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Bovine herd evaluation of the dairy herd of the faculty of agricultural sciences - Universidad Tecnica Luis Vargas Torres de Esmeraldas

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Abstract

This study was framed within the line of research of the Faculty of Agricultural Sciences entitled: production, management and sustainable development of agricultural, livestock and forestry products with an ecosystem approach. In addition, it was aligned with the sub-line of the Zootechnics career: comprehensive local, regional and national livestock development and management. The main objective was to evaluate the biometric characteristics of the dairy herd belonging to the Faculty of Agricultural Sciences. 100% of the cows that give birth were used as experimental units. The study did not use an experimental design, it only used descriptive statistics through quantitative and observational methods. The

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experimental variables were: Height of the haunch and withers, Width of the rump and pelvis, length of the rump, depth of the body, depth of the udder, height of the posterior insertion of the udder cm, Diameter and length of the teats. The results obtained were subjected to the following statistical tests: measures of central tendency (means) and Pearson correlation analysis. The rump width was 53.38±1.29 cm. The width of the pelvis was 20.08±0.67 cm, the height of the udder insertion in the cattle was 18±1.52 cm. The width of the rump and pelvis presented an average correlation of 0.58, where, by increasing one characteristic, the other would also improve. The morphometric characteristics evaluated in the dairy herd presented important values, where a desirable intermediate height, intermediate depth, rump width and pelvis width favorable in the production and reproduction of the cows were recorded.
Key words: Measurements, Correlation, Bovinometry, Zoometry.

Evaluación bovinometrica del hato lechero de la facultad de ciencias agropecuarias - Universidad Técnica Luis Vargas Torres de Esmeraldas

Resumen

Este estudio se enmarcó dentro de la línea de investigación de la facultad de Ciencias Agropecuarias titulada: producción, manejo y desarrollo sustentable de los productos agrícolas, pecuarios y forestales con enfoque de ecosistema. Además, se alineó con la sub línea de la carrera de Zootecnia: desarrollo y manejo pecuario integral local, regional y nacional. El objetivo principal fue evaluar las características biométricas del hato lechero perteneciente a la Facultad de Ciencias Agropecuarias. Se utilizó como unidades experimentales el 100% de las vacas que presentan un parto. El

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estudio no utilizó un diseño experimental, únicamente empleó estadística descriptiva a través de métodos cuantitativos y observacional. Las variables experimentales fueron: Altura del anca y cruz, Ancho de grupa y de la pelvis, largura de la grupa, profundidad del cuerpo, profundidad de la ubre, altura de la inserción posterior de la ubre cm, Diámetro y largo de los pezones. Los resultados obtenidos fueron sometidos a las siguientes pruebas estadísticas: medidas de tendencia central (medias) y análisis de correlación de Pearson. El ancho de grupa fue de 53,38±1,29 cm. El ancho de pelvis fue 20,08±0,67 cm, la altura de la inserción de la ubre en los bovinos fue de 18±1,52 cm. El ancho de grupa y pelvis presentó una correlación media de 0,58, donde, donde al incrementar una característica, mejoraría también la otra. Las características morfométricas evaluadas en el hato lechero presentaron valores importantes, donde se registró una estatura intermedia deseable, profundidad intermedia, ancho de grupa y ancho de pelvis favorable en la producción y reproducción de las vacas.

Palabras clave: Medidas, Correlación, Bovinometría, Zoometría.

INTRODUCTION

In Ecuador, cattle raising is one of the most important activities that have been developed and has contributed to the economic, commercial and social development of the population. There are several breeds for milk production, which are adapted to the environmental conditions of the area and are the main source of income for families engaged in cattle raising.

Currently one of the problems facing dairy cattle is the relationship between body conformation and how this influences milk yield is of

special interest to the dairy industry in seasonal countries, due to the fact that milk producers usually judge the merit of dairy cows, at least partially, on the basis of type or conformation (Davalos, 2016).

The lack of knowledge on dairy farms about linear classification methods has not allowed for a good selection process, in order to reproduce in our herd only specimens that have the best characteristics and identify those that are undesirable from a physical point of view (Riera et al., 2012).

The bovinometry represents a favorable tool to dimension the conformation and physical structure of a bovine by means of obtaining measurements, they acquire vital importance in dairy cattle, since they have shown to have a great relationship with the productive life cycle of a cow, basically because of their impact on health, reason why it is essential to know the dimensions of an animal.

