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Correlation of Sex, Age and Carcass Weight of Simmental-PO Cattle in the Slaughterhouse, Sukorejo District, Blitar City, East Java

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Abstract
The objective of this study is to describe the correlation between age and sex in relation to the carcass weight of Simental-PO cattle that are slaughtered at the slaughterhouse (RPH) in the Sekorejo District of Blitar City, located in East Java. The investigation was conducted in July of 2023. The study utilized 20 male and 10 female Simental-PO cattle that were slaughtered at the Sukorejo District Slaughterhouse, located in the Blitar Regency. The employed study methodology entails the utilization of the direct observation approach. The obtained data was subsequently analyzed using SPSS 22 software and afterwards subjected to statistical tests like the Pearson Bivariate Correlation Test and Multiple Linear Regression Test. The findings obtained from the bivariate Pearson correlation analysis indicated a statistically significant correlation between sex and carcass weight. However, no statistically significant correlation was seen between age and carcass weight. The regression analysis reveals that the variables of gender and age account for only 31.3% of the variation in carcass weight. The resulting regression equation is $Y = 17.887 + 69.943X_1 + 15.994X_2$*. The research indicated a significant correlation between gender and carcass weight, while age does not exhibit a significant correlation with carcass weight. Therefore, further studies are warranted to explore the influence of factors besides age and gender on Simmental-PO beef carcass weight.*
***Keywords**: Age, Gender, Carcass Weight, Simmental-PO Cattle*

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1. INTRODUCTION

Beef cattle provide a significant segment of the livestock industry in Indonesia, primarily serving as a source of meat. However, the current domestic beef output falls short in meeting the demand, mostly attributed to insufficient animal populations and suboptimal productivity levels. Cattle play a significant role in fulfilling the demand for animal-derived food products, such as

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meat and milk, within the Indonesian context. Cattle are an essential commodity that is consistently in demand among the population of Indonesia, particularly during significant festivities such as Eid al-Fitr, Idhul Adha, and the New Year. Beef is a type of meat derived from conventional or typical bovine animals, which is considered appropriate for human consumption and does not elicit negative health effects in individuals who partake in its eating. Undoubtedly, beef offers numerous advantages for our physical well-being. The body greatly benefits from the nutritional content included in beef (Prakoso et al., 2022)

Based on the research of Socheh et al. (2017), the beef cattle population in Indonesia has attained a total of 14,824,373 individuals, which represents a mere 20% of the overall meat consumption requirements of the Indonesian population. As the global population continues to grow, there is a corresponding rise in the demand for beef on an annual basis (H. P. Sari et al., 2022). According to data provided by the Central Statistics Agency (BPS), it is projected that the volume and value of beef imports in Indonesia will experience a 22.4% growth in 2021. The quantity of imported beef increased from 223.42 thousand tons in 2020 to 273.53 thousand tons in 2021. On the contrary, there has been a decline of 2.6% in the level of beef consumption seen in Indonesia. The overall consumption in the year 2020 was recorded at 0.039 kg per capita per month, which decreased to 0.038 kg per capita per month in March 2021. According toPrakoso et al, (2022), there was a 2.6% decline in consumption from March 2020, resulting in a monthly per capita amount of 0.039 kg. The decrease in consumption can be attributed to a rise in pricing. Consequently, meat consumption is predominantly limited to individuals belonging to the upper middle class.

The production of livestock can be assessed by considering body weight, which is influenced by several factors such as cattle body size, including chest circumference, body length, and body height (Socheh et al., 2017). According to Adhyatma et al. (2013), Simmental cattle possess the advantageous traits of rapid growth and the ability to command high prices in the market. The primary objective of cattle breeders is to achieve a substantial increase in body weight, hence facilitating the production of elevated slaughter weight, carcass weight, and carcass percentage. According to a study conducted by Socheh et al. (2018), there are discernible variations in the genetic potential among different cattle breeds in Indonesia, which subsequently impact the weight of the resulting carcass.

