

Hip Height Measurements, Production and Reproduction in Adult Dairy Cows in Argentina Grazing Systems

Mara L. Krupick^{1*}, Armando R. Charmandarian², Carlos A. Pagni³, Pablo R. Marini⁴

¹Obstetrics and Reproduction Pathophysiology Department, Faculty of Veterinary Sciences, Universidad Nacional de Rosario
Ovidio Lagos y ruta 33, 2170, Casilda, Argentina

²Obstetrics and Reproduction Pathophysiology Department, Faculty of Veterinary Sciences, Universidad Nacional de Rosario
Ovidio Lagos y ruta 33, 2170, Casilda, Argentina

³English I and English II Department. Faculty of Veterinary Sciences, Universidad Nacional de Rosario, Ovidio Lagos y ruta 33, 2170, Casilda, Argentina

⁴Dairy cattle Department. Faculty of Veterinary Sciences, Universidad Nacional de Rosario,
Ovidio Lagos y ruta 33, 2170, Casilda, Argentina

*Corresponding author's email: [mkrupick \[AT\] hotmail.com](mailto:mkrupick [AT] hotmail.com)

ABSTRACT--- *This study was aimed to characterize the measurement of the hip height as an indicator of body size, production and reproduction in dairy cows, kept in grazing systems in the Argentine humid Pampean region. Records corresponding to 210 third lactation Holstein cows, belonging to two dairies located on the area of Rosario city, Argentina, obtained in the period 2012-2013 were evaluated. The following variables were studied: milk yield (my), calving to conception interval (cci), number of services per conception (nsc) and hip height (hh). The results showed that despite the significant differences ($p \leq 0.05$) in average height, which varied between 138 and 149 cm, animals did not differ significantly in any of the productive and reproductive variables. The results showed that adult cows coexist with differences at the body structure level that would allow identifying different biotypes. The studied biotypes showed no relation with production and reproduction levels. A relation between production and reproduction was found. In this context, cows with less height would be the most appropriate for milk production grazing systems in Argentine Pampas.*

Keywords--- *hip height measurements, production, reproduction, dairy cows, grazing systems*

1. INTRODUCTION

One of the main objectives on a dairy farming system is to achieve maximum production and economic profitability of their herds in general and of their cows in particular. This increased productivity is generally reflected as a result of a correct interaction of genetic, nutrition, health, and management factors [9]. The continuous selection practiced to increase the angularity and greater body size of dairy cows with the selection by production has generated a low efficiency in fertility, health and longevity [5] [6] [10]. For grazing systems with supplementation as they are in Argentina, the body size of the dairy cow is a constantly debated issue, since it must be determined in which direction selection by size must be made if the aim is to make these grazing dairy systems more efficient and profitable. Animals with a large body structure reach maturity and fat deposition at an old age. They have a greater capacity for growth but costs of maintenance are higher [1]. The aim of the present study was to characterize the measurement of the hip height as an indicator of body size, production and reproduction in dairy cows kept in grazing systems in the Argentine humid Pampean region.

2. MATERIALS AND METHODS

The evaluated records corresponded to 210 Holstein cows, on their third lactation, belonging to two commercial establishments, located on the area of Rosario city, Argentina (latitude: parallel 32° 52' 18" South and 33° 02' 22" South.) Length: Meridian 60° 36' 44" West and 60° 47' 46" West) obtained in the period 2012-2013. The choice of the dairy

farms was based on the following common criteria to all of them: (1) exclusive use of Holstein cows, (2) basic feeding on grazing (alfalfa grasslands) with supplementation (corn grain, corn silage and hays) supplied in different proportions depending on the seasonal availability of the alfalfa grasslands, (3) periodic gynecological control, (4) official milk control, (5) same computing program (SISTAMBO), (6) Brucellosis, Tuberculosis, Campylobacteriosis and Trichomoniasis free; with Leptospirosis and Infectious bovine rhinotracheitis and Bovine viral diarrhea virus control, and application of the same sanitary plan, (7) reliability of data and (8) artificial insemination with American and Canadian semen. These criteria guarantee minimum guidelines of management (health, food and technical assistance), being these establishments located above the general average of the mentioned milk areas in these aspects.

