Effect of *PIP* and *IRX1* on hair coat characteristics of Brangus heifers

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Introduction

- **Heat stress** in cattle has received growing attention because of anticipated increases in environmental temperature by global warming. It is causing economic loss for beef cattle producers in tropical and subtropical environments.
- Thermotolerance can be defined as cattle's ability to maintain optimal growth, feed intake, and reproduction under the presence of heat stress.

Methods

- Hair samples were collected from **1,775** Brangus heifers from the Seminole Tribe, Okeechobee, FL.
- The length of five short and five long hairs from each cow were measured with the ImageJ software to represent the undercoat and topcoat, respectively.
- A total of 14 SNP in the *PIP* and *IRX1* genes were genotyped. The effect of each SNP on hair length was evaluated using the PROC GLM procedures of SAS.
- For multiple testing, we used Bonferroni Correction P-value ($P < 0.00357$).


ImageJ
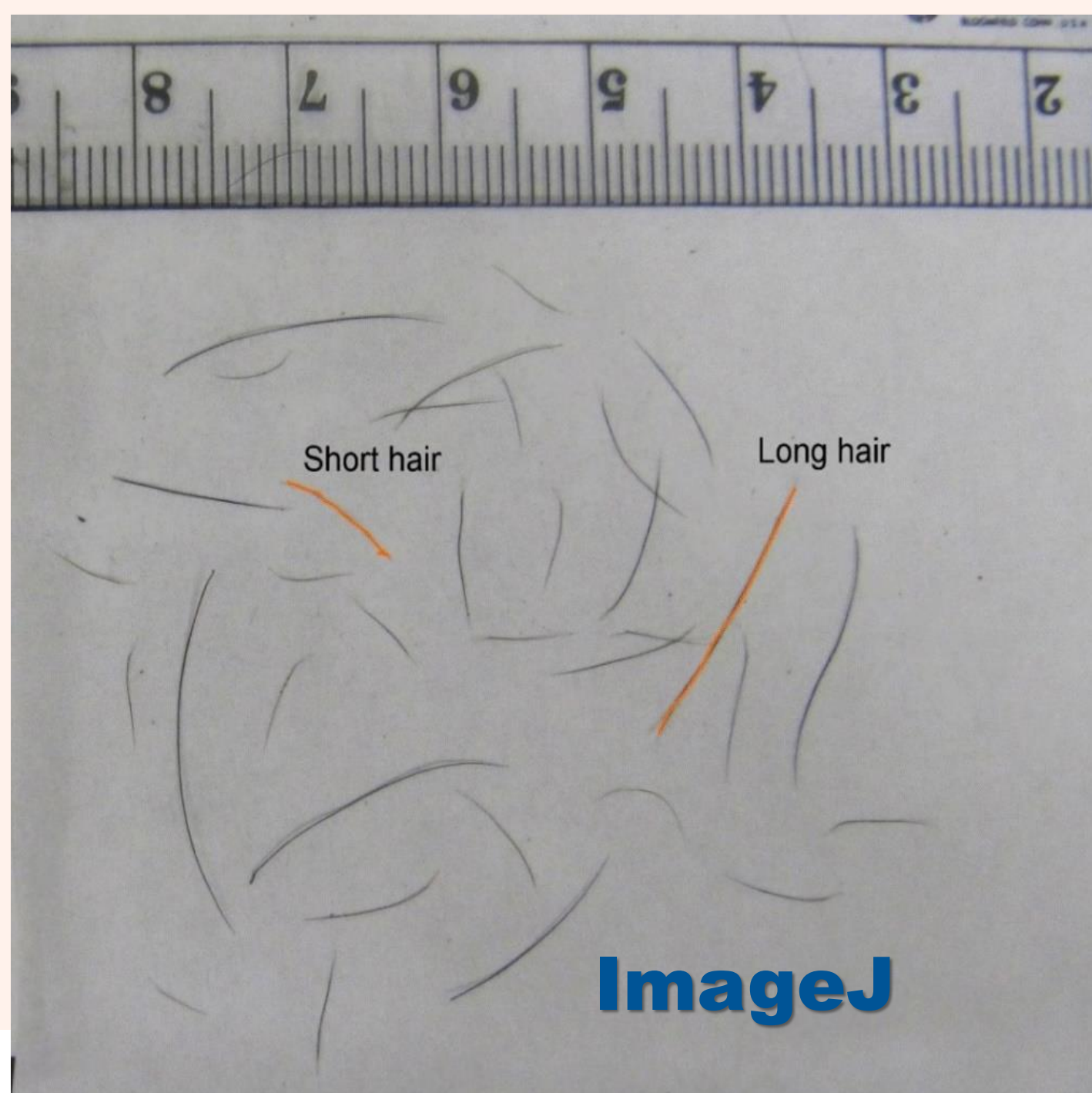
Objectives

The objective was to determine if genetic markers in the *PIP* and *IRX1* genes are associated with the coat score and hair length.

