Placentome size in *Bos taurus* x *Bos indicus* crosses in the mexican tropics differs from the source breeds

O tamanho do placentoma em cruzamentos *Bos taurus* x *Bos indicus* nos trópicos mexicanos difere das raças de origem

Son de diferente tamaño los placentomas de mestizos *Bos taurus* x *Bos indicus* en el trópico?

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**ABSTRACT**
The objective of the present study is to verify the size of placentomes, through ultrasonography, at different gestational ages in *Bos indicus* x *Bos taurus* crosses located in the tropics. Placentome size in cows can vary in response to many factors, including crossbreeding. Placentome measurements were taken by averaging the length and width of the placentome. We measured placentome size at different gestational ages in *Bos taurus* x *Bos indicus* cows raised in the tropics. Uteruses were collected immediately after slaughter from 102 cows with gestations ≥ 30 days and processed in the abattoir. All cows were Swiss Brown x Zebu...
phenotypes. Fetus gestational age was estimated by measuring from the crown to the tail base. Five placentomes were randomly chosen from each uterus (n= 510), and diameter (cm) measured for each. Gestational age was classified into nine categories (days): a) ≤45, b) >45 ≤60, c) >60 ≤90, d) >90 ≤120, e) >120 ≤150, f) >150 ≤180, g) >180 ≤210, h) >210 ≤240 and i) >240. Placentome size data was grouped by these categories. Descriptive statistics were generated for diameter for each gestational age category. All statistical analyses were run with the SAS program (2013). In all nine categories, placentome size was larger than reported for Bos taurus cows and smaller than reported in Bos indicus cows. In conclusion, placentome size in the sampled Bos taurus x Bos indicus cows was intermediate between that of the two source breeds. This confirms that existing reference tables for Bos taurus and Bos indicus purebreds are not accurate for crossbreeds.

**Keywords:** Gestation. Bovines. Placenta. Tropics.
distancia desde la corona hasta la base de la cola, para estimar la edad gestacional. Posteriormente se escogieron al azar 5 placentomas y empleando una cinta métrica se midió su largo y ancho, las cuales se emplearon para el calculó del tamaño total del placentoma (cm). La edad gestacional, expresada en días, fue agrupada en: a) ≤45, b) >45 ≤60, c) >60 ≤90, d) >90 ≤120, e) >120 ≤150, f) >150 ≤180, g) >180 ≤210, h) >210 ≤240, i) >240. Se obtuvieron estadísticos descriptivos para el tamaño del placentoma de acuerdo con los grupos de edad gestacional previamente definidos empleando el programa SAS. El tamaño de los placentomas en cada una de las edades gestacionales es mayor a lo señalado en vacas Bos taurus puras, pero son menores al reportado en hembras Bos indicus puras. En conclusión, en tamaño de los placentomas muestreados en hembras cruzas Bos taurus x Bos indicus fue intermedio entre las dos especies de origen, esto confirma que las tablas referenciales para Bos taurus y Bos indicus no son precisas en sus cruzas.


1 INTRODUCTION

Placentomes occur during gestation in ruminants. They form through the union of caruncles, found in the endometrium, and cotyledons, which develop in the placenta. The blood vessels in placentomes allow exchange of nutrients, oxygen and waste between fetus and mother (Aires et al., 2014). Circulation through the vessels converges in the umbilical cord (Hernández Medrano, 2018).

Placentome development is closely related to gestational age (Aires et al., 2014), so closely, in fact, that development reference tables have been published (Youngquist, 2007). Placentome size is affected by animal breed and gestational stage, but some studies suggest their growth can also be affected by nutritional conditions (Reid et al., 2022) and even climatic conditions (Dunlap et al., 2017). The combination of these factors can generate variability in growth that does not coincide with gestational stage reference tables. For instance, in an unpublished in-house survey of veterinarians involved in bovine reproduction, it was noted that they found gestational age estimation using placentome size obtained by palpation or ultrasound to be inconvenient since the resulting measurements do not coincide with published studies (Data not shown).

Reproductive management of livestock in the tropics can be challenging due to factors such as productive-reproductive differences between crossbred animals, maintaining adequate diet with low-quality pastures, and stressors such as high
humidity and temperature (González Padilla, 2015); all affect reproductive variables and can directly influence placental and fetal development (Arias et al., 2008; Verdoljak et al., 2018). The present study objective was to measure placentome size at different gestational ages in Bos taurus x Bos indicus crossbred cows in the tropics.

2 MATERIALS AND METHODS

2.1 STUDY AREA

Sample collection and measurement were done at the abattoir in the community of Las Vigas, Ometepec Municipality, in the state of Guerrero, Mexico. Regional climate is hot subhumid with a 23 °C average annual temperature and 1,100 mm average annual rainfall, largely between June and October (INAFED, 2022).

