

Body size performance (shoulder height, body length, and chest size) of Murrah Buffalo (Case study in Pagar Merbau Subdistrict, Deli Serdang Regency, North Sumatra)

Alvin Syah Muhammad Noor¹, Didin Supriat Tasripin², Bambang Kholiq Mutaqin^{3*}

¹Faculty of Animal Husbandry, Universitas Padjadjaran, Indonesia

² Department of Animal Production, Faculty of Animal Husbandry, Universitas Padjadjaran, Indonesia

³ Department of Animal Nutrition and Feed Technology, Faculty of Animal Husbandry, Universitas Padjadjaran, Indonesia

*Corresponding author: kholiq@unpad.ac.id

ABSTRACT

The research on the body measurements of female and male Murrah Buffalo was carried out in December 2023 on Pagar Merbau Subdistrict, Deli Serdang Regency, North Sumatra. The research aimed to know body measurements, including shoulder height, body length, and chest size, of Murrah Buffalo which were aged <1.5 years old, 1.5-3.5 years old and >3.5 years old on Pagar Merbau Subdistrict. The number of buffalo studied was 113, including 99 female buffalo and 14 male buffalo. The research method uses a descriptive quantitative method with a case study approach. Data collection uses the snowball sampling technique. The results showed that the averaged shoulder height of Murrah Buffalo females aged <1.5 years old, 1.5-3.5 years old and >3.5 years old were 89.82 ± 15.77 cm, 124.67 ± 3.25 cm, and 135.65 ± 6.24 cm; in males, they were 84.79 ± 16.40 cm, 121 cm, and 147 cm, respectively. Meanwhile, the average body length in females was 83.50 ± 26.74 cm, 122.73 ± 2.92 cm, and 131.26 ± 6.23 cm; in males, it was 89.67 ± 23.04 cm, 119 cm, and 151 cm, respectively. Furthermore, the average chest size in females was 102.82 ± 24.73 cm, 189.15 ± 13.76 cm, and 202.61 ± 12.24 cm; in males, it was 106.33 ± 26.13 cm, 201 cm, and 209 cm. The conclusion is that the body size of the Murrah buffalo in Pagar Merbau District, Deli Serdang Regency, is relatively proportional to the body size of the cheap buffalo.

Keywords: Body Length, Body Size, Chest Size, Murrah Buffalo, Shoulder Height

INTRODUCTION

Buffalo is one of the livestock with great potential for development, because buffalo have advantages compared to cattle, namely that they can live in various environmental conditions, can adapt to low-quality feed, and have a high ability to digest crude fiber compared to other ruminants (Piatkowska et al., 2010). There are two types of buffalo commonly found in Indonesia: The Swamp Buffalo, a type of buffalo for meat, and the River Buffalo, a dual-purpose type of buffalo. River buffalo generally live in humid environments, have large bodies, thick skin, wide ears, and sturdy legs, and are used as dairy buffalo for milk production, which is the Murrah Buffalo.

Murrah Buffalo are often found in the regions of North Sumatra and Aceh. Farmers typically raise buffaloes for various purposes, such as ploughing fields, transporting goods, and producing milk. North Sumatra is one of the provinces with the largest buffalo population and

experiences fluctuations yearly; there were 94,214 head in 2021 and 98,246 head in 2022. Deli Serdang Regency contributed to the buffalo population in 2021 with 1,838 head and in 2022 with 1,850 head (Badan Pusat Statistik, 2023b). The percentages of dairy buffaloes by age in North Sumatra are divided into three categories: Calves (<1 year) at 13.74%, young (1-2 years) at 12.02%, and adult (>2 years) at 74.24% (Ditjen PKH, 2022).

Murrah Buffaloes can help meet the increasing national demand for milk each year by boosting their population through improved reproductive performance and enhancing milk production capabilities through better management of care, feed, and health (Matondang & Talib, 2015). Therefore, selecting buffaloes for breeding stock depends on their qualitative and quantitative characteristics. Quantitative characteristics to consider include body size, such as shoulder height, body length, chest size, and the age of the livestock. These measurements can be used to predict the buffalo's body weight. Genetic and environmental factors determine these quantitative characteristics. In addition to paying attention to feed composition, the genetics of the livestock also influence growth and weight gain in buffaloes. Therefore, this study aims to determine the body size characteristics (shoulder height, body length, and chest size) of Murrah Buffaloes in Pagar Merbau Subdistrict, Deli Serdang Regency, North Sumatra.