The weight of an animal while it is alive, which ultimately has an impact on the weight of its carcass. There is typically a positive correlation between live weight and all linear body measurements. According to Ismail et al. (2014), the augmentation of bone, muscle, and adipose tissue as constituents of the carcass led to a corresponding elevation in the slaughter weight, consistently accompanied by a subsequent rise in the carcass weight. According to a study

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conducted (Nuraini et al., 2018), there are visible variations in live weight and carcass weight between male and female Ongole (PO) cross-breed cattle, specifically in fully grown individuals. This disparity is particularly evident in the case of Simmental-PO (simpo) and Limousine-PO (limpo) breeds. However, the findings presented by (Ninu, 2010) contrast from the results observed in this study. Ninu (2010) revealed no significant interaction between sex and live weight on the carcass productivity of Bali cattle in the western region of Timor Island, East Nusa Tenggara.

Simental-PO cattle represent a bovine breed that plays a significant role in fulfilling the meat requirements of society. The Simmental-PO breed of cattle possesses numerous advantageous traits, such as its ability to serve as a source of both meat and milk. Additionally, these cattle have a substantial body size, favorable muscle development, minimal subcutaneous fat formation, rapid daily weight gain, accelerated growth, and yield a sizable carcass (Yasin, 2022).

The growth of cattle exhibits a strong correlation with their age. Age is a significant determinant in the development of body weight and subsequent carcass weight. The rate of an animal's body growth holds significant implications for production outcomes, as quick growth facilitates high levels of productivity. Growth is an inherent biological phenomenon observed in all organisms, characterized by the augmentation of various bodily components such as organs, tissues, bones, skin, tendons, and adipose tissue, resulting in an overall rise in weight. It may be inferred that the weight of the carcass generated is influenced by both age and weight (Pikan et al., 2018). Karno (2017) posits that the primary objective of a beef cow farm is to achieve the production of superior carcasses, hence ensuring the provision of meat that exhibits exceptional quality and is suitable for consumption.

2. LITERATURE REVIEW

2.1. Simmental-PO Cattle

Simmental cattle, a breed of cattle, with their origins and development traced back to the Simme Valley in Switzerland (Ardian & Rahayu, 2022). According to Socheh et al. (2017), Simmental cattle exhibit a distinct reddish hue, ranging from dark to nearly yellow, accompanied by spotted patterns and a white facial region. Additionally, these cattle are known for their rapid growth and possess a lengthy and compact body structure. The weight of cattle serves as a measure of livestock productivity, and can be determined by assessing the linear dimensions of the cow's body, such as chest circumference, body length, and height (Socheh et al., 2017).

Simmental-PO cattle refer to a bovine population that arises through the breeding of Simmental bulls with Ongole crossbreed (PO) cows, predominantly achieved through the

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utilization of artificial insemination (AI) techniques. The Ongole crossbreed is a hybrid-cattle breed that has gained significant attention in the agricultural industry. Simmental cattle exhibit a genetic lineage derived from a crossbreeding between Simmental and Ongole cattle. Consequently, these bovines may manifest phenotypic traits that mirror those of Simmental cattle, Ongole crossbreeds, or a composite of both Simmental and Ongole characteristics. The Simmental Ongole crossbreed cattle are renowned for their exceptional maternal care towards their offspring. This particular bovine bred exhibits rapid growth rates and possesses a lengthy and robust physique. According to Sahala (2016), contemporary circumstances indicate that breeders of beef cattle for fattening purposes exhibit a preference for the maintenance of Simmental crossbreed Ongole cattle. This preference is attributed to the observed enhancements in both body weight and height, contingent upon the provision of enough nourishment and attentive management. Figure 2.1 displays the Ongole crossbreed Simmental cattle.

