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Correlation Analysis Between Livestock Population and Livestock Production in Indonesia During 2009 – 2018

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Abstract

Livestock product is one of the essential materials to maintain human body endurance. It is the source of some proteins which are significant for human health. The Indonesian government has also been keeping the growth of livestock productivity because the population growth can influence the consumption of some animal origin products. The objective of this research was to determine the correlation between livestock population and production in Indonesia on 2009-2018. The secondary data from the Indonesia Central Bureau of Statistics 2018, including the population of beef cattle, laying hens, goat, broiler, and the production of beef, eggs, lamb, and chicken meat in 2009 - 2018 was analyzed. Descriptive statistics and Pearson's correlation analysis were used for the statistical analysis. This research concluded that there were correlations between population and the production of goat, laying hens, and broiler (sig. < 0.05). However, there was no correlation between population and the production of beef cattle (sig. > 0.05). The important thing to increase the livestock production is grazing system.

Key words: Livestock Populatio; Livestock Production; Statistics Descriptive; Correlation Analysis

Introduction

Consumption of livestock product, which is originated from livestock animal and processed by the home industry or factory industry, is the highest in Indonesia. Indonesia consists of 34 provinces, with the human population is around 262 million (BPS, 2018). According to Widi and Ali (2018), the human population in Indonesia is expected to increase from the current 251 million to 274 million by 2020. This population growth in Indonesia can increase livestock product consumption. Nowadays, livestock product is more interesting for Indonesian because the livestock product can maintain human body endurance and immune system, which can be formed from animal protein. Animal protein source, such as eggs, meat, lamb, and chicken, is essential for the growth of the human body and body weight. At a global level, both the average per capita consumption of meat and the total amount of meat consumed are rising, driven by increasing average individual incomes and by population growth (FAO, 2018). Average daily consumption of calorie and protein per capita 2010 – 2017 in Indonesia are shown in Table 1. The escalating trend in demand for meat can result in several problems. Meat can be an important source of nutrients for people (Forouzanfar et al., 2015). In general, the number of animal products is approximately one-third of global human protein consumption (Steinfeld et al., 2006; Popp et al., 2010).

Furthermore, the high-quality of livestock product can be produced by healthy and excellent livestock. Proper nutrition for the animal on the farm will give a good result for the production of animal. Relationship between the health and welfare of animals raised for livestock product has been acknowledged by animal health and animal agricultural authorities worldwide (AWI, 2018).

Table 1. Average Daily Consumption of Calorie and Protein per Capita 2010 – 2017 (BPS,2018)

Indicators	Unit	2010	2011	2012	2013	2014	2015	2016	2017
Average Daily Consumption of Calorie and Protein per Capita (including a rough estimate of the consumption of dietary protein)	Gram	55.01	54.685	53.64	52.76	54.04	55.54	58.94942	62.15691
Average Daily Consumption of Calorie and Protein per Capita (including a rough estimate of calorie consumption of finished foods)	KKal	1925.61	1902.425	1858.97	1835.58	1863.995	1957.555	2069.449	2136.124

This research aimed to determine the correlation between livestock population and production on 2009 – 2018.

Materials and Methods

Data

The research used secondary data from the Central Bureau of Statistics 2018 in Indonesia, including the population of beef cattle, laying hens, goat, broiler, and the production of beef, eggs, lamb, and chicken meat in 2009 – 2018. The measurement of production eggs, beef, chicken meat, and lamb were using tons.

Data Analysis

The descriptive statistics of the data was evaluated. Moreover, statistical analysis using Pearson's product moment correlation was done to investigate the correlation between livestock population and production based on the following formula (Watson and Petrie, 2013) :

$$r = \frac{N\sum X\sum Y - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$$

Where ;

N = The number of pairs of livestock population and production

$\sum XY$ = The sum of the product of paired of livestock population and production

$\sum X$ = The sum of the livestock population (laying hens, beef cattle, goat, and broiler)

$\sum Y$ = The sum of the livestock production (eggs, beef, chicken meat, and lamb) in tons

$\sum X^2$ = The sum of the squared livestock population (laying hens, beef cattle, goat, and broiler)

$\sum Y^2$ = The sum of the squared livestock production (eggs, beef, chicken meat, and lamb)

SPSS (Statistical Package for Social Science) 21.0 version with a license from Universitas Gadjah Mada Yogyakarta was used to perform the statistical analysis in this study.