MATERIALS AND METHODS

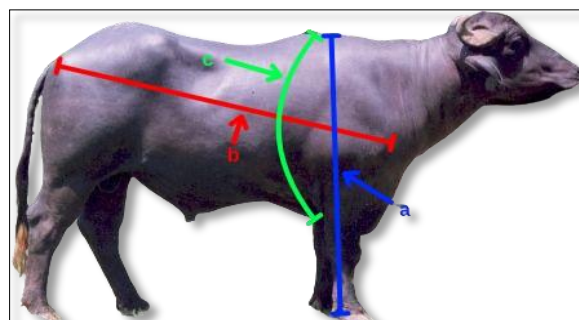
Research objects and location

The research objects are 113 Murrah Buffaloes grouped by age: calves (<1.5 years), young buffaloes (1.5-3.5 years), and adults (>3.5 years), located in Pagar Merbau Subdistrict, Deli Serdang Regency, North Sumatra.

Research method and variable measurement

The variables observed in this study are body measurements. The measurement procedure follows the (Badan Standardisasi Nasional, 2020) guidelines, which include:

- Shoulder Height: The vertical distance from the ground to the highest point of the shoulder behind the withers (*os scapula*), measured with a measuring stick in centimetres.
- Body Length: The distance from the shoulder point (*tuberositas humeri*) to the end of the pelvic bone (*tuber ischii*), measured with a measuring stick in centimetres.
- Chest Size: The circumference of the chest cavity behind the wither (*os scapula*), measured with a tape measure in centimetres.



Note: a) Shoulder Height, b) Body Length, c) Chest Size
Figure 1. Measurement of Murrah Buffalo Body Size

The research method used is a case study approach. Data sampling is conducted using the *Snowball Sampling* technique. *Snowball Sampling* is a method used to identify, select, and collect samples within an ongoing network or chain of relationships. It involves creating a

sociogram, a diagram of circles connected by lines. Initially, the sample size is small but grows larger as the process continues (Nurdiani, 2014).

Statistical Analysis

The collected data is analyzed using descriptive analysis methods. Descriptive analysis is a form of analysis that presents distribution or frequency in the form of tables, diagrams, or narratives (Malik, 2018). The purpose of this analysis is to present data in a simple manner so that it can be easily read and analyzed. The data used in this study includes Murrah Buffalo's body measurements, specifically shoulder height, body length, and chest size.

The collected data is then processed descriptively, resulting in the mean, minimum and maximum values, standard deviation, and coefficient of variation. These values can be determined using the following formulas:

1. Mean (Average)

Quantitative data is calculated by dividing the total sum of values by the number of data points.

$$\mu = \frac{\sum xi}{N}$$

Note: μ = population mean
 $\sum xi$ = sum of data values
 N = number of data points

2. Minimum

The minimum value is used to determine the lowest value of the observed variable.

3. Maximum

The maximum value is used to determine the highest value of the observed variable.

4. Standard Deviation

Standard deviation determines how close the data from the statistical sample is to the mean. Standard deviation is the square root of the variance. Variance is the sum of the squares of all individual deviations from the mean.

$$\sigma = \sqrt{\frac{\sum (xi - \mu)^2}{N}}$$

Note: σ = population standard deviation
 N = number of data points
 xi = value of the i variable
 μ = population mean

5. Coefficient of Variation

The coefficient of variation is a measure used to determine the spread/distribution of data relative to the mean.

$$CV = \frac{\sigma}{\mu} \times 100$$

Note: CV = Coefficient of Variation
 σ = population standard deviation

μ = Population mean

RESULTS AND DISCUSSION

General Condition of Pagar Merbau Subdistrict

Pagar Merbau is a Subdistrict located in the Deli Sedang Regency, North Sumatra. Pagar Merbau Subdistrict covers an area of 62.89 km² and is geographically situated between 3°48' North Latitude and 98°49'-98°91' East Longitude with an average elevation of 12 meters above sea level (Badan Pusat Statistik, 2023a). Pagar Merbau Subdistrict is generally hot and has a tropical climate with two seasons: the rainy and dry seasons. There are 2 Murrah Buffalo farms in Pagar Merbau Subdistrict: Mr. Toni's Farm and Mr. Narinder's Farm. The population of Murrah Buffalo in Pagar Merbau Subdistrict can be seen in Table 1.