Production data were obtained from the official milk control. Reproductive data were from periodic checks carried out by the establishments, Veterinary Advisor was the same for both establishments. The measurement of the hip height was held in the milking parlour with an instrument specifically designed for that purpose [3]. The following variables were recorded:

- Milk yield (my) (liters)
- Liters per cow in the third lactation (lpc)
- Calving to conception interval (cci): days between calving and conception
- Number of services per conception (nsc): amount of services needed to get the pregnancy
- Hip height (hh): (cm) in the third lactation.

All cows, regardless of the dairy farm of origin, were ordered by its hip height (hh) and were grouped into:

1. a. Categories (quartiles) according to the values in the quartile of the first order, the median and the quartile of third order. The effect of the belonging quartile on each of the variables was evaluated to visualize the effect results; averages and standard error were obtained for each variable, and mean comparison by Tukey-Kramer HSD test ($P < 0,05$) of the different productive and reproductive variables evaluated was performed. Median and range were obtained for the variable nsc and it was analyzed through the Wilcoxon/Kruskal-Wallis Test followed by the Dunn Test [11], as for the analysis for icc, Kaplan-Meier survival curve was applied to each subgroup and compared to each other using Logrank test (Mantel-Cox).

3. RESULTS AND DISCUSSION:

Table 1: Mean and standard error of the variables by quartile

Quartile	hh (cm)	my (l)	Icc (days)	Nsc (days)
1 (53)	138 ± 0,26 d	7974 ± 407 a	139 ± 12 a	2 (1-10) a
2 (53)	142 ± 0,26 c	8314 ± 407 a	135 ± 12 a	2 (1-7) a
3 (52)	145 ± 0,27 b	9175 ± 411 a	164 ± 12 a	2,5 (1-10) a
4 (52)	149 ± 0,27 a	8744 ± 411 a	127 ± 12 a	2 (1-9) a

Note: Different letters in the same column ($P \leq 0,05$).

In table 1 the categorization in quartiles showed that, despite the significant differences in average height, which varied between 138 and 149 cm, animals did not differ significantly in any of the productive and reproductive variables.

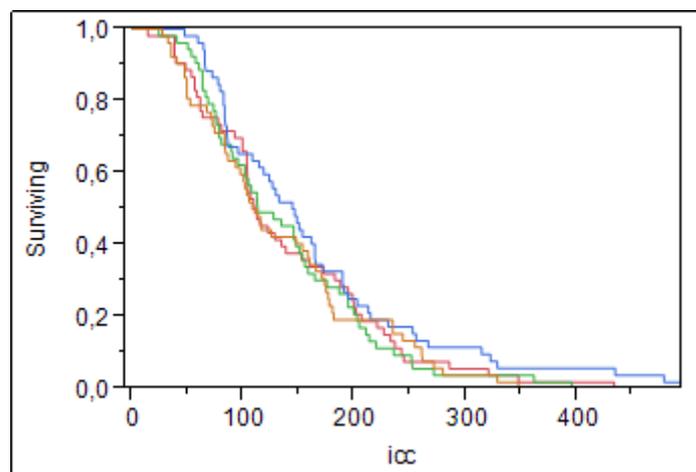


Figure 1: Curve of Kaplan-Meier survival time (in days) required by each cow from calving to conception according to the quartile

By analyzing the pregnancy rates of the four quartiles in relation to the progression of the milking days (Figure 1), it was observed that regardless of the size, cows behaved similarly at 82 milking days when pregnancy rate was only 27.6% and calving a calf within 365 days, 76% of cows were pregnant at 186 days of milking. No statistically significant differences ($P < 0,05$) among groups of different sizes were found.