Results

- Two SNPs located in the ***PIP and IRX1*** were significantly associated with overall hair length (figure A and figure B).
- A SNP ***IRX1*** had a significant effect on the short hair length (figure C).
- A SNP close to ***PIP (prolactin induced protein)*** had significant effects on long hair length and overall hair length (figure D).
- No markers were associated with the coat score.

Effect of PIP on overall hair length
Overall Hair Length, mm
AA: 10.1 (a), AB: 11.3 (b), BB: 11.4 (b)
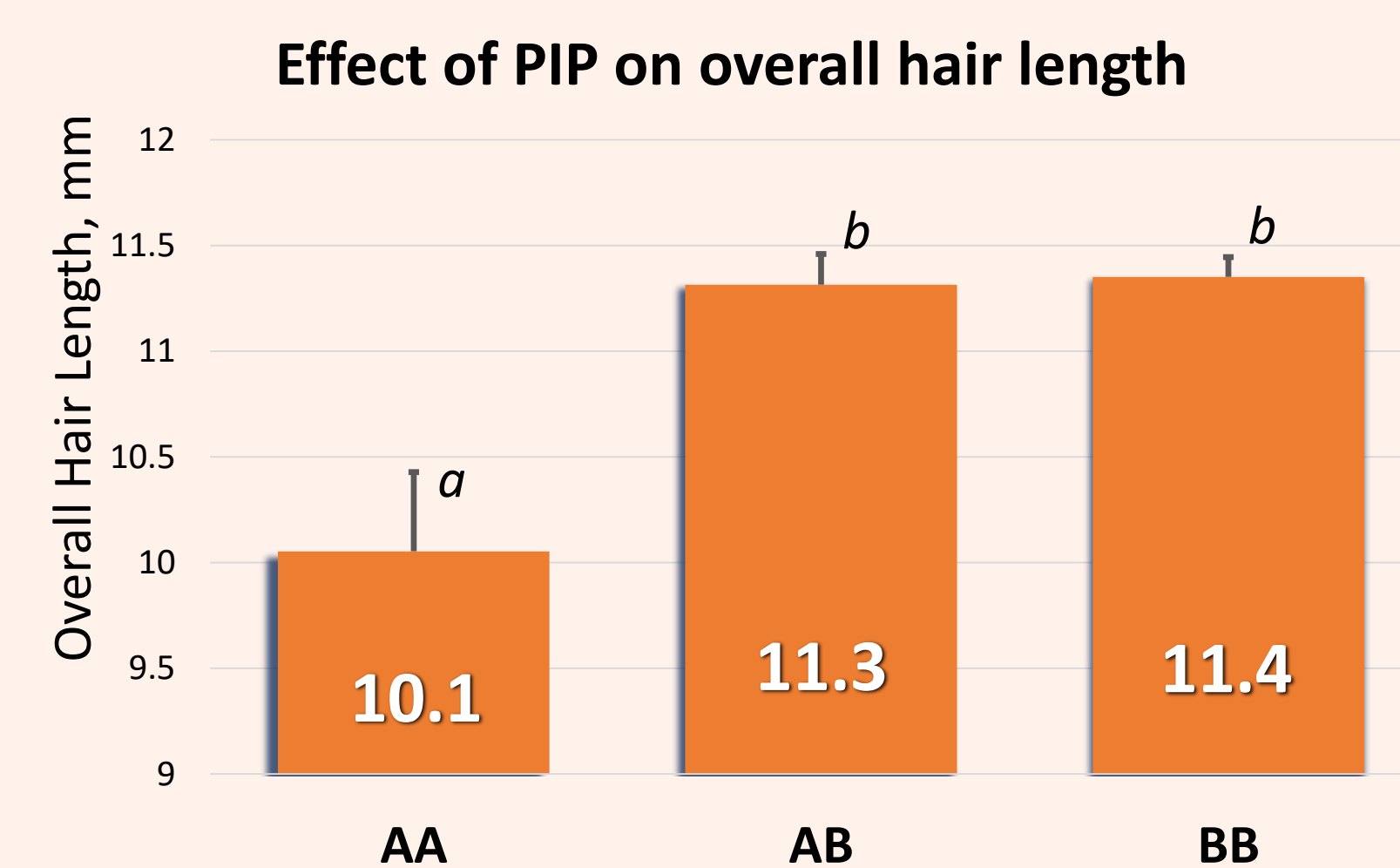
- Figure A. Hair from cattle with genotype AA were 1.2 and 1.3 mm shorter than hair from AB and BB cattle, respectively.