Table 1. Murrah Buffalo Population in Pagar Merbau Subdistrict

No.	Buffalo Classification	Male	Female	Population (heads)
1	Adult Buffalo	1	55	56
2	Young Buffalo	1	30	31
3	Calves	12	14	26
Total Population				113

Feeding Management

Feed is given to livestock to be eaten and partially or wholly digested without harming the animal's health (Subekti, 2009). Farmers in Pagar Merbau Subdistrict support the genetic potential of Murrah Buffaloes for optimal production and good growth performance by providing good feed management. The feed provided in Pagar Merbau Subdistrict comes in two forms: pasture grass when grazing and rations when penned.

The type of grass provided is grass that grows in oil palm plantation areas, such as pasture grass, which is given by grazing the Murrah buffalo around the oil palm plantations. The feeding is also supplemented with rations. These feed ingredients are obtained from raw materials such as tofu pulp, cassava pulp, and palm kernel meal. Feeding by grazing in both farms is due to the barn locations being near oil palm plantations, and the amount of feed consumed by the buffaloes is solely based on their grazing ability.

Housing

Mr. Toni's Murrah Buffalo farm consists of one building divided into four sections: an adult buffalo barn, a calf barn, a nursing barn, and an isolation barn. The barn faces west to ensure the animals receive adequate sunlight. The floor is made of cement with a slope towards the center for drainage of waste and urine, making it easy to clean. The feed and water troughs are made of cement and attached to the barn walls. The walls are made of cement, and the door is made of metal.

Meanwhile, Mr Narinder's Murrah Buffalo farm consists of one building divided into four sections: an adult buffalo barn, a young buffalo barn, a calf barn with a raised platform, and a milking barn. The floor is made of cement, flat with a slight slope towards the center for the adult barn, and sloping to the sides for the young buffalo barn. The feed and water troughs are made of cement and are placed in the centre of the barn for the adult buffalo and along the walls for the young buffalo and calves. The walls are made of cement and wood, and the door is made of wood.

Management Practices

There are three livestock management systems: extensive, semi-intensive, and intensive (Susilorini, 2008). The management system used at Mr. Toni's and Mr. Narinder's farms is semi-intensive, which combines pasture (grazing) and intensive systems. In semi-intensive

management, practised by farmers in areas with grazing land, livestock are grazed in plantation areas, such as oil palm or rubber plantations, during the day, and housed back in the barn at night. This system benefits farmers by not requiring additional labour for feed provision when using the cut-and-carry system. However, this setup is not always flexible, as plantation owners generally do not permit grazing in plantation areas (Romjali, 2019).

Description of Murrah Buffalo Shoulder Height Data

Shoulder height is the highest point of the shoulder behind the withers (*os scapula*), aligned with the front legs. Shoulder height can be measured using a measuring stick. It is believed to be related to growth. The increase in buffalo shoulder height at each factor (Asri, 2023). The growth phase from birth to puberty is characterized by a rapid growth rate (Latulumamina, 2013). The results of the shoulder height analysis of female and male Murrah Buffaloes in Pagar Merbau Subdistrict, Deli Serdang Regency, are shown in Table 2.