The Faculty of Agricultural Sciences has cattle that have adapted to the conditions of this environment, however, there is no information and data to characterize these animals, and to determine the phenotype of the cattle. Currently, genetic improvement programs are not only focused on selecting animals with excellent productivity, but also on functional individuals with good conformation, which will allow longer-lived and more productive animals (Velasquez & Alvarez, 2006).

For the above mentioned, the main objective of this research is to evaluate the external conformation of the existing cattle population in the dairy cattle program of the Faculty of Agricultural Sciences, to generate data by own experience with reference, to be able to select functional animals within a given herd, in addition it will allow discarding those animals that present problems in their

conformation predicting with a certain degree of accuracy to functional animals in their conformation (Muñoz, 2017).

METHODOLOGY

The present investigation was carried out in the Milk Production Cattle Program of the Faculty of Agricultural Sciences, which is located in the Mutile enclosure of the rural parish of San Mateo.

The study lasted 30 days, during which time the respective bovine measurements and data collection were carried out.

For the development of the research, a total of 12 animals were used, representing 100% of the cows that calved.

The study did not use an experimental design, it only used descriptive statistics through quantitative and observational methods to determine morphological characteristics of the cattle present in the milk program of the Faculty of Agricultural Sciences.

The experimental variables evaluated were the following:

- Height of haunch cm.
- Height at withers cm.
- Rump width cm.
- Pelvis width cm.
- Length of the rump cm.
- Depth of the body cm
- Height of the posterior insertion of the udder cm.
- Teat diameter cm.
- Teat length cm

The results obtained were subjected to the following statistical tests:

- Measures of central tendency (means), Experimental error (EE) and dispersion.

- Pearson correlation analysis.

To take the height of Anca, it was measured with a metric wooden zoo stick that has the measurements expressed in centimeters, taking as reference the vertical distance from the highest point of the rump to the animal's support plane (Muñoz, 2017).

Withers height was measured from the highest point to the perpendicular distance from the measuring withers to the support plane. The height is based on the actual measurement of the cow at the withers.

To determine the width of the rump, measurements were taken mainly from the front points of the hips and the midpoint of the hip which was taken by using a metric bovine cane and the results were expressed in centimeters.

The variable width of the pelvis was taken through the implementation of a zoometric ruler expressed in centimeters, which was placed under the tail, between the tips of the ischiums, which will be a reference to inquire about the ease of calving that each of the elements to be evaluated presented.

Depth of the Body is the maximum distance obtained by measuring with the help of a tape measure or zoomometric cane from the top of the back to the obligo (Muñoz, 2017).

Rump length is obtained by measuring the length between the tip of the ilium to the tip of the ischium.

The height of the udder was measured taking as a point the base of the vulva towards the udder ligament which is expressed in centimeters, this variable also serves to indicate the amount of milk produced by cows because if the udders are longer they produce more milk than udders of medium to small size.

Teat diameter, for the evaluation, the diameter in the middle part of the teat was measured with the help of the caliper.

Teat length, for this variable was measured from the base of the udder to the tip of the teat.

RESULTS

Weight

The average recorded for weight variable was 519.83±19.02 kg (Table 1), a result higher than that reported by Serrano Alfonso, (2009), who recorded an average of 509.60 kg when evaluating Holstein cows, while Barragan & Botero, (2010), found an average of 406 kg when evaluating the characteristics of bovine measurements in females in pasture in the Gyr breed. The differences found may be related to the age, breed, management and feeding of the animals.

Height of rump

Ank height presented an average of 140.92±1.86 cm in cattle (Table 1), results that are considered intermediate in the Linear Classification System Holstein Association USA, (2005): where 130 cm is low, 140 cm is intermediate and 150 cm is high.

The Linear Evaluation System for Dairy Gyr Cattle and their crossbreds states that it is desired that the haunch be high enough to keep the udder off the ground. Ideal and Average = 136.5 cm (Ramos, F et al 2010).

The results obtained are related to Zhicay, (2016), who when evaluating the purebred Holstein breed reports a haunch height of 140.80 cm, as well as Muñoz, (2017), who records a value of 142.25 cm, in crossbred Holstein cows at the Tunshi Experimental Station and higher than those evaluated by Zhicay, (2016), who also

reported 131.79 cm, in crossbred Holstein cows, differences that can be attributed to hereditary patterns and management conditions.

