

CONSUMPTION, ELASTICITY AND DEMAND ESTIMATION OF ANIMAL SOURCES FOOD IN INDONESIA**Esty Asriyana Suryana¹, Drajat Martianto², Yayuk Farida Baliwati²**¹ Center for Agricultural Postharvest Research and Development, Ministry of Agriculture
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ABSTRAK

Asupan protein hewani dalam pola konsumsi pangan sangat menentukan seseorang untuk hidup sehat, aktif, dan produktif. Penelitian ini bertujuan untuk menganalisis konsumsi dan perkiraan kebutuhan pangan sumber hewani di Indonesia. Analisis ini menggunakan model AIDS untuk memperkirakan elastisitas permintaan pangan dan menggunakan persamaan linier untuk memperkirakan kebutuhan pangan sumber hewani pada tahun 2021-2025. Hasil penelitian menunjukkan konsumsi pangan sumber hewani di Indonesia masih belum memenuhi angka kecukupan gizi yang direkomendasikan. Komoditas peternakan masih sangat responsif terhadap perubahan harga dan pendapatan. Nilai elastisitas permintaan pangan hewani semuanya negatif sesuai dengan hukum permintaan. Untuk elastisitas pendapatan nilainya adalah positif. Perkiraan konsumsi menunjukkan bahwa permintaan daging pada periode 2021-2025 terus meningkat seiring dengan pendapatan dan pertumbuhan penduduk. Untuk memenuhi kebutuhan protein hewani, selain program saat ini untuk mencapai swasembada pangan sumber hewani, perlu diupayakan peningkatan produksi berdasarkan perkiraan kebutuhan pangan minimum.

Kata kunci: model AIDS, konsumsi, elastisitas, kebutuhan pangan, estimasi pangan, protein.

ABSTRACT

Intake of animal protein in food consumption patterns is very decisive for a person to live a healthy, active, and productive life. This study aims to analyze of consumption and estimation of food demand for animal sources in Indonesia. This analysis used the AIDS model to estimate the elasticity of food demand and use linear equations to estimate food demand of animal sources in 2021-2025. Results showed the consumption of food for animal sources in Indonesia still did not meet the recommended nutritional adequacy rates. Animal commodities are responsive to prices and income changes. The value of the elasticity of demand for animal food was all negative accordance with the law of demand which has a negative direction. For income elasticity the value of income elasticity for whole animal protein source food commodities was positive. The estimation of consumption showed that the demand for animal meat in the period 2021-2025 continues to increase along with income and population growth. To meet the need of animal protein, in addition to the current program to achieve food of animal sources self-sufficiency, it is necessary to strive to increase production based on minimum food demand estimation.

Keywords: AIDS model, consumption, elasticity, food demand, food estimation, protein.

INTRODUCTION

Food development aims to achieve sustainable food security which is characterized by consumption of sufficiently diverse and nutritious and balanced food. Fulfillment of food sufficiency is an investment in the formation of better human resources and prerequisites for the fulfillment of other basic rights such as education, employment and others (Dewan Ketahanan Pangan, 2011; Suryana, 2014). Protein is one of the most important nutrients in the development of human resources. Together with energy, the adequacy of protein can be used as an indicator to see the condition of people's nutrition and also the government's success in integrated food, agriculture, health and socio-economic development. For protein sources, the recommended standard for protein consumption is based on the results of the National Food and Nutrition (WNPG) X year 2012 and still a reference is 57 grams / capita / day where 22 grams are recommended to be fulfilled from animal protein, where 13 grams is recommended to be fulfilled from protein from fish and 9 grams protein from livestock.

Demand for food is dynamic in nature, which may change due to changes in nutrition knowledge, income, food prices (these and other food prices), preferences, socio-culture, food characteristics and household characteristics (Muzayyanah et al., 2017; Novarista et al., 2010; Ugwumba & Effiong, 2013). Household food consumption behavior including animal protein source food is closely related to demographic socio-economic factors (Susanti, 2014). Various studies have been conducted on the analysis of the demand for animal food commodities using household-level survey data. The difference between this study and previous studies is that the categorization of consumption and demand based on regional households and income classes has never been carried out.