Table 2. Description of Shoulder Height by Age

	Female			Male		
	Age (year).....					
	<1.5	1.5-3.5	>3.5	<1.5	1.5-3.5	>3.5
N (head)	14	30	55	12	1	1
$\bar{x}$ (cm)	89.82	124.67	135.65	84.79	121	147
Min (cm)	72.00	119.00	124.50	67.00	0	0
Max (cm)	120.00	130.00	151.00	120.50	0	0
SD (cm)	15.77	3.25	6.24	16.40	0	0
CV (%)	17.56	2.61	4.60	19.34	0	0

Notes: N = Number of Population, $\bar{x}$ = Mean, SD = Standard Deviation, KV = Coefficient of Variation

Based on the research results in Table 2, the average shoulder height of female Murrah Buffaloes aged <1.5 years, 1.5-3.5 years, and >3.5 years is 89.82 ± 15.77 cm, 124.67 ± 3.25 cm, and 135.65 ± 6.24 cm, and for males, it is 84.79 ± 3.25 cm, 121 cm, and 147 cm. These results are higher than the study by Matondang and Talib (2015), which reported 78.8 ± 30.2 cm for female calves and 66.5 ± 36.6 cm for male calves. These results are also higher than the study by Gerli et al. (2016), which reported 122 ± 5.02 cm for young females and 115.5 ± 4.95 cm for young males. The shoulder height of adult buffaloes in this study is also higher compared to the study by Gerli et al. (2016), which reported 133.00 ± 4.60 cm for females, and the study by Krisnandi et al. (2013), which reported 113.8 ± 5.9 cm, as well as the study by Sitorus & Anggraeni (2008), which reported 132 cm for males.

Based on the coefficient of variation in Table 2, it is evident that the shoulder height data of Murrah Buffaloes in Pagar Merbau Subdistrict are homogeneous for both female and male calves, young, and adult buffaloes. This is in line with the opinion of (Sampurna & Nindhia, 2017) that a livestock population is considered homogeneous if it has a coefficient of variation value of $\leq 30\%$. The coefficient of variation is considered a measure of relative variability, with differences caused by unequal numbers of livestock in each category.

The shoulder height of female and male Murrah Buffaloes in Pagar Merbau Subdistrict has shown good growth. According to Manggung RRR (1979), shoulder height influences body weight growth because it can estimate body weight; as shoulder height increases, the chest becomes deeper, leading to muscle development in the chest and larger body size, indicating heavier weight.

Description of Murrah Buffalo Body Length Data

Body length is a key measurement of livestock that can be used to estimate its compactness. Along with body weight and shoulder height, it significantly affects livestock performance,

especially in relation to body weight. Table 3 shows the results of the body length analysis of female and male Murrah Buffaloes in Pagar Merbau Subdistrict, Deli Serdang Regency.

Based on the research results in Table 3, the average body length of female Murrah Buffaloes aged <1.5 years, 1.5-3.5 years, and >3.5 years is 83.50 ± 26.74 cm, 122.73 ± 2.92 cm, and 131.26 ± 6.23 cm, and for males, it is 89.67 ± 23.04 cm, 119 cm, and 151 cm. The results for female and male calves show higher data than the study by Matondang & Talib (2015), which reported 76.1 ± 28.7 cm for females and 62.4 ± 32 cm for males. The results for young females also show higher data compared to the study by (Praharani & Triwulaningsih, 2008), which reported 118.91 cm, while the results for young males are lower compared to the study by (Gerli et al., 2016), which reported 122 ± 1.41 cm. The results for adult females show higher data than the study by Tantriani (2023), which reported 123.2 ± 4.94 cm; for males, it was 126.8 ± 5.04 cm. Body length is influenced by age and sex. According to Erlangga et al. (2018), differences in body size, such as body length, are influenced by the age of the livestock, sex, genetics, feed, and management practices.

Table 3. Description of Body Length by Age

Description	Female			Male		
	Age (year).....					
	<1.5	1.5-3.5	>3.5	<1.5	1.5-3.5	>3.5
N (heads)	14	30	55	12	1	1
$\bar{x}$ (cm)	83.50	122.73	131.26	89.67	119	151
Min (cm)	52.00	117.00	115.00	56.00	0	0
Max (cm)	118.00	129.00	147.00	120.50	0	0
SD (cm)	26.74	2.92	6.23	23.04	0	0
CV (%)	32.02	2.38	4.75	25.70	0	0

Notes: N = Number of Population, $\bar{x}$ = Mean, SD = Standard Deviation, CV = Coefficient of Variation