2.2 ANIMALS

A total of 102 uteruses were collected from cows killed at the abattoir. The cows had an average age of 6 ± 2 years, average live weight of 550 ± 50 kg and a gestation time of ≥ 30 days. All were Swiss Brown x Zebu phenotypes although producers did not specify the degree of Zebu interbreeding. They came from extensive grazing systems in the towns and municipalities surrounding the abattoir.

2.3 MEASUREMENTS

Uteruses were extracted from the cows immediately after slaughter, and processed in the abattoir. Fetuses were extracted from the uteruses through an incision and the length between the crown and tail base measured (Lenis Sanín et al., 2014). Five placentomes were randomly selected from each uterus and their diameter measured with a measuring tape (Atkins et al., 2010).
2.4 STATISTICAL ANALYSIS

Gestational age expressed in days was classified into nine categories: a) ≤45, b) >45 ≤60, c) >60 ≤90, d) >90 ≤120, e) >120 ≤150, f) >150 ≤180, g) >180 ≤210, h) >210 ≤240, i) >240. Placenta diameter measurements exceeding ±3 standard deviations of the mean by age group were discarded. Descriptive statistics were generated for diameter for each gestational age category. All statistical analyses were run with the SAS program (2013).

3 METHODOLOGY

In the present results, placenta diameter in each gestational age category (Table 1) is larger than those reported for purebred Bos taurus cows: 0.9 cm diameter for 90-120 days’ gestation, 1.4 cm for 120-150 days, and 2.32 cm 150-180 days (Zoller et al., 2019). In contrast, the present diameter results are generally smaller than reported in purebred Bos indicus cows: 3.04 cm for 120-150 days, 3.81 cm for 150-180 days and 4.14 cm for 180-210 days (Kouamo et al., 2018).

Table 1. Placenta diameter (cm) by gestational age (days) in Bos taurus x Bos indicus cows.

<table>
<thead>
<tr>
<th>Gestational age</th>
<th>Placentomes (n=)</th>
<th>Diameters</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤45</td>
<td>72</td>
<td>0.40</td>
<td>2.87</td>
</tr>
<tr>
<td>&gt;45 ≤60</td>
<td>54</td>
<td>0.69</td>
<td>2.76</td>
</tr>
<tr>
<td>&gt;60 ≤90</td>
<td>70</td>
<td>0.87</td>
<td>3.38</td>
</tr>
<tr>
<td>&gt;90 ≤120</td>
<td>109</td>
<td>0.75</td>
<td>3.68</td>
</tr>
<tr>
<td>&gt;120 ≤150</td>
<td>84</td>
<td>1.00</td>
<td>5.50</td>
</tr>
<tr>
<td>&gt;150 ≤180</td>
<td>39</td>
<td>1.58</td>
<td>5.25</td>
</tr>
<tr>
<td>&gt;180 ≤210</td>
<td>35</td>
<td>1.77</td>
<td>4.39</td>
</tr>
<tr>
<td>&gt;210 ≤240</td>
<td>30</td>
<td>1.65</td>
<td>4.18</td>
</tr>
</tbody>
</table>

SE = Standard error. Source: Own research

Placentomes increase in size and vascularity to provide a greater exchange surface and blood flow to meet fetus growth requirements (Machado et al., 2010). Bos indicus cows generally generate larger placentomes than B. taurus cows, possibly because feed availability and quality in tropical areas are often lower than in temperate areas (Romero, 2008). A larger placenta size could imply a need to maximize nutrient delivery to the fetus (Reid et al., 2022).
Placentome size in the present study was intermediate between *B. taurus* and *B. indicus*. This may result from crossbreeding but could also be a response of the cows to low nutritional quality pastures in the extensive systems where they were produced. In the latter case, the placentomes would have increased in size to ensure sufficient nutrient supply to the fetus. Further research is needed to confirm the placentome diameter trends observed in the present results and identify the cause for discrepancies between different purebreds and crossbreeds in the tropics.

4 CONCLUSION

This is the first study that indicates the size of the placentomes in the *Bos taurus* x *Bos indicus* crosses that make up the predominant animals in the tropical area, where there is less information, which opens a research opportunity.

In conclusion, placentome size in the sampled *Bos taurus* x *Bos indicus* cows was intermediate between that of the two source breeds. This confirms that existing reference tables for *Bos taurus* and *Bos indicus* purebreds are not accurate for crossbreeds.

The main limitation in this study was working with sacrificed animal, it is therefore necessary to consider monitoring placental growth in live animals.
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