Demand projections are very important for production planning which will have an impact on how much the supply level is to maintain price stability (Nur et al., 2012). Information about the projected demand for consumption of animal protein source foods is needed by the government in recommending policies regarding the target choice of the types of animal protein source commodities to be developed in order to balance food consumption. Based on this, the purpose of this study is : (1) analyze the level of animal food consumption participation and per capita level based on income class and region (city / village), (2) analyze the elasticity of demand for animal food according to income class and region (city / village), and (3) estimating demand for animal food consumption for the years 2021-2025.

RESEARCH METHOD

The type of data used is secondary data from Statistics Indonesia. The data used to analyze the demand for animal food in the form of data on animal food consumption expenditures for households from the national level 2014 National Socio-Economic Survey (Susenas). The sample size of the Susenas in this study included 285,574 households (122,079 urban area households and 163,495 village area households) which were spread across all provinces in Indonesia. Data used for estimating food demand is population data, population growth rate and population growth projections for 2021-2025.

Descriptive analysis was used to describe in general how household food consumption, especially animal food from the percentage of household expenditure for food consumption against total household expenditure. Request analysis using the Linear Approximation / Almost Ideal Demand System (LA / AIDS) model was first formulated by (Muellbauer & Deaton, 1980).

The model used was a linear approximation of the AIDS, This model can answer the demands of consumer preferences with a more flexible form of function. This model is derived from the cost or expenditure function and the indirect utility function by considering consumers' decisions in determining a set of commodities together. This is not found in other demand models, so that a two-way cross linkage between two commodities can be determined. Linear Almost Ideal Demand System (LA-AIDS) model, as follows:

$$w_i = \alpha_i + \sum_j Y_{ij} \log p_j + \beta_i \log \left(\frac{x}{p^*} \right) + \gamma_i \log(Z) + u_i$$

Where:

w_i = expenditure / share budget for group i (%)

p_j = combined price of group j – (Rp)

x = total household expenditure (Rp)

p^* = stone price index where $\log p^* = \sum_k w_k \log p_k$

The LA-AIDS model above illustrates the relationship between the variable budget share / proportion of commodity expenditure i influenced by the commodity price variable j, the animal protein food expenditure variable divided by a weighted price index, the household member variable, the income group variable, the region type variable and the variable education of the head of the household. Furthermore, the equation above is estimated using the Seemingly Unrelated Regression (SUR) method, which aims to see how the effects of price and income parameters as well as social variables are affected. In accordance with the theory of demand, in this AIDS model research, parameter restrictions are carried out to ensure that the satisfaction maximization assumption is met, namely:

Symmetry : $Y_{ij} = Y_{ji}$

Homogeneity : $\sum_0^j Y_{ij} = 0$

Adding up :

$$\sum_0^i \alpha_i = 1, \sum_0^i \gamma_{ij} = 0, \sum_0^i \beta_i = 0$$

The magnitude of demand elasticity for price and expenditure is calculated from a formula derived from the demand function (Muellbauer & Deaton, 1980). The formula for calculating the elasticity is as follows:

a Price elasticity : $e_{ii} = \frac{Y_{ii}}{w_i} - 1$

b Income elasticity : $n_i = 1 + \frac{\beta_i}{w_i}$

The estimation of demand analysis is used to estimate / estimate the level of consumption and the amount of demand for types of animal food consumed by the community for the coming years. The demand elasticity of animal food for income in 2014 was proxied by the proportion of animal food expenditure. Referring to the research of (Nur et al., 2012) to project the demand for animal food consumed directly using the following equation Referring to the research of (Nur et al., 2012) to project the demand for animal food consumed directly using the following equation :

$$q_{dit} = q_{di0} * [1 + (E_{iy0} \cdot dY)]$$

Where :

q_d = consumption per capita

E_{iy0} = income elasticity in the base year

dY = Growth of real income level per capita per year

i = commodity analyzed

t = Estimated year

t_0 = Base year

$$Q_{it} = q_{dit} \cdot N_t$$

Where :

Q_{it} = Total number of requests in year t

N_t = total population in year t

The estimation model uses per capita consumption in 2014. Some other parameters needed in the estimation model are: income elasticity obtained from AIDS models, revenue growth is calculated from the GDP growth target based on data released by the Ministry of Finance and estimates of population growth and population projections obtained from Indonesian population projection data (Badan Pusat Statistik, 2013).

