education and fish substitute variable are fit in this residents' fish consumption model.

**Table 2.** Coefficients and Regression of Residents' Fish Consumption

| Model   | Coefficients <sup>a</sup>  |           |        |      | ANOVA<br>(Regression) |                   |
|---|----------------------------|-----------|--------|------|-----------------------|-------------------|
|   | Unstandardized Coefficient |           | t      | Sig  | F                     | Sig               |
|   | B                          | Std.error |        |      |                       |                   |
| (Constant)  | -7.009                     | 1.192     | -5.878 | .000 |                       |                   |
| Age ( $X_1$ )   | .121                       | .036      | 3.311  | .002 |                       |                   |
| Income ( $X_2$ )  | .429                       | .119      | 3.600  | .001 |                       |                   |
| Fish price ( $X_3$ )  | .092                       | .023      | 4.049  | .000 |                       |                   |
| Status at the Family<br>( $D_1$ )                                   | .205                       | .649      | .316   | .753 | 33.014                | .000 <sup>b</sup> |
| Ethnic ( $D_2$ )  | 1.468                      | .558      | 2.632  | .011 |                       |                   |
| Education ( $D_3$ )   | 1.448                      | .567      | 2.556  | .014 |                       |                   |
| Fish substitute ( $D_4$ )   | 1.114                      | .540      | 2.062  | .044 |                       |                   |
| R square  |                            |           |        |      |                       | .816              |
| VIF (Variance Inflation Factor) for collinearity check              |                            |           |        |      |                       | <10               |
| Durbin-Watson (DW) for autocorrelation check ( $du < dw < 4 - du$ ) |                            |           |        |      |                       | 1.642             |

a. Dependent Variable: Residents' fish consumption (Y)

b. Predictors: (Constant),  $D_4, D_2, D_3, X_3, X_1, D_1, X_2$

It is similar with case in Bali province, the age of 45-49 years was an independent variable that affects the level of fish consumption (Widihastuti & Arthathiani, 2020). Also, Can et al. (2015) mentioned that significant differences in fish consumption were also found among age groups, gender groups, and education groups, as well as between marital statuses. Where, fish price and the availability of favorite fish are factor influencing fish

purchase and consumption behavior (M V et al., 2023), and the other research result also mentioned that lower domestic prices can increase fish consumption (Tran et al. (2017), nevertheless, a reasonable increase in fish prices accompanied by the quality and freshness of the fish is not a problem for consumers in East Kalimantan found.

Furthermore, the status at the family variables as mentioned above has no affect significantly at the regression. It means that both husband and wife are not dominant to take a decision in a family for fish consumption, even the research result from Retnowulandari (2018); David (1994) conveyed a wife is equal to the rights and position of the husband in the family life and in social life, where joint husband-wife decision-making patterns are the common norm. Then, the family status as the child (adult daughter or son) or someone who lives the same household can also determine their meals preference type for consumption like fish. It is related with they have a role getting their own income, further they have an authority to make opinion and decision at the family. In similar vein, income and asset ownership strength in the family can impact to economic strength assets, communication, problem solving, social support, family cohesion, and religious support strength at the family (Orthner et al., 2003). The high consumption of fish by non-Javanese tribal communities is an important factor influencing the fish consumption figures in East Kalimantan Province. However, there are found that those who are Javanese and live outside Java tend to follow the fish eating culture and habit of the people in the area where they live.

Many studies state that education is assimilated with a person's knowledge level like education level of most residents who consuming high fish in this study. Such as affecting household fish consumption expenditure in Indonesia, where the length of schooling (education level of homemakers case) is at a significance level of 5 percent (Ningsih et al., 2022). Through nutrition education intervention, fish consumption of the residents is good met, but it is not meaningful that resident education in the field is higher than people at the others place if for reason of the fish consumption level. Then, fish substitute has opportunity to move fish for consumption. In fact, residents tend select fresh/non-processed food for preferences of fish substitute because they do cooking process by themselves for keep quality food, nutrition, and taste.

### ***Important Sustainable Fishing and Culturing***

Generally, several the integrated the projects and policies have to be considered for the increase of fish consumption of residents in East Kalimantan. We can work towards a sustainable future for fish consumption, ensuring that marine resources are managed responsibly and effectively for generations to come through implementing key points for sustainable fishing and culturing. Based on in-depth interview to East Kalimantan residents related important sustainable fishing and culturing, there is eight key points found, namely regulation and quotas, sustainable aquaculture practices, ecosystem based management, certification and traceability, research and innovation, consumer education and awareness, community involvement and socioeconomic considerations, and international cooperation.