Based on the coefficient of variation in Table 3, the body length data of Murrah Buffaloes in Pagar Merbau Subdistrict are homogeneous except for female calves. The female calves show a lack of homogeneity, with a coefficient of variation of 32.02%. According to (Sampurna & Nindhia, 2017), a livestock population is considered homogeneous if it has a coefficient of variation value of $\leq 30\%$. The coefficient of variation is considered a measure of relative variability, with differences caused by the unequal number of livestock in each category. The lack of homogeneity in female calves occurred because some female calves were only 3-4 weeks old at the time of measurement. This results in a significant difference in body length compared to female calves aged 6-9 months.

Body length is a quantitative trait influenced by genetic and environmental factors such as feed and management practices. High-nutrient feed will have a different impact on growth compared to low-nutrient feed. Regular feeding supported by optimal management practices will help increase the body size of livestock (Pålsson & Vergés, 1952).

Description of Murrah Buffalo Chest Size Data

Chest size is closely related to body weight; an increase in body weight typically accompanies an increase in chest size. This is because an increase in chest size reflects the growth of muscles and fat in that area. This is in line with the opinion of (Diwyanto & Martojo, 1984) (Diwyanto & Martojo, 1984) that chest size has the highest correlation value with other body measurements across all age levels. The results of chest size analysis in female and male Murrah buffaloes in Pagar Merbau District, Deli Serdang Regency, are shown in Table 4.

Based on the research results presented in Table 4, the average chest size of Murrah buffaloes, both female and male, aged <1.5 years, 1.5-3.5 years, and >3.5 years, are as follows:

102.82±24.73 cm, 189.15±13.76 cm, and 202.61±12.24 cm for females, and 106.33±26.13 cm, 201 cm, and 209 cm for males. The study reveals that the chest size measurements of both female and male Murrah buffaloes in Pagar Merbau District are consistent across different age categories, as indicated by the coefficients of variation (CV) presented in Table 4. According to (Sampurna & Nindhia, 2017), livestock populations are considered uniform if the coefficient of variation is $\leq 30\%$, which is observed in this study.

Table 4. Description of Chest Size by Age

Description	Female			Male		
	Age (years).....					
	<1.5	1.5-3.5	>3.5	<1.5	1.5-3.5	>3.5
N (heads)	14	30	55	12	1	1
$\bar{x}$ (cm)	102.82	189.15	202.61	106.33	201	209
Min (cm)	73.00	156.00	180.00	73.00	0	0
Max (cm)	146.50	204.00	237.00	163.00	0	0
SD (cm)	24.73	13.76	12.24	26.13	0	0
CV (%)	24.06	7.27	6.04	24.57	0	0

Notes: N = Number of Population, $\bar{x}$ = Mean, SD = Standard Deviation, CV = Coefficient of Variation

Comparative analysis with previous studies shows higher chest size values in both female and male Murrah buffaloes compared to (Matondang & Talib, 2015), where values were 101.7±40.9 cm for females and 90.3±50.2 cm for males, and (Gerli et al., 2016), where values were 155.33±7.17 cm for females and 162.50±6.36 cm for males. Additionally, the adult females and males in this study also exhibit higher measurements compared to (Sitorus & Anggraeni, 2008), with values of 202.59 cm for females and 195.00±11.36 cm for males.

The analysis of chest size descriptions indicates robust growth in female and male Murrah buffaloes. Optimal growth patterns in livestock depend on management systems, nutrition levels, health, and climate factors, while genetic factors, feed quality, and sex also influence livestock growth potential (Hasnudi, 2005). (Budiharjo, 1985) adds that good husbandry practices significantly affect body weight growth.

CONCLUSION

Based on the results and discussion, it can be concluded that the body size of Murrah buffalo, both female and male, aged <1.5 years, 1.5-3.5 years, and >3.5 years, shows consistent figures. The body size of Murrah buffalo in Pagar Merbau District, Deli Serdang Regency, is categorized as proportional for the buffalo's general size.

CONFLICT OF INTEREST

A statement that there is no conflict of interest with any party regarding the material discussed in the article, funding, and differences of opinion between the authors.

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