Effect of IRX1 on overall hair length
Overall Hair Length, mm
AA: 11.7 (a), AB: 11.5 (a), BB: 11.0 (b)
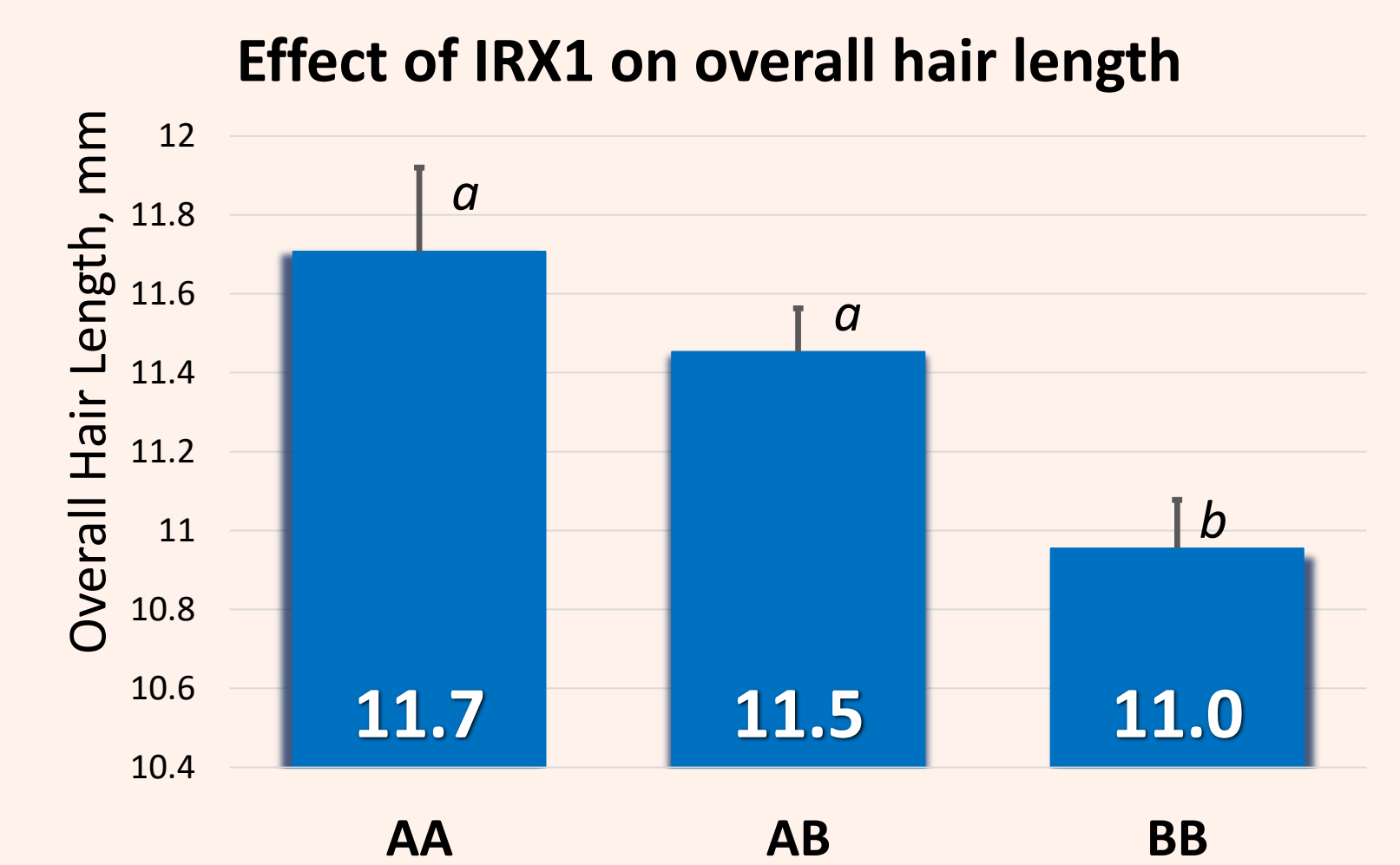
- Figure B. Hair from cattle with genotype BB was 0.7 and 0.5 mm shorter than hair from AA and AB cattle, respectively.