Figure 1. Simmental-PO bulls

Figure 2. Simmental-PO Cows

2.2. Cattle's Sex

When selecting beef cattle, it is advisable to choose for male cattle due to their superior growth rate compared to female cattle. Another rationale is to prevent the decline in the population of female bovines that continue to exhibit productivity (Sakti, 2017). The determination of birth weight in calves is influenced by gender. Male calves typically have a greater birth weight in comparison to their female counterparts. The parity factor exerts a

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notable influence on various aspects of the cow's reproductive performance, including birth weight, weaning weight, and gender. Research conducted by Sari et al. (2020) suggests that when parity increases, there is a corresponding increase in both the birth weight and weaning weight of the calf.

According to Nuraini et al. (2018), there are noticeable variations in carcass production between bulls and cows. Additionally, the gender factor plays a significant role in determining the carcass weight of male and female cattle, with male cattle generally exhibiting greater carcass weight compared to their female counterparts. Additionally, it is evident that bulls yield carcasses that exhibit greater size or weight compared to cows. This finding aligns with the assertion made by Priyanto et al. (2019) that male cattle exhibit a greater proportion of carcass weight compared to their female counterparts. According to a study conducted by Nuraini et al. (2018), there are discernible variations in live weight and carcass weight between male and female cross-breed cattle, namely in the case of ongole (PO) cross-breed cattle, simmental PO (simpo), and limousin PO (limpo). These differences are particularly notable in adult cattle.

Contrasting findings were presented by(Ninu, 2010), indicating the absence of a significant interaction between sex and live weight in relation to the carcass productivity of Bali cattle in the western region of Timor Island, East Nusa Tenggara. The impact of growth hormones on livestock's carcass weight and carcass percentage is expected to vary based on the animals' sex. Male livestock generally exhibit higher live weights compared to female livestock, resulting in a relatively lower proportion of carcass and non-carcass components in males as compared to females. The livestock residue that is not in the form of carcasses possesses lower economic worth. However, the remaining carcasses retain their suitability for eating, hence contributing to a rise in income(RAHMAN, n.d.).

2.3. Cattle’s Age

According to Priwardana (2019) research, age is identified as a significant element that exerts an influence on weight. The phenomenon of body growth being influenced by age. According to the findings Hafid et al. (2020), it has been observed that cattle typically experience accelerated growth during their early stages of development. However, growth rates gradually decline as the animals reach a point where bone and muscle growth cease. Subsequently, any gain in body weight is primarily attributed to overall size increment rather than the growth of specific tissues. The sole occurrence is the buildup of adipose tissue.

As individuals age, differences in growth rates have a tendency to magnify, hence exerting an influence on many bodily measurements. The correlation between livestock production capability and an increase of body weight and body dimensions, such as body length, chest circumference, and gumba/shoulder height, remains significant. Additionally, it

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has been shown that there exists a correlation between body weight and live weight/carcass weight when considering chest circumference measures. Based on the available evidence, it can be inferred that there is a positive correlation between age and body weight, and the resulting effect is a rise in carcass weight. Lestari (2017) demonstrates a statistically significant impact ($P<0.01$) of age on various parameters, including slaughter weight, carcass weight, meat weight, bone weight, and fat weight.

The age of livestock can be ascertained by examining the wear patterns of bovine incisors. The age of livestock can be ascertained by examining the wear patterns of their incisors. For instance, if there is a single set of fully developed permanent incisors, it can be inferred that the bovine in question is approximately 2.5 years old. The bovine specimens under consideration possess three sets of permanent incisors and are classified as cows between the ages of three and three and a half years. According to Masyita et al. (2015), the presence of four pairs of permanent incisors in a cow indicates that the cow is at least four years of age or older.

2.4. Carcass Weight

The carcass carries significant importance within the anatomy of an animal subsequent to the removal of blood, head, lower legs encompassing the carpal joints for the forelimbs and tarsal joints for the hind limbs, skin, as well as various organs including the lungs, throat, digestive tract, urinary tract, liver, spleen, heart, and associated adipose tissue (Mahardika, 2020).