RESULT AND DISCUSSION

Level of participation in animal food consumption

The level of animal food consumption shows the proportion of households that consume animal food to the total population of households observed (Purwantini, 2015). Its usefulness to find out among food sources of a nutrient (in this study is animal protein), what food is the main source of these nutrients in the household and how the ranking of contributions contributes between these foods (Purba, 2004).

Table 1 shows the level of participation in animal food consumption. Data comes from low (40%), medium (40%) and high (20%) income groups, respectively, for urban, rural areas, as well as total urban

and rural areas. Nationally, the participation rate of egg consumption reached 73.84%, the highest compared to other protein source foods both in income classes and in rural and urban areas. This can happen because eggs are easily available, easily available, easily accepted as food by all community groups and age groups and also because of the affordable price. The study conducted by (Ariani & Saliem, 2015) states that for animal food, egg consumption is the highest among other animal foods and this trend applies to all agroecosystems.

The high level of participation and consumption of animal food is a major contributor to the high level of protein consumption in households. The level of consumption participation which has a figure above 50% besides the commodity of eggs is fresh fish which is 63.86%. The participation of preserved fish and chicken ranges from 30-40%, and for dairy, other meat and meat commodities have participation rates below 20%. The participation rate of meat consumption is still very low, which is 3.76 %, this means that only four people from 100 households in Indonesia consume meat during the survey period.

Table 1.Percentage of population based on animal food consumption participation in Indonesia (%)

Group of study	Meat	Chicken	Others meat	Egg	Milk	Fresh fish	Preserved fish
Income class							
High	10.73	48.79	11.19	77.86	30.61	69.43	32.41
Middle	3.16	38.12	7.24	78.83	16.76	69.89	42.07
Low	0.88	19.63	5.10	66.83	8.68	55.04	39.74
Total	3.76	32.86	7.17	73.84	16.30	63.86	39.20
Area							
Rural	6.56	44.72	7.95	82.52	24.57	66.57	38.99
Urban	1.67	24.00	6.59	67.36	10.12	61.83	39.37
Total	3.76	32.86	7.17	73.84	16.30	63.86	39.20

Source: BPS 2014, processed

Animal food consumption

The consumption of animal food as a source of animal protein at the national level based on the 2014 Susenas data is shown in Table 2. The dynamics of consumption patterns seen is by comparing patterns of household animal food consumption by region and income class. From the whole animal food researched, fresh fish is the most consumed commodity by the people of Indonesia. This is likely due to purchasing power, community acceptance and prices of these commodities are cheaper than other types of animal food such as meat or other meat. Based on statistical data from the Ministry of Maritime Affairs and Fisheries (2013), the level of fish consumption in Indonesia has increased every year. Based on the report from the Directorate General of Strengthening Competitiveness of Marine and Fishery Products (PDSPKP) Ministry of Maritime Affairs and Fisheries (2016) the most consumed types of marine fish are tuna, cob and skipjack, reaching 4.5 kg per capita / year while consumption of fresh fish is dominated by tilapia and catfish.

For livestock commodities that are widely consumed by the people of Indonesia are eggs and chicken. In line with the research

of (Winda et al., 2016) that chicken and chicken eggs are livestock products that are often consumed and liked by the community because they are easily obtained have a good taste and can be accepted by all groups. Besides chicken and egg meat has a price that is relatively cheaper than other livestock products. Based on Table 2, it can be seen that Indonesians' consumption of meat in 2014 is still low at 0.27 kg / capita / year, or less than 0.01% of the total consumption of animal food, similarly in all income classes and urban and rural areas. In accordance with (Ariani et al., 2018) in the results of his research, the results of the average national consumption of meat in rural and urban areas were 0.1 kg and 0.5 kg per capita / year. According to (Ritchie & Max, 2017), based on data reported by FAO (2013), the consumption of meat and fish in Indonesia is lagging behind Malaysia, Thailand, Brunei and even Vietnam.

Through the consumption participation approach, it can be seen the average consumption level / capita of a food commodity by its consumption group. Thus the population used to calculate the average consumption / capita is the population that is in the consumption group only not the total population that is the object of research.

