Classification of linear properties of participated cow body used in progeny test in east java

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Abstract. This study aims to classify the linear characteristics of the lactation cow's body as Participated Cow used in the progeny test of dairy cows at KAN Jabung, Malang, East Java. Linear body traits, such as udder characteristics reflect milk production capability. The study involved 180 lactating cows. The research method employed a survey approach with data collection through purposive sampling, focusing on lactating cows based on specific criteria. Data analysis was conducted using descriptive analysis, calculating mean value, maximum and minimum values, value of diversity and standard deviation. The results indicated that the Participated Cow linear characteristics including front leg strength, rear leg position, body depth, buttock angle, front randomized angle, rear randomized angle, udder height, udder width, udder depth, front nipple length and back nipple length respectively had a score of 5; 5; 5,5; 4; 5,5; 5; 7; 3; 5; 5; 4. In conclusion, linear classification on PC that meets the ideal score is only 3 variables: hind legs, udder depth and nipple length with a percentage of 27.27%, so further research is needed to evaluate linear properties of PC so that it can be used as a guideline for the selection of PC in the progeny test.

1 Introduction

Dairy cows in Indonesia are predominantly of the Friesian Holstein breed and its offspring (PFH) which are primarily raised smallholder farmers for milk production. Milk production is influenced by both genetic and environmental factors. To optimize milk production, it is necessary to enhance genetic quality through targeted selection program, such as progeny testing. Selection is not limited to males, but can also be applied to female dairy cows [7].

Selection criteria for female dairy cows often focus on performance. Proper evaluation of Participated Cow can effectively improve the genetic quality and milk production of dairy herds. Linear body traits includedthe position of the front legs, body depth, rear foot position, buttock angle, random angle, udder height, udder width, udder depth, and nipple length. Linear type classification serve a crucial tool in the decision-making process, with the aim of selecting animals that express their productive and reproductive potential

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through their phenotypic characteristics, thereby contributing to a longer productive lifespan of livestock [5]. Linear body traits can be assessed according to the guidelines provided by the World Friesian Hosltein Association. [6] Explaining that the linear classification of cattle bodies has an important function in improving the genetic quality of livestock, but there has not been much assessment in people's farms. The qualitative nature of the body has strategic value both in the indirect selection program along with the main production nature of dairy cattle, namely milk production. The purpose of this study is to classify the performance of linear body traits in participated cow used in progeny test programs in the East Java region.

2 Materials and methods

2.1 Research materials

This research was conducted from August to December 2023 among farmers who are members of the Jabung KAN (Agro Niaga Cooperative), Malang, East Java. The research involved 180 participated cows (PC) as research subjects.

2.2 Research methods

Data collection encompassed both primary and secondary data through purposive sampling. Primary data were gathered directly during observations, focusing on traits such as, hind legs position, body depth, buttock angle, front randomized angle, rear randomized angle, udder height, udder width, udder depth, front nipple length and back nipple length. Secondary data served as supporting information and included details about farmers, population, age, and feeding practices.

2.3 Research preparation

- Obtain permission from KAN Jabung to conduct the research.
- Survey the research locations in Hamlet Dempok, Gading Kembar, and Gunung Kunci, Jabung Sub-District, Malang Regency.
- Select 180 heads of Crossbreed Friesian Holstein (CFH) during lactation period to be used in the research.

2.4 Data collection

The research variables are hind legs position, body depth, buttock angle, front randomized angle, rear randomized angle, udder height, udder width, udder depth, front nipple length and back nipple length (Table 1).

2.5 Data analysis

The research method employed a survey method and data were analyzed descriptively by calculating mean values, minimum and maximum values, and standard deviation.

Average or mean value ($\bar{X}$)

$$(\bar{X}) = \frac{\sum xi}{\mathrm{n}} \qquad (1)$$

Information:
($\bar{X}$) : the mean value of each variable
∑xi : total data value
n : amount of data
i : 0, 1, 2,...n

Variety (S^2)

$$S^2 = \frac{n\sum xi^2 - \sum xi^2}{n\,(n-1)} \qquad (2)$$

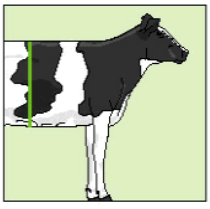
Information:
S^2 : variety value
n : amount of data
xi : number of a variable
i : 0, 1, 2,…n

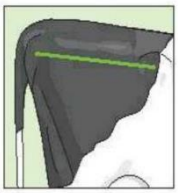
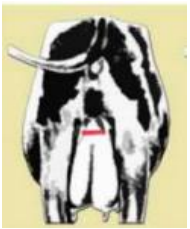
Standard deviation (SD)

$$SD = \sqrt{S^2} \qquad (3)$$

Information:
SD : Standard deviation
S : variety

Table 1. Observed variables and how to measure them

Linear Properties	Code	Information	Picture
Chest Width	CW	The strength of the front legs can be observed or measured using a ruler, commonly referred to as chest width	 1
Rear Legs Rear View	RLRV	The position of the hind legs can be determined by observing whether they are close together or apart	 1
Body Depth	BD	Measurement can be done using a measuring stick, especially around the rib cage	