There are several factors that influence the percentage of carcass composition. One such factor is the amount of fat present, as older cattle tend to store more fat compared to younger livestock. Additionally, the inclination of livestock to consume crude fiber leads to an enlarged digestive tract in the intestines. Moreover, if the quantity of feed and water provided is abundant, it can result in a lower percentage of carcass yield. Lastly, the presence of skin also contributes to the overall carcass composition. The size and thickness of carcasses significantly impact the overall carcass proportion. Both genetic and environmental factors play a significant role in determining the rate of growth and body composition, encompassing weight and carcass characteristics. In addition to the aforementioned factors, carcass composition can also be influenced by age, live weight, and development rate (Marino et al., 2020). The observed augmentation in carcass meat weight can be attributed to the concurrent rise in feed protein intake.

The carcass weight of individual Simmental cow exhibits variation based on factors such as the technique of cutting, fat thickness, and other contributing factors. According to Juandhi (2019), a beef calf is deemed to possess desirable qualities if it yields a carcass equivalent to

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59% of its total body weight, with 46.50% of the carcass being consumable meat. (Hetharia, 2021)asserts that several elements exert influence on carcass weight and percentage, including feed composition, age, live weight or slaughter weight, breed of cattle, sex, and hormonal influences. According to Neno (2018), there exists a strong correlation between body weight and carcass weight, as these two variables are inherently interconnected. Specifically, an increase in body weight is associated with a corresponding increase in the resulting carcass weight.

3. MATERIAL AND METHODS

The study was carried out in July 2023 in the Dimoro Animal Slaughterhouse, situated in the Sukorejo District of Blitar Regency. The sampling procedure was conducted in a random manner on a group of 30 Simmental-PO cattle, comprising 20 males and 10 females.

The research employed the field observation approach to gather data, specifically focusing on variables such as gender, age, body weight, and carcass weight. Ratnasari et al. (2015)proposed the utilization of the field observation approach, which involves the direct observation of things in their natural environment to gather data aligned with the researcher's specific research objectives. The process of sex determination in cattle involves the relocation of the animal from its resting site to the slaughter facility, when it is visually assessed using Simental-PO cattle as a reference. Age determination can be accomplished by quantifying the number of horn rings and the quantity of absent teeth. This age determination procedure is conducted prior to the animal's weighing process.

The weight of female cattle is ascertained subsequent to a period of rest, following which the animals are weighed prior to their slaughter. Subsequently, the bovine specimen undergoes the process of dissection and dermabrasion, wherein the internal organs are extracted, except the head, lower extremities, and reproductive organs of the male bovine or the mammary glands of the female bovine that has undergone parturition. This dissection may or may not involve the removal of the tail, resulting in the acquisition of a bovine carcass. Subsequently, the carcass is either divided longitudinally along the spine or left intact. Subsequently, the remains of the deceased animal are assessed for mass by employing a specialized weighing instrument designed specifically for measuring carcasses, thereby ascertaining the overall weight of the carcass.

The data collected was subjected to analysis utilizing the Pearson Bivariate Correlation and Multiple Linear Regression techniques within the SPSS 22 software..

4. RESULTS AND DISCUSSION

4.1. Average Cattle Carcass Weight by Gender and Age

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The present study involved the examination of carcass weight, sex, and age of Simmental-PO cattle. A total of 30 Simmental-PO cattle were included in the observations. The obtained results are as follows:

Table 1. Average Cattle Carcass Weight by Gender and Age

Age (year)	Total		Average Carcass Weight per Sex (kg)		Total (Average)
	Bull	Cow	Bull	Cow	
3	7		211,4		211,4
4	9	1	211,4	180	195,7
5	3	6	256,7	160	208,3
6	1	2	250	190	220
Rata-Rata	-	-	220,15	176,25	-
Jumlah	20	10	4403	1710	6113

The average carcass weight of male Simmental-PO cattle is higher in comparison to that of female Simmental-PO cattle. According to the data shown in Table 1, the mean carcass weight of male Simmental-PO cattle in the study was recorded as 220.15 kg, whilst the average carcass weight of females was documented as 176.25 kg. The disparity in weight is contingent upon the gender of the cattle specimen, with bulls exhibiting a greater carcass weight in comparison to cows. This finding aligns with the assertion made by Albertí et al. (2005) that male cattle exhibit a greater carcass weight in comparison to their female counterparts. In addition to the aforementioned factors, it is important to note that the weight at which an animal is slaughtered also has a significant impact on the quality of the meat obtained from the carcass.