Table 1. *Results obtained in the present investigation of bovinometric measurements.*

Variable	Media	E.E.	CV
Weight (kg)	519,83	19,02	12,67
Height of haunch (cm)	140,92	1,86	4,58
Withers height (cm)	136,67	1,3	3,31
Croup width (cm)	53,38	1,29	8,39
Pelvis width (cm)	20,08	0,67	11,52
Length of rump (cm)	50,58	0,68	4,65
Depth of body (cm)	72,08	1,66	7,99
Height of the posterior udder insertion (cm)	18	1,52	30,34
Teat diameter (cm)	2,25	0,21	31,78
Teat length (cm)	4,54	0,47	36,31

The withers height variable recorded an average of 136.67±1.30 cm in the cattle of the dairy herd (Table 1), the average obtained according to the Linear Classification System Holstein Association USA, (2005), is intermediate in the classification range: 130 cm low, 142 cm intermediate, 154 cm high.

The results are related to Zhicay, (2016) and Muñoz, (2017), who recorded an average of 139.73 cm and 139.70 cm respectively in crossbred Holstein cows, the values reported in the researches maybe due to what is stated by Zhicay, (2016), where he mentions that purebred American cows are taller (150 cm) than crossbred cows, due to the fact that crossbred cows are usually the product

of a series of technically undefined crosses which are characterized by being smaller in size.

For this variable, it is important to indicate that medium and tall animals are more likely to keep the udder away from the ground, which reduces injuries and facilitates milking operations (Nieto, et al. 2021).

Rump width

The average recorded for the rump width variable was 53.38±1.29 cm (Table 1), in cattle, these values are higher than Muñoz, (2017) and Avila, (2012), who when evaluating the crossbred Holstein breed recorded a width of 47.90 cm and 41.11 cm respectively, the differences may be related to the genetics of the animals.

In relation to the average obtained, it is considered desirable since a wide rump, provides ease of calving, under the rump is the udder and the wider the rump is generally projected in a cow with good barrel and good intake capacity (Avila, 2012).

Pelvis width

The average recorded for the pelvis width variable was 20.08±0.67 cm (Table 1), these results according to the scale used by the World Holstein Friesian Federation (WHFF): 1-3 Very narrow, 4-6 Intermediate, 7-9 Wide (2 cm for each point), allow inferring that the evaluated cows have a wide pelvis which would facilitate calving (Serrano, 2009).

 The values obtained are lower than Muñoz, (2017), who when evaluating the Holstein breed in the tropics recorded a pelvis width of 38.76 cm, while Avila, (2012), reported in crossbred Holstein cows 41.11 cm.

The differences found are probably due to what Avila, (2012) mentioned, where he indicates that there are differences due to

several factors, including genetics, breed, age and nutritional status of the animals, factors that can influence the development and size of the pelvis of each individual.

Pelvic conformation is an important consideration as it allows for ease of calving; a wider pelvis provides more room for the calf to develop properly and pass through the birth canal, which facilitates the birthing process, thus reducing neonatal mortality and morbidity (Rodriguez & Solano, 2020).

Rump length

For rump length, an average of 50.58±0.68 cm was obtained in cattle (Table 1), the results are related to Serrano, A, (2009), who when evaluating Holstein first cows, recorded an average of 50.19 cm. While Ramónez & Zhunio, (2017), when evaluating the morphometric characterization and zoometric indexes of the existing Holstein bovine racial groups in the western cantons of the province of Azuay, report 46.6 cm value lower than those obtained in the present research.

The variations may be due to gestation, the number of calving in cows and all the processes in which the calving channel grows and there is a lengthening of the pelvis area. That characteristic is related to the dorsal udder support (Luz & Almeida, 2015).

The length of the rump is an indicator of the conformation and body structure of the animal. A rump of adequate and balanced length is desirable, since it contributes to a good harmony and proportion in the animal's body, indicates good muscle and bone development in the region of the hindquarters, which is relevant for both production and general functionality of the bovine, (Centeno & Betanco, 2017).

Body depth

Body depth in cattle was 72.08±1.66 cm (Table 1), a value that differs from Zhicay, (2016), who when evaluating the Holstein breed recorded an average of 80.59 cm.

It is important to keep in mind that the measurement of body depth is one of the many criteria used to evaluate the conformation and quality of a bovine, and is used in conjunction with other parameters to evaluate the performance and productive potential of animals, as it is directly related to the animal's ability to eat large amounts of forage. It is the distance from the loin to the lowest part of the cow's abdomen. Counts range from very shallow bodies (1-2). To extremely deep body (8-9), (Hidalgo, 2014).

Height of the posterior udder insertion.

The height of udder insertion in cattle was 18±1.52 cm (Table 1), values close to those indicated by Luz & Almeida, (2015), with 15 cm, in Gyr females.