Rump Angle	RA	Observation from the side helps determine the angular shape of the rump section indicated by the hip bone and pin bone	 1
Front Foot Angle	FFA	The assessment of the front randomized angle assessment can be made from the front side	 1
Rear Foot Angle	RFA	The rear randomized angle assessment can be made from the rear side	 1
Rear Udder Height	RUH	The linkage of the rear udder is determined by its height; a high rear udder indicates greater udder capacity	 1
Rear Udder Width	RUW	The width of the rear udder linkagecan be determined from the rear view	
Udder Depth	UD	Udder depth is measured between the floor and the udder, relative to the hock	 1

Front Teat Length	FTL	The length of the front teatcan be measured from a side view	
Rear Teat Length	RTL	The length of the front putting can be measured from the side appearance	

3 Results

Based on the variety analysis data, it shows that each qualitative trait of participated cow in the KAN Jabung area falls within intermediate category. Front foot strength (CW) scored 5; hind foot position (RLRV) scored 5; body depth (BD) scored 5.5; butt angle (RA) scored 4; front randomized angle (FFA) scored 5.5; rear randomized angle scored 5; udder height (RUH) scored 7; udder width (RUW) scored 3; udder depth (UD) scored 5; front nipple length (TL) scored 5; and nipple length (TL) scored 4. This classification aligns with the guidelines of the World Friesian Holstein Association [8], which explains that the linear s body traits of cows are measured using linear values ranging from 1-9 and are categorized as short/narrow, intermediate, or high/tall.

Table 2. The results of qualitative properties in Participated Cow

Qualitative Properties	Min	Max	Average	Standard deviation	Score	Ideal Score	Category
Cheast Width (cm)	8	33	19	3,8	5	7	Intermediate
Rear Legs Rear View (cm)	1	24	5	3,4	5	5	Intermediate
Body Depth (cm)	53	92	78	5,1	5,5	7	Intermediate
Rump Angle	-5	10	4	2,4	4	5	High pins
Front Foot Angle (°)	40	70	53	7,6	5,5	7	Intermediate angle
Rear Foot Angle (°)	30	70	51	8,8	5	7	Intermediate angle
Rear Udder Height (cm)	11	28	18	3,2	7	9	High
Rear Udder Width (cm)	6	34	13	4,9	3	9	Narrow rear udder
Udder Depth (cm)	10	37	21	4,4	5	5	Intermediate
Front Teat Length (cm)	3	8	5	1	5	5	Intermediate
Rear Teat Length (cm)	2	6,5	4	0,7	4	5	Intermediate

4 Discussion

Linear type classification is a crucial tool in the decision-making processes as it aims to select animals that exhibit their productive and reproductive potential through their phenotypic characteristics, thereby contributing to a longer productive lifespan of livestock [5]. The assessment of linear traits describes the morphological features of dairy cows, focusing on specific characteristics. However, there is a lack of harmonization in the traits assessed across different breeds, it challenging to compare phenotypic values between breeds [1].

There are differences in the rump angle, udder width and udder height. The butt angle, scoring 4, falls into high pins category, also referred to as oblique rump. The butt angle connects several vital anatomical structures through the pelvic region, essentially linking the cow's buttocks and waist to its legs, limbs and mammary system. Inadequate strength in these body parts can disrupt a dairy cow's productivity [3]. The udder width falls into the narrow category, while the udder height is categorized as high. According to [5] linear traits in dairy cows are heritable and have phenotypic and genetic correlation with longevity in Holstein dairy cows.

The linear traits of dairy cows, such as udder and nipple size, tend to increase with age. Deep udders and long nipples are more succeptible to mastitis compared to smaller udders and nipples [9]. The Holstein Foundation [4] suggest that the ideal pelvic angle or buttock angle is achieved when the pins bone is slightly below the hook bone. [2] Identified ideal value for linear traits in Holstein dairy cows including: forelimb strength (CW) with an ideal value of 9; body depth (BD) with an ideal value of 9; hind leg standing (RLRV) with an ideal value of 9; butt angle (RA) with an ideal value of 5; front randomized angle (FA) with an ideal value of 7; udder height (RUH) with an ideal value of 9; udder width (RUW) has an ideal value of 9; udder depth (UD) with an ideal value of 5; and nipple length (TL) with an ideal value of 5.

5 Conclusions

The conclusion of this study is that the linear classification on PC that meets the ideal score is only 3 variables: hind legs, udder depth and nipple length with a percentage of 27.27%, so further research is needed to evaluate the linear properties of PC so that it can be used as a guideline for the selection of PC in the future progeny test program.

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