The reason for the disparity in carcass weight between bulls and cows lies in the anatomical differences between the two sexes. Bulls possess larger muscular structures and a relatively lower proportion of adipose tissue, which accounts for their increased carcass weight compared to cows. This finding aligns with the study conducted by Blanco et al. (2020), which reported that bulls have a greater carcass weight and a higher percentage of carcass dressing when compared to cows and steers cattle. Additionally, their research revealed that bulls had a higher carcass proportion index and pelvic index in comparison to both cows and steers.

The mean carcass weight varied with age, with bulls at 5 years old exhibiting bigger weights compared to bulls at 6 years old. Similar fluctuations were observed in cows, where

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carcass weight declined between the ages of 4 and 5 years, but afterwards increased at 6 years old. In the interim, it is seen that the mean data for both males and females exhibited a rise in carcass weight as age increased, as depicted in Table 1. An elevation in carcass mass can be attributed to the imbalanced development of bodily tissues and organs. This finding aligns with the assertion made by Stimbirys et al. (2016) that the differential growth intensity observed in tissues and organs contributes to the augmentation of carcass weight during the developmental phase of cattle.

4.2. Correlation of Sex and Age on Carcass Weight

Table 2. Sex and Age Bivariate Correlation Test Results on Carcass Weight

		Bobot Karkas (Y)
Jenis Kelamin (X1)	Pearson Correlation	.495**
	Sig. (2-tailed)	.005
	N	30
Umur (X2)	Pearson Correlation	-.108
	Sig. (2-tailed)	.571
	N	30

**. Correlation is significant at the 0.01 level (2-tailed).

The results from the Pearson Bivariate Correlation analysis presented in Table 2 indicate a statistically significant association between sex and carcass weight (sig. ≤ 0.05). However, the analysis did not reveal a significant relationship between age and carcass weight (sig. > 0.05). The previous statement contradicts the findings of (Nuraini et al., 2018), who posit that there exists a positive correlation between age and live weight in livestock, thereby influencing the proportions of fat, muscle, and bone.

In addition to fat content, carcass weight can be influenced by factors such as body conformation and the quality and quantity of feed provided. This aligns with the assertion made by Sebsibe (2008) that carcass weight is influenced by various parameters, including the quality and quantity of feed, body conformation size, gender, slaughter weight, and the breed or strain of the animals being raised. The carcass weight of cattle is also influenced by gender due to the differential growth rates observed between male and female cattle (Nuraini et al., 2018).

4.3. Regression Analysis Between Sex, Age and Carcass Weight of Simmental-PO Cattle

The results obtained from the multiple linear regression analysis presented in Table 3 indicate that the Coefficient of Determination (R2) has a value of 0.313. This finding indicates that approximately 31.3% of the variables influencing the carcass weight of Simmental-PO

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cattle may be attributed to the parameters of sex and age of the cattle. The remaining 68.7% originates from additional characteristics that were not analyzed in the present study.