The values obtained are close to the desired values according to the Linear Evaluation System of Dairy Gyr cattle and their crossbreeds where an average of 15 cm is established, thus, the shorter the perineum, the greater the height of the posterior udder. The ideal is an udder whose implantation is located four toes from the vulva. Higher udders allow a greater production capacity (Luz & Almeida, 2018).

For Muñoz, (2017), high udders seen from behind allow a better production capacity without the need for depth, for the above mentioned, it can be stated that the dairy herd of the faculty has a satisfactory udder rear height, improving productive qualities.

Teat diameter

The average recorded for this variable was 2.25±0.21 cm (Table 1), the results obtained are related to those of Nieves, (2016), who when evaluating the Holstein breed recorded an average of 2.2 cm, while Hernandez, et al (2017), reports an average of 3.36 cm value higher than those obtained. The differences can be attributed to age and lactation stage.

The average recorded is in the desired range according to Luz & Almeida, (2018), establishes ideal teats with an intermediate diameter of 3.3 cm downwards,

 In relation to this variable it is important to indicate that excessively thick teats impair milking and suckling, being therefore undesirable for the breed.

Teat length

The average recorded for this variable was 4.54±0.47 cm (Table 1), values that are within the allowed range according to the Brazilian Association of Dairy Gyr Breeders (ABCGIL), where a length should be from 5 to 7 cm (Luz & Almeida, 2018).

The results obtained are related to Muñoz, (2017), with 5.91 cm, and differ from Hernandez, et al (2017), with 6.23 cm, when evaluating teat morphology in dairy cows in the tropics. Variations in teat morphometry evaluated may be related to heredity, age and lactation number (Nieves, 2016).

In view of the values obtained, it is necessary to indicate that teat size is very important to prevent infections, since it avoids the fall of the teat cups in mechanical milking, and facilitates, in turn, manual milking and the possibility of draining residual milk; and additionally, it allows greater accessibility to milk suction by the calf during suckling, (Hernández, et al 2017).

Genetic correlations of the female bovine population of a calving of the dairy cattle program.

Body weight compared to rump width, presented a high positive correlation of 0.85 this correlation was higher than that presented by Contreras et al., (2020) which obtained mean of 0.58. The results obtained indicate that as the weight of the cows increases, the width of the rump increases.

Body weight compared to pelvis width presented a mean correlation of 0.6, a value lower than those presented by Bermudez, (2012), who recorded a high correlation between body weight and pelvis width of 0.97 in female Holstein cattle. These results allow the author to state that increasing the weight of females in the pelvis width would increase.

Withers height and haunch height presented a high correlation with 0.78 cm, results that imply an improvement where increasing one variable would improve the other based on the desired phenotype.

Withers height and rump width presented a high correlation of 0.62, which was higher than that presented by Contreras et al. (2020), which presented an average correlation of 0.55 in Criollo cattle. The results found show that there is a positive association between the characteristics.

The rump width compared to pelvis width, had a mean correlation of 0.58, while Herrera et al., (2022); in their study on Romosinuano and Costanoan cows with horns, also obtained a mean correlation of 0.54. The values obtained and investigated indicate a positive association between the variables, where increasing one characteristic would also improve the other.

The diameter of the front teat in relation to the diameter of the rear teat had a high correlation of 0.87. Alcívar & Lucas, (2022), in their study on Gyr cattle, also presented a high correlation of 1.

Therefore, increasing the diameter of the front teat also increases the diameter of the rear teats.

For the variables front teat length and rear teat length, it presented a high correlation of 0.86, a value that agrees with that reported by Cortez et al., (2021), who when evaluating daily milk production from udder morphometry in Holstein Friesian dairy cows, obtained a high correlation of 0.86 for the variables front and rear teat length. In view of these correlations, Nieves, M. (2008), indicates that teat length influences flow rate and milk production; therefore, it should be of prime importance in breeding programs.

CONCLUSIONS

The morphometric characteristics evaluated in the dairy herd presented important values, where an intermediate desirable height, intermediate depth, rump width and pelvis width favorable for the production and reproduction of the cows were recorded.

In relation to udder conformation, the evaluated group presented good height of the posterior insertion of the udder, desirable depth that favor milk production. Teat morphology in terms of diameter and length presented favorable sizes for a mechanical milking system.

It was found that cow weight conditions rump and pelvis width, in relation to height at the withers it was also evidenced that cows at greater height provide the height of the rump and width of the rump.

The width of the rump also favors the width of the pelvis, a positive aspect in the gestation and calving of the cows. The diameter and length of the front teats also favor the increase of the length and diameter of the rear teats.

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