Table 2. Animal food consumption in Indonesia (kg / capita / year)

Group of study	Meat	Chicken	Others meat	Egg	Milk	Fresh fish	Preserved fish
Income class							
High	0.90	8.19	1.42	9.45	3.31	21.52	3.39
Middle	0.18	4.56	0.76	7.35	1.20	16.35	3.78
Low	0.04	1.63	0.48	4.45	0.41	9.49	2.98
Total	0.27	4.11	0.78	6.61	1.31	14.64	3.38
Area							
Rural	0.45	5.49	0.65	7.84	2.12	14.48	3.07
Urban	0.13	3.09	0.87	5.7	0.70	14.38	3.62
Total	0.27	4.11	0.78	6.61	1.31	14.64	3.38

Source: BPS 2014, processed

Table 3. Average consumption of animal food in household groups that consume (based on consumption participation rates) in Indonesia (kg / capita / year)

Group of study	Meat	Chicken	Others meat	Egg	Milk	Fresh fish	Preserved fish
Income class							
High	8.41	16.78	12.68	12.14	10.82	31	10.45
Middle	5.72	11.97	10.5	9.32	7.18	23.39	8.98
Low	4.36	8.28	9.38	6.66	4.74	17.24	7.51
Total	7.13	12.52	10.86	8.95	8.03	22.92	8.63
Area							
Rural	6.82	12.27	8.19	9.5	8.62	22.51	7.87
Urban	8.04	12.87	13.27	8.46	6.95	23.26	9.19
Total	7.13	12.52	10.86	8.95	8.03	22.92	8.63

Source: BPS, processed

Based on Table 3, it can be seen that the pattern of food consumption of protein sources based on participation rates is almost the same as the consumption pattern based on total population. The highest consumption of animal food is fresh fish, which is equal to 22.92 kg / capita / year. While the lowest consumption is meat at 7.13 kg / capita / year but has a difference that is far enough from food consumption in a total population of only 0.27 kg / capita / year. This is due to relatively higher prices and presumably because domestic livestock production is still not able to meet the needs of the community. (Suryana, 2009) states that cattle as one of the ruminant livestock which have the largest contribution are still unable to meet domestic needs which tend to increase every year. Consumption of chicken, other meat, eggs,

milk and preserved fish ranges from 8-12 kg / capita / year.

Table 4 shows the consumption of animal protein in Indonesia. Based on the table it can be seen that animal protein obtained by Indonesian people is mostly filled with fresh fish. The high consumption of fresh fish is influenced by the high purchasing power of the people towards fish and the abundant availability of fish. Even though the consumption of fresh fish is already high, this number does not meet the figures for the adequacy of animal protein from the recommended fish commodities.

The recommended number of animal protein sufficiency is 22 grams / capita / day, of which 13 grams are expected to be fulfilled from fish commodities and 9 grams from livestock commodities.

Table 4. Consumption of animal protein in Indonesia (gram / capita / day)

Group of study	Meat	Chicken	Others meat	Egg	Milk	Fresh fish	Preserved fish
Income class							
High	0.23	5.13	0.62	3.32	1.72	14.91	4.02
Middle	0.15	3.26	0.39	2.11	1.09	9.48	2.55
Low	0.09	1.87	0.22	1.21	0.63	5.44	1.46
Total	0.14	3.08	0.37	1.99	1.03	8.95	2.41
Area							
Rural	0.23	4.53	0.38	2.36	1.55	9.71	1.96
Urban	0.07	2.00	0.36	1.71	0.64	8.39	2.75
Total	0.14	3.08	0.37	1.99	1.03	8.95	2.41

Source: BPS, processed

The highest protein from animal feed from livestock is from chicken, then eggs each 3.06 and 1.99 gr / capita / day. The lowest consumption of animal protein in Indonesian society is from meat by 0.14 gr / capita / day. The pattern of consumption of animal protein in Indonesian tends to be the same between income classes as well as between rural and urban areas.

Most of the Indonesian society still meets their consumption needs which come from carbohydrate sources. This is probably because animal food is generally costs more than other foods. Animal food will be consumed if the basic food needs have been met.

Demand for animal food elasticity

Table 5 and Table 6 show the magnitude of its own price elasticity and income elasticity for animal food commodities in Indonesia. Based on the sign of the magnitude of the price elasticity itself in Table 5 all are marked negative in accordance with the law of the request having a negative direction. The absolute value of its own price elasticity nationally for most animal foods except for fresh fish and other meat is worth less than one or is inelastic.