Effect of PIP on topcoat length
Long Hair Length, mm
AA: 13.4 (a), AB: 15.3 (b), BB: 15.5 (b)
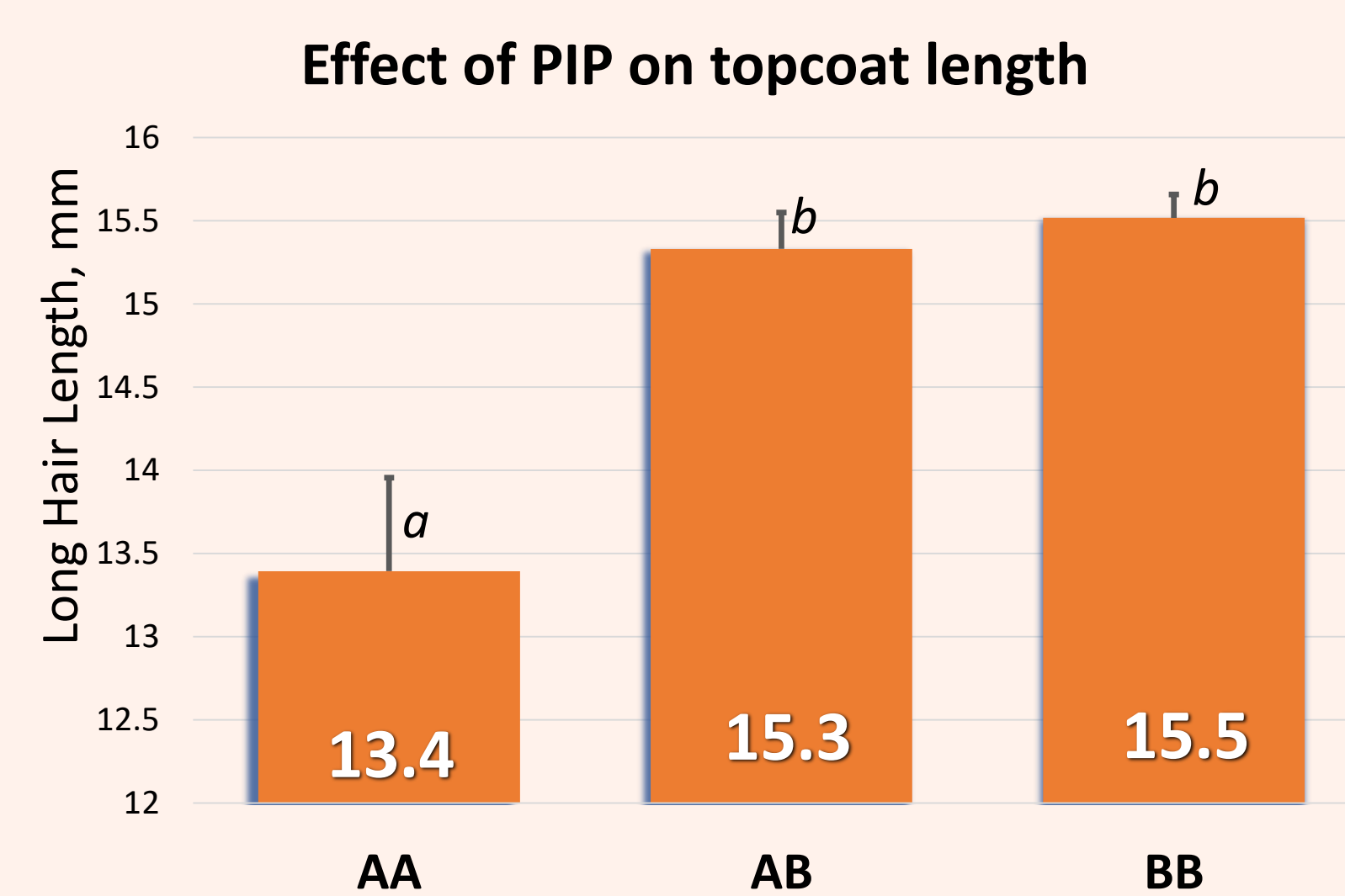
- Figure C. Hair from cattle with genotype AA were 1.9 and 2.1 mm shorter than from AB and BB cattle, respectively.