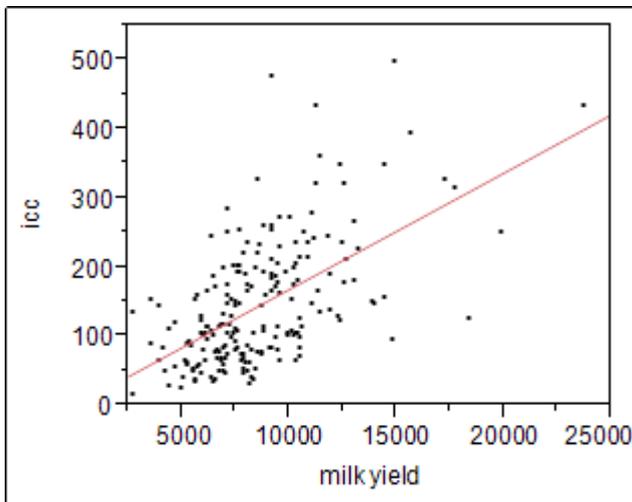


Figure 2: Milk yield depending on the interval from calving to conception

Figure 2 shows that as milk yield increases, calving conception interval also increases. This suggests a linear relation between two variables.

$$icc - 0,228701 = 0,0168811 * my$$

$$R^2 = 0,32 \quad R^2 \text{ adjusted} = 0,31$$

Table 2: Analysis of the variance:

				F ratio
Model	1	530026,8	530027	98,50
Error	208	1119138,0	5380	Prob \geq F
Ctotal	209	1649164,8		$\leq ,0001$

Table 3: Estimated parameters:

Intercept	-0,228701	15,39	-0,01	0,9882
PI	0,016881	0,0017	9,93	$\leq ,0001$

For many years, Holstein dairy cows in North America have been selected by an increase in body size [7]. Consequently dairy farmers of North America and the rest of the world that use American Holstein semen are milking dairy cows of larger size than those milked during the 1960's [2]. This is Argentina's case, where only Holstein American or Canadian semen to inseminate cows from 1992 was used. Despite the emphasis on getting a larger body size in selection and especially by registered breeder programs, research did not show that larger size cows have functional or economic advantages than small-size ones. Other studies have shown that small-size cows are more efficient than larger ones [12] and smaller cows have fewer health problems, especially for digestive disorders [7].

Results from table 1 did not show clearly the association height - production - reproduction as to conclude that larger cows produce more milk than smaller cows, by contrast cows belonging to the third quartile showed increased production not being statistically significant ($p \geq 0,05$). The categorization in quartiles showed that different groups of cows were found ($p \leq 0,05$) but they did not differ significantly in any productive nor reproductive variables. It was observed that the more milk-producing group had the highest values of cci and nsc. Compared to an earlier work [8] it was observed that cows had increased in 1 cm the size of the groups of the first and fourth quartile, somehow supporting what Hansen et al., [5] said, emphasizing that the body size increase of cows continues in North America. The dairy cow production has markedly increased in the past 40 years and, in some European countries have doubled their levels, thanks to a combination of improved genetics, feeding and management, but with a particular focus on milk production. However, this high productivity has been accompanied by a documented global decrease in the reproductive efficiency of the dairy herd (the ability of the female to produce a live calf), particularly in the dominant breed, the Holstein. Fertility,

is a component of reproductive performance, it defines the ability of the female to get pregnant, but must reflect - in the end - in an alive and viable calf birth [11]. The results shown in figure 1 allowed us to infer that the size does not affect the reproductive behavior, because regardless of the same, all the groups have a high cci, which does not allow the calving of a calf per year. What is observed is that cows have very good levels of milk production for Argentina grazing systems, but this is accompanied by low levels of the icc, as shown in Figure 2, where with a higher milk production a higher calving conception interval is obtained. This work coincides with one previously made [8] where the absence of association between height and production shows up the possibility of obtaining similar productions with cows of different body size, and therefore with different requirements. This would make possible to analyze the possibility to reduce the cow size allowing a concomitant reduction of the requirements without affecting its production what would be equivalent to predict an increase of the efficiency .

4. CONCLUSIONS

Results indicate that adult cows coexist with differences in their body size that will allow the identification of different biotypes. The studied biotypes showed no relation with the levels of production and reproduction. In this context, cows with minor height would be the most suitable for grazing milk production systems in the humid Pampean region in the Argentine Republic.

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