This fact shows consistency with the demand theory, which is an inverse linear relationship between price and demand (Nicholson, 2002). The elasticity of fresh fish and other meet is more than one or elastic. Food commodities, including food sources of

animal protein tend to be inelastic because they are basic household needs, in line with the research of (Anyiro et al., 2014; Suryanty & Reswita (2016) about demand for animal foods. That is, if there is an increase in commodity prices by 1 percent, then there will be a decrease in commodity quantity equal to the value stated in the table (in percent).

Among the animal food commodities, the most inelastic is milk, because an increase in its own price of 1% will only reduce its demand by 0.55%. If a food commodity that inelastic increases in price, then households must increase their expenditure to consume this commodity due to the low response of the household to these price changes.

Analysis of household consumption behavior by looking at the comparison between urban and rural areas and its relationship to socio-economic characteristics in general illustrates that commodity prices and income have a significant effect on the level of consumption of commodity groups. Income is more responsive in rural areas than in urban areas. This fact is evident because individuals in rural areas have lower purchasing power compared to urban areas. Generally, the socio-economic characteristics have a significant effect on the level of consumption (Aziz et al., 2017; Sari, 2016).

Table 5. Price elasticity of animal food in Indonesia

<i>Group of study</i>	Meat	Chicken	Others meat	Egg	Milk	Fresh fish	Preserved fish
Income class							
High	-0.42	-0.72	-0.99	-0.74	-0.51	-1.11	-0.75
Middle	-0.27	-0.70	-1.27	-0.81	-0.46	-1.12	-0.76
Low	-2.00	-0.92	-1.95	-1.01	-0.66	-1.33	-1.02
Total	-0.89	-0.79	-1.44	-0.92	-0.55	-1.22	-0.91
Area							
Urban	-1.41	-0.73	-1.22	-0.72	-0.63	-1.12	-0.86
Rural	-0.63	-0.78	-1.51	-0.97	-0.44	-1.27	-0.93
Total	-0.89	-0.79	-1.44	-0.92	-0.55	-1.22	-0.91

Source: BPS 2014, processed

Table 6. Income elasticity of animal food in Indonesia

Group of study	Meat	Chicken	Others meat	Egg	Milk	Fresh fish	Preserved fish
Income class							
High	0.69	0.97	0.79	0.92	0.88	1.00	0.91
Middle	0.79	0.97	0.81	0.94	0.88	1.05	0.97
Low	0.88	0.97	0.83	0.97	0.93	1.03	0.98
Total	0.79	0.97	0.81	0.94	0.90	1.03	0.95
Area							
Urban	0.89	0.95	0.89	0.77	0.71	1.23	0.95
Rural	0.66	0.97	0.85	0.95	0.89	1.02	0.96
Total	0.79	0.97	0.81	0.94	0.89	1.03	0.95

Source: BPS 2014, processed

Overall, the value of income elasticity for animal protein source food commodities is positive (Table 6). Nationally, income elasticity is mostly below 1 except for fresh animal food that is, if income increases, the amount of animal food demanded will also increase with a smaller increase in demand than the increase in income. Consistent with the results of a study conducted by Virgantari et al. (2015) who also analyzed the demand for animal food using the QUAIDS model where only fish commodities had income elasticities above 1. The elasticity value of less than one (inelastic) indicates that the number of commodities requested is a basic need and increases smaller than the proportion of increase in income. In general, animal food commodities have smaller measurement elasticity values with increasing income. This shows that the higher the level

of income of a household, the lower the response to demand for animal food.

Estimated consumption of animal food

According to Kumar et al. (2009) revenue growth is an important factor in demand projections. The annual growth rate of per capita income is obtained by subtracting the population growth rate from economic growth in the same year and used to predict per capita consumption. The estimated demand for household animal food consumption as presented in Table 7 is based on the estimation of the model equation from the consumption of each animal food per year and on the variables of each equation, then impacts on the magnitude of the changes that will occur, estimated consumption for year $t+1$.

