Impact of Hair Coat Differences on Rectal Temperature, Skin Temperature, and Respiration Rate of Holstein x Senepol Crosses in Florida
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Acknowledgement

- Prime Rate Ranch of Okeechobee, Florida played a major role in this study by producing the 75% Holsteins (via a superovulation program) that were utilized in this study.
The **Slick Hair** Gene

- The *Slick Hair* gene is a single gene, dominant in mode of inheritance that is responsible for the short, shiny, hair coat of the Senepol and other breeds.
- Other breeds that have the *Slick Hair* gene include: Carora, Romosinuano, Criollo Limonero, Blanco Orejinegro, Chino Santandereano, Reyna and other criollo breeds.
Criollo Yaco
Orgullo de las Pan
Research Animals

- The primary animals involved in this study were \( \frac{3}{4} \) Holstein: \( \frac{1}{4} \) Senepol yearling bulls and heifers.
- They were sired by two registered Holstein bulls (one red and white, one black and white).
- Their dams were two Senepol X Holstein \( F_1 \) cows that were paternal half sisters.
Research Locations

- Subtropical Agricultural Research Station – Brooksville, Florida
- Beef Research Unit – Gainesville, Florida
Evaluations of Environmental Conditions

• Relative Humidity (RH)
• Ambient Temperature (AT)
• Black Globe Temperature
• Temperature-Humidity Index: THI
  \[ THI = 0.8 \times AT + RH \times [(AT - 14.3) + 46.3] \]
Traits Evaluated

- Rectal Temperature
- Skin Temperature
- Respiration Rate
- Clipped Hair Weight
- Growth Rate
- Feed Intake
Weather Conditions – STARS

- Highest Ambient Temperature: 35.5°C in June of 2000
- Temperature Humidity Index: 103
- Lowest Ambient Temperature: 21.0°C in February of 2000
- Temperature Humidity Index: 73
Impact of Temperature-Humidity Index at STARS

• Correlation of THI with Rectal Temperature:
  -0.10 (P > 0.76) in Slick Animals
  -0.35 (P > 0.29) in Normal-haired Animals

These results are somewhat confusing but apparently indicate that the ambient conditions across the months didn’t effect rectal temperature at STARS
Rectal Temperatures of Slick and Normal-Haired Holstein Crosses at STARS

- September
  - Slick 39.4°C Normal 39.7°C P < 0.05
- October
  - Slick 39.3°C Normal 39.8°C P < 0.05
- November through June
  - No significant differences between slick and normal-haired animals
Average Daily Gain of Slick vs. Normal-haired Animals at STARS

• The average daily gain over a period of a year at STARS did not differ between slick and normal-haired animals
  – Slick 1384 grams per day
  – Normal 1345 grams per day
• This is comparable to results comparing slick vs. normal-haired beef animals at the same location
Why didn’t the slick ones gain faster?

• I don’t know for sure
• Apparently the heat stress wasn’t sufficient to trigger an effect on growth under these conditions
• These cattle always had access to shade and their temperatures never were recorded over 40.1°C
Second Study

Beef Research Unit

July-August
Environmental Conditions at the Beef Research Unit

- Average Ambient Temperature -- 32.9 °C
- Average THI -- 99.7
- Highest Ambient Temperature -- 36.0 °C
- Highest THI -- 107.0
- Highest Black Globe Temperature -- 56.5 °C
Effect of Hair Type on Rectal and Skin Temperatures at the Beef Research Unit

<table>
<thead>
<tr>
<th>Hair Type</th>
<th>Days</th>
<th>No.</th>
<th>Rectal Temp., C</th>
<th>Skin Temp., C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slick</td>
<td>24</td>
<td>8</td>
<td>38.99</td>
<td>37.49</td>
</tr>
<tr>
<td>Normal</td>
<td>24</td>
<td>8</td>
<td>39.32</td>
<td>38.03</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td></td>
<td>- 0.33*</td>
<td>- 0.49*</td>
</tr>
</tbody>
</table>
Respiration Rates of Slick vs. Normal-Haired Animals at the Beef Research Unit

- Slick-haired animals
  56.6 breaths per minute
- Normal-haired animals
  69.0 breaths per minute

- This difference was significant at the 0.05 level
Black Globe Temperature Categories

- BGTC1  < 40.0  °C
- BGTC2  40.0 – 44.9  °C
- BGTC3  45.0 – 50.0  °C
- BGTC4  > 50.0  °C
Respirations per minute

Black globe temperature classes

RPM Normal
RPM Slick

* (P>0.05)
Reduced Respiration Rates of Slick-haired Animals

• The advantage of slick-haired animals was similar to that of shaded vs. unshaded animals shown by Brown-Brandl et al. (2001)

• It is also comparable to the advantage of zebu-crossbred over unadapted *Bos taurus* animals
What is the advantage of a reduced respiration rate?

• Adapted cattle are less affected by higher heat loads and thus are able to maintain lower respiration rates at the same temperatures.

• They are thus more efficient, as a result of using less metabolic energy to maintain a normal body temperature.
Feed Intake of Slick vs. Normal-haired Animals

- We expected that the slick-haired animals would consume more feed
- Heat-stressed animals eat less
- The slick ones did eat somewhat more:
  - Slick 27.0 g of feed per kg live wt/day
  - Normal 26.7 g of feed per kg live wt/day
- This difference, while small, did approach significance
Objective Evaluation of Quantity of Hair on Slick and Normal-haired Animals

• Slick-haired animals
  11.47 mg/cm²

• Normal-haired animals
  17.82 mg/cm²

• This difference is significant at the 0.05 level
Quantity of Black vs. White Hair on Spotted Animals

- Black Areas: 11.02 mg/cm²
- White Areas: 18.28 mg/cm²

- This difference is almost identical and of the same probability, 0.05, as the slick vs. normal hair difference!
Quantity of Black vs. White Hair on Spotted Animals

• The difference in quantity of hair of slick vs. normal-haired animals was nearly twice as large in black vs. white areas

• The weight of clipped white hair from slick-haired animals was only slightly less than that of clipped black hair from normal-haired animals
What is the importance of these white vs black hair results?

• **Answer:** We don’t know yet. It seems that a solid, light red animal, like that of most of the Criollo breeds might be the preferred coloration.

• Holsteins with higher percentages of white have been shown to be superior in Florida but these animals don’t graze and thus, are not as susceptible to sunburn.
Conclusions:

• In addition to producing a shorter, shinier hair coat, the Slick Hair gene also results in animals having the ability to maintain lower rectal temperatures.

• This reduction in rectal temperature appears to be up to 0.5°C, the same reduction as 50% or more zebu influence in crosses provides.
Conclusions:

• Cattle with the *Slick hair* gene also have slower respiration rates while maintaining lower body temperatures
• This should allow them to be more efficient
• Such cattle aren’t likely to be more productive unless placed under grazing conditions under heat stress
What is next?

• Identification of the genomic location of the *Slick Hair* gene
• Sequencing of the *Slick Hair* gene
• Evaluation of the impact of the *Slick Hair* gene on milk yield, reproduction and survival in commercial dairies in south Florida and Puerto Rico
Puerto Rican Slick-Haired Holstein Cow #66
Also ......

- Production of homozygous slick, red Holsteins
- Evaluation of the impact of the *Slick Hair* gene on growth and semen characteristics of Holstein bulls
- Possible importation of Reyna semen for use in dairy crossbreeding programs
First Lactation Reyna Cow in Nicaragua