Effect of IRX1 on undercoat length
Short Hair Length, mm
AA: 7.5 (a), AB: 7.3 (a), BB: 7.0 (b)
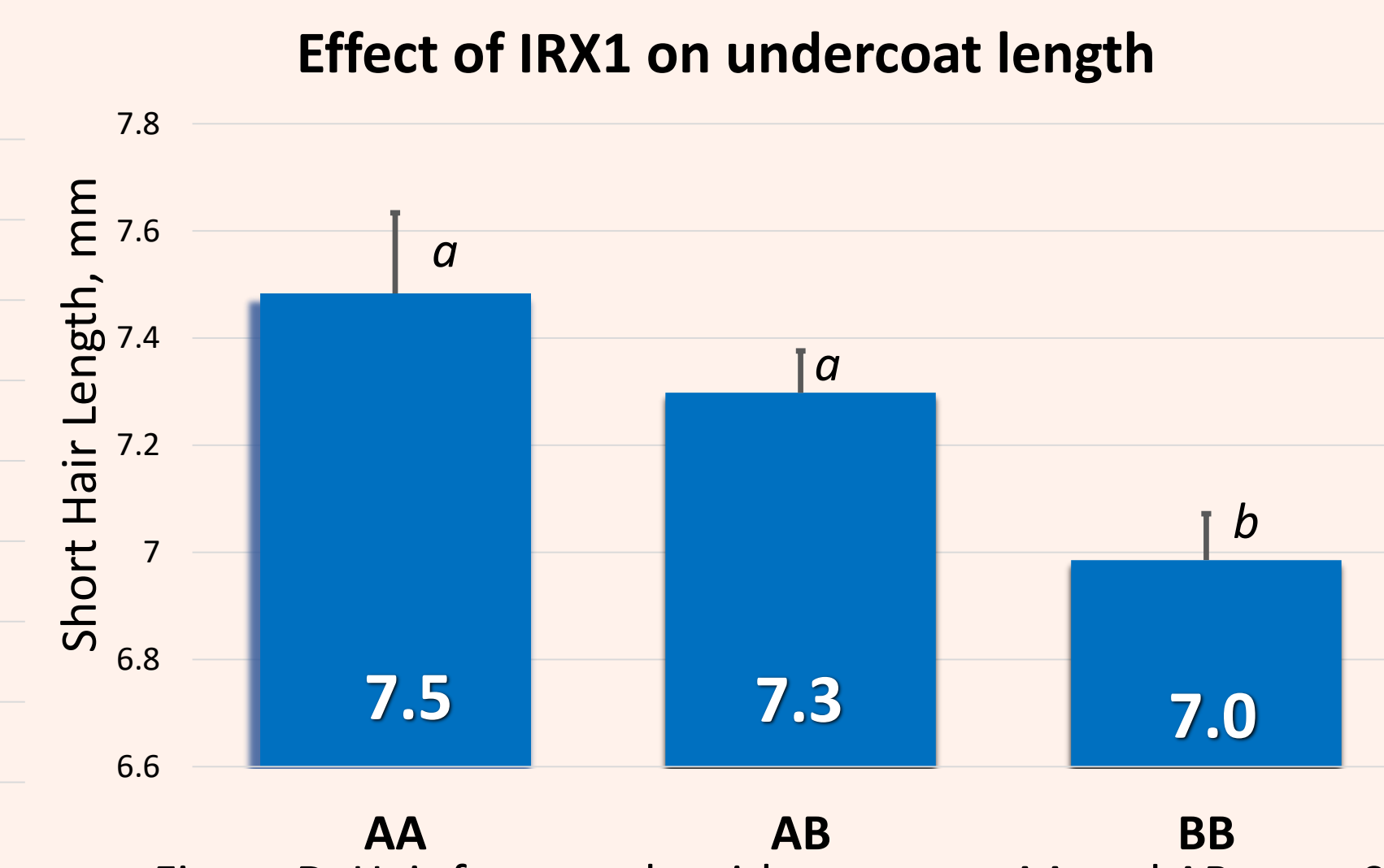
- Figure D. Hair from cattle with genotype AA and AB were 0.5 and 0.3 mm longer than hair from BB cattle.

Conclusions

- *PIP* (prolactin induced protein) it's a receptor shown to regulate hair length and *IRX1* is a gene that regulates ectodermal appendages, including hair.
- A shorter hair is fundamental for the adaptation of the cattle to lose heat through the hair-skin more efficiently. Selection on this two SNP may improve cattle's adaptation to thermal stress by reducing hair coat length, allowing for more efficient heat loss at the hair-skin interface.

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