#### **1. Regulations and quotas**

- Establish and enforce fishing quotas, where governments should set and enforce catch limits based on scientific assessments to prevent overfishing and allow fish populations to recover.
- Seasonal and area closures, namely implementing closed seasons and protected areas can help safeguard breeding grounds and juvenile fish, ensuring long-term population health.

#### **2. Sustainable aquaculture practices**

- Species selection, namely choose species that are resilient, have low environmental impact, and do not require high levels of wild-caught fish for feed.
- Feed efficiency, namely use sustainable and efficient feed sources, such as plant-based or insect-based feeds, to reduce pressure on wild fish stocks.
- Water quality management, namely implement systems to monitor and manage water quality, reducing pollution and disease outbreaks.

#### **3. Ecosystem-based management**

- By catch reduction, namely develop and use fishing gear that minimizes by catch of non-target species and juvenile fish, ensuring more selective fishing practices.



- Habitat protection, namely protect critical habitats such as coral reefs, mangroves, and sea grass beds that support fish populations and biodiversity.
4. Certification and traceability
    - Eco-labels and certifications, where encourage consumers to choose seafood certified by organizations like the Marine Stewardship Council (MSC) or Aquaculture Stewardship Council (ASC), which adhere to strict sustainability standards.
    - Traceability systems, namely implement traceability systems to track the origin of seafood products, ensuring they come from sustainable sources and reducing the risk of illegal, unreported, and unregulated (IUU) fishing.
  5. Research and innovation
    - Technological advancements, namely invest in research and development of new technologies that improve fishing efficiency, reduce environmental impact, and enhance aquaculture practices.
    - Alternative aquaculture systems, namely explore alternative systems like integrated multi-trophic aquaculture (IMTA) and recirculating aquaculture systems (RAS) that have lower environmental footprints.
  6. Consumer education and awareness
    - Public awareness campaigns, namely educate consumers about the importance of sustainable seafood choices through campaigns and labeling initiatives.
    - Responsible consumption, namely promote responsible consumption habits, such as diversifying seafood choices to include underutilized species and reducing waste.
  7. Community involvement and socioeconomic considerations
    - Support for local communities, namely ensure that fishing regulations and aquaculture practices support the livelihoods of local fishing communities and promote fair labor practices.
    - Co-management approaches, namely engage local communities in fisheries management decisions, fostering a sense of ownership and responsibility for sustainable practices.
  8. International cooperation
    - Global agreements and partnerships, where strengthen international cooperation through agreements and partnerships that promote sustainable fishing practices and combat IUU fishing.
    - Data sharing and research collaboration, namely encourage the sharing of data and collaborative research efforts to improve the understanding and management of fish stocks globally.

Overall, for improvement of fish consumption figures, the government has to support the residents through more measurable programs that integrated into the projects and policies.

### 3. Conclusion

To answer the first aim, understanding and knowing of East Kalimantan residents on fish consumption benefit for the health show high (85%) and the remaining 15% is un-know for sure. Those health benefits cover fish as a rich source of omega-3 fatty acids, high-quality protein, and related with reducing risk of health disease, stroke, and certain types of cancer. Where, among health benefits, most residents know that fish provide high-quality protein, important vitamins and minerals like vitamin D, vitamin B12, and selenium.

Further, to answer the second aim, in analysis, all variables that build this model have amounting to 82% ( $R^2$ ) affected into fish consumption residents. Partially, age ( $X_1$ ), income ( $X_2$ ), fish price ( $X_3$ ), ethnic ( $D_2$ ), education ( $D_3$ ), and fish substitute ( $D_4$ ) variables significantly influence the fish consumption of East Kalimantan residents at  $p < 0.05$ , and having strong regression. Except, the status at the family variable, it has not influence partially to fish consumption of residents.

Hence, to stimulate awareness of fish consumption, the government has to support the residents through more measurable programs for the increase of fish consumption such as socializing the benefit of fish consumption for health and fish eating program. Also, besides socioeconomic status has a role in fish consumption measurable, fish market accessibility, cultural influences, government policies, promoting sustainable consumption, and environmental aspect implicitly are also the drive of fish consumption. Then, the

increase of important sustainable fishing and culturing in East Kalimantan should be noticed especially making programs that integrated into the projects and policies.

## Conflict of Interest

The authors declare no conflict of interest for the results.