Table 3. Coefficient of Determination for Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.560[a]	.313	.262	40.872

Table 4. Multiple Linear Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	17.887	69.339		.258	.798
Jenis Kelamin (X1)	69.943	20.318	.705	3.442	.002
Umur (X2)	15.994	9.798	.334	1.632	.114

The data obtained from doing a regression analysis using SPSS 22 are presented in Table 4. The results indicate that the constant term in the multiple linear regression model for this particular research has a value of 17.887. The coefficient for gender in the linear regression model is 69.943, while the coefficient for age is 15.994. The resultant values can be utilized to build a regression equation, specifically:

$$\mathbf{Y = 17{,}887 + 69{,}943\ X_1 + 15{,}994\ X_2}$$

Table 4 illustrates the correlation between sex and body weight. According to the results of the t-test, there is a statistically significant impact of sex on carcass weight, as indicated by the calculated t-value exceeding the critical value from the t-table. The mean carcass weight of male cattles, commonly referred to as bulls, is significantly higher compared to that of female cattles, known as cows, with respective values of 220.15 kg and 176.25 kg. This finding aligns with the research conducted by Blanco et al. (2020), which reported that the average carcass weight of a Pirenaica bull is 290 kg, while that of a female Pirenaica is 273 kg.

The carcasses of bulls are larger than those of cows, but cows have more fat. According to the conclusion reached by Ćirić et al. (2017), bulls have a greater quantity of meat than female cows do. This finding is consistent with their research. In addition to this, when compared to cows, bulls have a larger forequarter as well as a larger hindquarter.

The carcass weight of bulls surpasses that of their cows counterparts due to the accelerated growth rate exhibited by bulls in comparison to cows. The growth rate of the bull is additionally regulated by endogenous hormones present within its physiological system. This

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aligns with the perspective put forth by Setiyono (2017), positing that gender exerts an influence on steroid hormones. This interaction is established due to the influence of testosterone (an androgen hormone) produced by the testes, which results in accelerated growth rates in bulls compared to cows.

The relationship between the age of Simmental-PO cattle and carcass weight can be seen in table 4. The results of multiple linear regression analysis based on the t test, the age of Simmental-PO cattle did not have a significant effect on carcass weight (t count < t table). This is not in line with the research by Stimbirys et al. (2016) which stated that age affects slaughter weight and carcass weight, namely the best carcass weight is when cattle are slaughtered at 29 months rather than 22 months. Meanwhile, in this study, 6 years old bulls had lower carcass weight than 5 year old bulls. A 4 years old cow has a higher carcass weight than a 5 years old cow.

According to the study's results of Nuraini et al. (2018), there exists a significant relationship between the age of the carcass and its weight, indicating that as the age of the carcass increases, so does its weight. The interplay between sex and age has a significant impact on the synthesis of adipose tissue in corpses following the onset of puberty. The fat content in female cattle flesh is often higher compared to that of male animals. The assertion made by (Nuraini et al., 2018) affirms that carcasses primarily consist of two basic constituents, namely muscular tissue (often referred to as meat) and bones. The rate of development of these primary constituents transpires between the ages of 1 and 3 years, ceasing at 3 years of age, hence exerting an influence on the bovine's body mass.

Besides the factor of age, the carcass weight can also be influenced by the type of nutrition and rearing strategy employed. This finding aligns with the assertion made by (Nurwantoro et al., 2012)that cattle housed indoors and provided with concentrate feed exhibit greater daily body weight increase and marbled fat compared to cattle maintained outside and fed with forage. Furthermore, the hue of the meat exhibits enhanced brightness, while its texture is notably soft. According to de Carvalho & Ngadiyono (2010), the weight of carcasses in livestock is affected by the intake, quality, and nutritional composition of the nutrients present in their diet.

5. CONCLUSION

The conclusions of the study indicated a significant correlation between gender and carcass weight, but no statistically significant correlation was observed between age of the cattle and carcass weight. This observation aligns with the concept of regression testing, wherein a statistically significant association is found between sex and carcass weight, whereas no statistically significant association is shown between age and carcass weight. The regression

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equation derived from the conducted research can be expressed as Y = 17,887 + 69,943X1 + 15,994X2. The variables of gender and age accounted for just 31.3% of the overall impact on carcass weight, with the remaining 68.7% attributed to unobserved factors in this study.

The research proposes the need for additional observations to ascertain the correlation between elements beyond age and sex that may impact the carcass weight of Simmental-PO cattle. This includes investigating the quality, amount, and composition of the feed provided.

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