Table 7. Estimated consumption and demand for animal food in Indonesia Year 2021-2025

Year	Meat	Chicken	Others meat	Egg	Milk	Fresh fish	Preserved fish
Consumption (kg/year)							
2021	0.31	4.95	0.91	7.91	1.56	17.85	4.06
2025	0.37	6.00	1.07	9.52	1.86	21.86	4.89
Trend (%/th)	3.17	3.89	3.23	3.75	3.59	4.14	3.80
Demand (000 ton)							
2021	85	1.343	247	2.145	422	4.839	1.099
2025	105	1.709	304	2.710	529	6.226	1.392
Trend (%/th)	4.20	4.93	4.26	4.79	4.63	5.18	4.20

Based on the assumption of fixed income elasticity, the results of estimation of animal food commodities indicate that demand in the period 2021-2025 will continue to increase.

Henchion et al. (2014) state that meat consumption will continue and increase in the future. This estimation number is based on an increase in population which results in the level of consumption increasing along with the increase in the level of community income and changes in commodity prices. The estimation results show that the consumption of fresh fish in 2021 is estimated at 17.85 kg / year and estimates in 2025 will reach 21.86 kg / year with an increase of 4.41%. Virgantari et al. (2011) also made projections for per capita fish consumption in Indonesia in 2009-2014 resulting in an average rate of consumption increase of 4.28% year. The consumption of animal food from meat is estimated at 0.31 kg / year in 2021 and reaches 0.37 kg / year in 2025 with a rate of increase of 3.17% per year.

With population growth in the period, the highest demand for animal food is fresh fish reaching 6,226 thousand tons in 2025 with an annual increase rate of 51.8%. Animal food from livestock, meat commodity is the lowest demand commodity with a rate of 4.20% increase per year. In line with the research of Nur et al. (2012) who calculated the projected demand for meat in 2009-2013 to have an increase of 4% per year. The demand for chicken in 2021 is 1,343 thousand tons and reaches 1,709 thousand tons in 2025. Yogi (2018) also conducted a study for forecasting chicken consumption and got the results that in 2021 the demand for chicken consumption was 1,944 thousand tons. Based on the estimated demand, production is expected to increase to meet the demand for

minimal animal food commodities in line with the growth in demand for animal food.

However, this acceleration effort will take a relatively long time if it only relies on increasing income. Other measures such as production efficiency in order to ensure availability at a suitable price or price stabilization need to be made especially for consumers with low income classes. Estimates on the demand side can be used as input for making intervention policies and become an important indicator in considering the food security of the Indonesian people.

Food availability includes aspects of production, reserves and balance between exports and imports of food. Food availability must be managed in such a way, so that even though food production is seasonal, limited and spread out between regions, the volume of food available to the community must be sufficient in quantity and type, and supply stable from time to time.

Based on the results of this study, it is illustrated that the consumption of Indonesian people is dominated by fresh fish, meat and chicken eggs. The price elasticity of these three commodities also illustrates that if there is an increase in prices, the demand for this commodity will decrease more than that of other animal food commodities. Based on the above considerations, it is necessary to make price stabilization efforts for the three commodities.

CONCLUSION

The consumption of animal food, especially livestock, still low and uneven. Nationally, consumption of animal protein has not met the recommended nutritional adequacy rate of 22 gr / capita / day. The consumption of Indonesian people is dominated by fresh fish, while for livestock is

dominated by chicken.. Based on the price elasticity value if there is an increase in prices, there will be a decrease in the largest demand for commodities that have the highest consumption level, namely fresh fish and chicken. Similarly, if there is a change in income, the demand for fresh fish and chicken will increase less than the proportion of increase in income.

The estimation results show that consumption of animal food demand in the period 2021`-2025 continues to increase along with income growth and population growth.

To meet the need for animal protein, in addition to government programs that have been carried out (beef self-sufficiency) it is necessary to increase the production and availability of animal food commodities that are in accordance with people's preferences and acceptancesuch as: chicken, eggs, or fish which are carried out in a sustainable manner so that their enough availability and the price is stable as well as affordable.

Therefore, the change in target from beef self-sufficiency to self-sufficiency in animal protein, which was announced by the Ministry of Agriculture in 2018, needs to be realized immediately through various programs to increase animal food commodities according to regional characteristics. Meanwhile, based on estimated demand, animal food production is expected to meet minimum demand in line with the increase in consumption figures for the demand for animal food commodities.

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