Results and Discussion

Descriptive Statistics

Total production of eggs, beef, chicken meat, and lamb in 2009-2018 are shown in Figure 1. The graph illustrates the highest livestock product consumed by Indonesian in 2009-2018 was chicken meat. The lowest livestock product consumed by Indonesians in 2009-2018 was lamb. There were several possible reasons which could influence the low consumption of lamb in Indonesia. One of them was the assumption of frequent meat consumption escalates the risk of having some types of chronic disease (Forouzanfar et al., 2016). From 2009 until 2018, the consumption livestock product, such as eggs, beef, chicken meat, and lamb, had been increasing every year. The increasing of livestock product consumption during those years because of the population growth in Indonesia. According to Delgado et al. (1999), the increased demand for meat in developing countries such as Indonesia must have a "livestock revolution", which can affect the food markets in those countries. The two primary livestock products consumed by

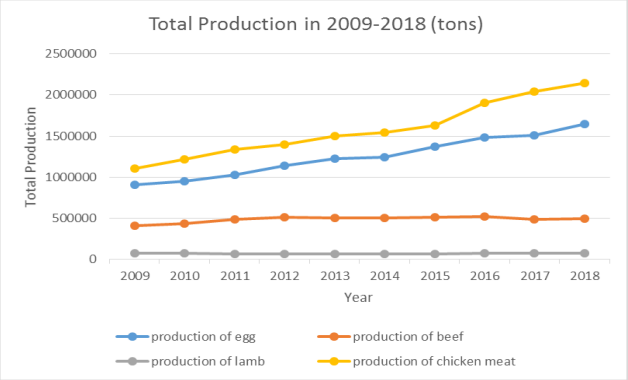

Figure 1. Total production of eggs, beef, chicken meat, and lamb in 2009-2018 (tons)

Indonesians were chicken meat and eggs. Majority of Indonesian people are Muslim, therefore, beef and chicken meat are the most common meat proteins in Indonesia (Anonym, 2017).

The total livestock population on 2009-2018 in Indonesia is shown in Figure 2. The graph illustrated that the highest number of livestock population in Indonesia was broiler. The population of the goat was the same as the population of beef cattle in 2009-2018. Based on the graph, the livestock population and production had a straight line or the proportion of population and production are same. The results of the population were comparable with their production. The comparable population and production were confirmed by correlation analysis.

Based on Table 2, the average of beef cattle and goat population were the same as just under 20 million in 2009-2018. On the other hands, the highest average was broiler, which was over 1000 million. The most significant average of livestock production was chicken meat, which had more than 1 million tons in 2009-2018. The difference between the average of beef and lamb was about just under 20.000 tons.

Table 2. Average of Livestock Population and Production in 2009-2018

Livestock Animal	Average of the population	Average of the production (tons)
Beef Cattle	14946251.4	485025.28
Laying Hens	144830975.1	1250083.135
Goat	17821553.2	67449.458
Broiler	1412424640	1582134.674

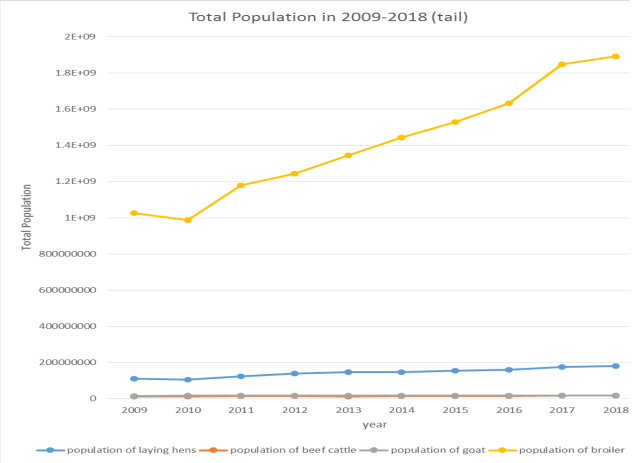

Figure 2. The population of laying hens, beef cattle, goat and broiler in 2009-2018 in Indonesia