## References

- Anyanwu, O., Folta, S., Zhang, F., Chui, K., Chomitz, V., Kartasurya, M., & Naumova, E. (2023). Fish—To Eat or Not to Eat? A Mixed-Methods Investigation of the Conundrum of Fish Consumption in the Context of Marine Pollution in Indonesia. *International Journal of Environmental Research and Public Health*, 20, 5582. <https://doi.org/10.3390/ijerph20085582>
- Arifin, Z., & Falahudin, D. (2017). Contribution of Fish Consumption to Cadmium and Lead Intakes In Coastal Communities of West Kalimantan, Indonesia. *Marine Research in Indonesia*, 42, 1-10. <https://doi.org/10.14203/mri.v42i1.154>
- Arikunto, & Suharsimi. (2010). *Prosedur Penelitian Suatu Pendekatan Praktik*. Rineka Cipta, Jakarta.
- Arsil, P., Ardiansyah, & Yanto, T. (2019). Consumers' Intention and Behaviour towards Fish Consumption: A Conceptual Framework. *IOP Conference Series: Earth and Environmental Science*, 255, 012006. <https://doi.org/10.1088/1755-1315/255/1/012006>
- Arthatiani, F., Luhur, E., Wardono, B., & Yulisti, M. (2021). Socio-economic determinants of preserved fish consumption in Java Island: SUSENAS data analysis 2019. *IOP Conference Series: Earth and Environmental Science*, 870, 012046. <https://doi.org/10.1088/1755-1315/870/1/012046>
- Boa, H., Suwannathep, S., Gunawan, B. I., & Bunnag, B. (2023). Assessing the Impact of Mangroves in Traditional Shrimp Farming in the Mahakam Delta Using A Cost Benefit Analysis. *Journal of Sustainability Science and Management*, 18(4), 44-56. <https://doi.org/http://doi.org/10.46754/jssm.2023.04.004>
- BPS-Kaltim. (2023). *Kalimantan Timur Province in Figures 2023*. BPS Statistic of Kalimantan Timur Province.
- BPS-Kukar. (2023). *Kutai Kartanegara Regency in Figures, 2023*. BPS Statistics Kutai Kartanegara Regency.
- Can, M., Gunlu, A., & Can, H. (2015). Fish consumption preferences and factors influencing it. *Food Science and Technology*, 35, 339-346. <https://doi.org/10.1590/1678-457X.6624>
- Cardoso, C., Bernardo, I., Bandarra, N. M., Louro Martins, L., & Afonso, C. (2018). Portuguese preschool children: Benefit (EPA+DHA and Se) and risk (MeHg) assessment through the consumption of selected fish species. *Food Chem Toxicol*, 115, 306-314. <https://doi.org/10.1016/j.fct.2018.03.022>
- David, F. P. (1994). The Roles of Husband and Wives in Household Decision-Making. *Bahandian*, 42(1), 15.
- DKP-Kaltim. (2022). *Statistic Report of Marine and Fisheries of East Kalimantan Province*. Department of Maritime Affairs and Fisheries. East Kalimantan.
- Jauziyah, S., nuryanto, N., Tsani, A. F. A., & Purwanti, R. (2021). Pengetahuan Gizi dan Cara Mendapatkan Makanan Berhubungan dengan Kebiasaan Makan Mahasiswa Universitas Diponegoro. *Journal of Nutrition College* 10(1), 10. <https://doi.org/10.14710/jnc.v10i1.30428> %& 72
- KKP-RepublikIndonesia. (2023). *Marine and Fisheries in Figures 2023*. Pusat Data Statistik dan Informasi Kementerian Kelautan dan Perikanan. Ministry of Fisheries and Maritime Affairs.
- M V, S., Ramesha, T., Narayanaswamy, C., & Gopika, R. (2023). Factors Influencing Fish Purchase and Consumption Behaviour of Koraga and Soliga Tribes, Karnataka, India. *Indian Journal of Extension Education*, 59, 86-90. <https://doi.org/10.48165/IJEE.2023.59418>
- Mielcarek, K., & Socha, K. (2022). Freshwater fish consumption in the prevention of diseases. *Acta Poloniae Pharmaceutica - Drug Research*, 79, 325-331. <https://doi.org/10.32383/appdr/150863>
- Naeem, M., & Selamoglu, Z. (2023). Fish as a Significant Source of Nutrients. 6, 1-14. <https://doi.org/10.35841/AAJPHN.6.4.156>
- Nasution, S. (2003). *Metode Penelitian Naturalistik Kualitatif (Bandung)*. Tarsito. Library. Fis. Uny. Ac. Id/Opac/Index. Php.
- Ningsih, S. K., Afifah, E. N., & Lubis, F. R. A. (2022). The Effect of Housewives' Education Level on Fish Consumption Expenditure in Indonesia. *Harmoni Sosial Jurnal Pendidikan IPS*, 9(1). <https://doi.org/doi:https://doi.org/10.21831/hsjpi.v9i1.28808>
- Olena, H., Paraniak, R., Kutishchev, P. s., Paraniak, N., Hradovych, N., Matsuska, O., Rudenko, O., Lytvyn, N., Gutyj, B., & Maksishko, L. (2021). The influence of environmental factors on fish productivity in small reservoirs and transformed waters. 176-180. [https://doi.org/10.15421/2021\\_27](https://doi.org/10.15421/2021_27)
- Orthner, D. K., Jones-Sanpei, H., & Williamson, S. A. (2003). Family Strength and Income in Households with Children. *Journal of Family Social Work*, 7(2), 5-23. [https://doi.org/10.1300/J039v07n02\\_02](https://doi.org/10.1300/J039v07n02_02)
- Osei, V. S., Forrester, G., Clotney, M. N. K., McManus, M. C., & Collie, J. (2021). The influence of environmental factors and fishing effort on demersal fish species in Ghanaian waters. *Regional Studies in Marine Science*, 46. <https://doi.org/10.1016/j.rsma.2021.101858>
- Panchakarla, S., Tandle, A., Meshre, S., Kawade, S. S., & Gedam, S. P. (2023). A Review on Nutritional Benefits of Fish on Human Health. *Chronicle of Aquatic Science*, 1(4), 14.
- Pasquare, F. A., Bettinetti, R., Fumagalli, S., & Vignati, D. A. (2013). Public health benefits and risks of fish consumption: current scientific evidence v. media coverage. *Public Health Nutr*, 16(10), 1885-1892. <https://doi.org/10.1017/S1368980012004302>