Correlation Analysis

Table 3 shows the correlation analysis using Pearson's correlation. The result concluded that there was a correlation between livestock population and production. There was a significant and positive correlation between the population of broiler and production of chicken. The significant value was 0.000 (sig. < 0.05), and Pearson's correlation was higher than 0.09. Similarly, there was also a significant and positive correlation between the population of laying hens and the production of eggs (sig. < 0.05) (Pearson's > 0.09). Therefore, there were strong correlations between the population of broiler and production of chicken meat, and between the population of laying hens and production of eggs. These correlations reflected that the higher the population of broiler and laying hens, the higher the production of chicken meat and eggs. According to Compassion in World Farming, the broiler industry has grown due to consumer demand for affordable poultry meat. Breeding (genetic engineering) for particular traits and improved nutrition has been used to boost the weight of the chicken breast. Commercial broiler chickens are bred to be very fast growing in order to gain weight quickly (Anonym, 2013). As well as broiler, many factors could influence the production of eggs. Therefore, the production cycle must be managed effectively and efficiently in order to provide maximum output and profitability (FAO, 2018a). High feed conversion efficiency can produce more than 300 eggs/year (Lieboldt et al., 2015).

Table 3. Correlation Value between livestock population and production

The Livestock Population	The Livestock Production	Pearson's Correlation	Sig.
Beef Cattle	Beef	0.587	0.074
Broiler	Chicken meat	0.985	0.000
Laying Hens	Eggs	0.979	0.000
Goat	Lamb	-0.722	0.018

Nevertheless, there was no correlation between the population of beef cattle and the production of beef 0.000 (sig. > 0.05) (Pearson's correlation < 0.09). This result concluded that the population of beef cattle did not have high productivity to produce beef. Many factors could influence the

productivity of beef cattle to produce a great quality beef product. The factors were including the environment and management of feed. The environment has a meaningful interaction with the production system (FAO, 2018b). Grazing system is one of the feed systems for cattle to increase the production of beef cattle, however, climate change is one significant problem these days in the grazing system. The main consequences resulting from climate change are: altered rangeland productivity, effects on livestock parasites and disease, and increased competition for both land and water, location, production system, crop, and pasture species, which will determine the extent and direction of the anticipated effects (Thornton and Gerber, 2010). There is a term to increase production so that it is a sufficiently high intake of nutrients to ensure that the animal can grow and produce after maintenance requirements (Hlatshwayo, 2018). Based on the correlation results, the production of beef could be caused by insufficient feeding management. In addition, multivitamins given by farmers are insufficient to increase livestock weight. Additional nutritional supplies required for maximum beef production (Hlatshwayo, 2018).

Production of lamb had a negative correlation with a population of the goat (sig. < 0.05) (Pearson's correlation = -0.722). Many factors which is influence the production of lamb. If the population were limited, a small herd of goats might be the only livestock that a small, part-time farmer could raise to achieve self-sufficiency (Barkley et al., 2005). In the United States, the production of lamb was over 80 percent of the total of goats produced (Barkley et al., 2005). In most cases associated between reproduction disease in goat's and reproduction system in goat could be managed and treated (Barkley et al., 2005). Livestock diseases that have obstructed the development of the sector by decreasing production and hampering trade in animal products are highly important (Jilo et al., 2016; Abdela, 2016).

Conclusion

The information of livestock population and production are very important to describe the productivity of animal in the past and future. In a developing country, livestock products give more benefits to the government to increase the income of small farmers, as well as the big factories which produce the livestock product. There was a correlation between population and production of goat, laying hens, and broiler, nonetheless, there was no correlation between population and production of beef cattle. The important thing to increase the livestock production is grazing system.

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