- Phogat, S., Dahiya, T., Jangra, M., Kumari, A., & Kumar, A. (2022). Nutritional Benefits of Fish Consumption for Humans: A Review. *International Journal of Environment and Climate Change*, 1443-1457. <https://doi.org/10.9734/ijecc/2022/v12i121585>
- Qayoom, U., Mushtaq, Z., Mir, S., & Gul, S. (2020). Health benefits of eating fish.
- Ratih, D., Ruhana, A., Astuti, N., & Bahar, A. (2022). Alasan Pemilihan Makanan dan Kebiasaan Mengonsumsi Makanan Sehat pada Mahasiswa Unesa Ketintang. *Jurnal Tata Boga*, 11(1), 11.
- Retnowulandari, W. (2018). A Review of The "Head Of The Family" Concept From The Family Law, Gender Perspective. *SHS Web of Conferences*, 54, 02008. <https://doi.org/10.1051/shsconf/20185402008>
- Sajeev, M. V., Radhakrishnan, A., Mohanty, A. K., Joshy, C. G., Akber Ali, V. P., Gopika, R., Mathew, S., & Ravishankar, C. N. (2021). Factors Influencing the Fish Consumption Preferences: Understandings from the tribes of Wayanad, Kerala. *Indian Journal of Extension Education*, 57(4), 23-27. <https://doi.org/10.48165/ijee.2021.57405>
- Shaw, S., He, X., Haban, A., Tomasallo, C., & Meiman, J. (2023). A focus group study of fish consumption behaviors among Asian women in Milwaukee, Wisconsin. *Preventive Medicine Reports*, 36, 102528. <https://doi.org/https://doi.org/10.1016/j.pmedr.2023.102528>
- Stewart, B. (2016). Fisheries Policy. In (pp. 46-56).
- Tran, N., Rodriguez, U. P., Chan, C. Y., Phillips, M., Mohan, C., Henriksson, P., Koeshendrajana, S., Suri, S., & Hall, S. (2017). Indonesian aquaculture futures: An analysis of fish supply and demand in Indonesia to 2030 and role of aquaculture using the AsiaFish model. *Marine Policy*, 79, 25-32. <https://doi.org/10.1016/j.marpol.2017.02.002>
- Utri-Khodadady, Z., & Glabska, D. (2023). Analysis of Fish-Consumption Benefits and Safety Knowledge in a Population-Based Sample of Polish Adolescents. *Nutrients*, 15(23). <https://doi.org/10.3390/nu15234902>
- Wenaty, A., Mabiki, F., Chove, B., & Mdegela, R. (2018). Fish Consumers Preferences, Quantities of Fish Consumed and Factors Affecting Fish Eating Habits A case of Lake Victoria in Tanzania. *International Journal of Fisheries and Aquatic Studies*, 6(6), 6.
- Widihastuti, R., & Arthatiani, F. (2020). Factors that influence the level of fish consumption in Tabanan Regency, Bali Province. *IOP Conference Series: Earth and Environmental Science*, 521, 012023. <https://doi.org/10.1088/1755-1315/521/1/012023>
- Wijaya, T., Farlianto, F., & Mamengko, R. (2022). Barriers Factor Analysis of Fish Consumption Behavior in the Special Region of Yogyakarta and Central Java. *AGRIEKONOMIKA*, 11, 1-10. <https://doi.org/10.21107/agriekonomika.v11i1.12993>

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