

Research Note

EVALUATION OF VISUAL ASSESSMENT AS A TOOL FOR CLASSIFYING HAIR COAT TYPE IN PUERTO RICAN SLICK AND WILD TYPE-HAIRED HOLSTEIN COWS^{1,2}

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During the past 15 years, slick-haired dairy cattle have received considerable attention from the scientific community as a possible alternative to counteract the negative effects of heat stress and climate change on milk production. Cattle presenting a short and sleek hair coat can better withstand heat stress than wild type-haired cattle under tropical and sub-tropical conditions (Sánchez-Rodríguez, 2019). Even though the slick and wild type-haired phenotypes present considerable differences in hair coats that can be visualized, most researchers working with these animals prefer to use genomic tests to classify their experimental groups. However, such tests require trained personnel, expensive materials, and appropriate facilities. Thus, we raise the question about the accuracy of visually determined hair coat classification. If such visual assessment accurately coincides with the genomic classifications, then trained evaluators could do the classifications on farm, without the necessity of costly and time-consuming procedures. Our study aimed to evaluate the accuracy of visually determined hair coat classifications (slick or wild type) when compared to the corresponding genomic categories.

A total of 94 lactating Holstein cows (32 heterozygous slick and 62 wild type-haired) from the dairy herd at University of Puerto Rico Agricultural Experiment Substation at Lajas were evaluated on July 7, 2022. At the time of the study, slick-haired cows averaged 21.11 ± 4.84 kg/d of milk yield, 2.35 ± 1.05 lactations, 151.10 ± 95.04 days in milk, and 562.49 ± 72.58 kg of body weight. In wild type-haired cows, respective values

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of 19.93 ± 3.44 kg/d of milk yield, 2.42 ± 1.33 lactations, 165.15 ± 77.96 days in milk, and 557.16 ± 52.52 kg of body weight were observed. Descriptive statistics are reported as means \pm standard deviations. A coccygeal blood sample was collected from each cow in a 2.7 mL buffered sodium citrate blood collection tube (BD Vacutainer; Becton, Dickinson and Company, Franklin Lakes, NJ)¹⁰. The blood was processed and analyzed for the presence of the first discovered prolactin receptor mutation (the SLICK1 allele mutation, by Real Time PCR using TaqMan assay) at the Animal Molecular Biotechnology Laboratory of the University of Puerto Rico at Mayagüez. The procedure previously described by Sosa et al. (2021) was followed. No homozygous slick-haired Holstein cows were present in the population evaluated. Genomic results (heterozygous slick or wild type-haired) were used as reference points for the evaluation of the hair coat categories determined visually. Six independent evaluators (i.e., blinded to the genomic classifications) were trained to differentiate visually between slick and wild type-haired cows by means of the comparisons presented in Table 1 and Figure 1. Evaluators' experiences with cattle (and hair coat classification) ranged from none to considerable. Two days before the study, evaluators received a PDF document with pictures of slick and wild type-haired cows comparing each characteristic presented in Table 1 and Figure 1. On the day of the study, evaluators received a 30-minute training session immediately before sampling. In this training, evaluators were exposed to several pairs of cows (with a slick and a wild type-haired cow in each pair) and asked to discuss the phenotypic differences between hair coat types. Cows compared in this training section were not included in the current study. All evaluators were then asked to visually classify each remaining Holstein cow in the lactating herd as slick or wild type-haired, independently of other evaluators. If a definite hair coat determination could be made by analyzing the poll, head, and neck of the cow, no further examination was carried out. If not, secondary (loin and rump) or tertiary (tail base and switch) evaluations were performed until a classification was established. Genomic and visual classifications data were compared by means of the Proc FREQ in SAS. The sensitivities (the probability that the genomic classifications were successfully identified by visual classification) for each hair coat type, as well as the misclassification rates, were determined.

The sensitivities and misclassification rates for the visually determined hair coat classifications are presented in Table 2. When the determinations of the six evaluators were taken together, visual classification successfully identified the genomic categories 96.45 and 98.14% of the time for the slick and wild type-haired cows, respectively. Sensitivity ranges of 91.43 to 98.36% and 96.12 to 98.36% were observed for evaluators with none and moderate previous experience identifying hair coat type in similar cattle, respectively. For evaluators with considerable experience, sensitivity values of 100% were observed in both hair coat type groups. In 2004, Janse et al. published an article categorizing different sensitivity ranges on a scale of *very poor* to *excellent*, in terms of the observed agreement between the two variables compared. These categories have been accepted and employed by others, including Paquet et al. (2008) and Lake et al. (2012). According to those researchers, sensitivity values above 90% (as those observed in this study) indicate an excellent agreement between the genomic and the visual classifications. It is worth mentioning that the current study was carried out in summer (July 2022). During the hot season, cattle shed their hair exhibiting shorter coats, while during the cooler months, their coats are longer (Hayman and Nay, 1961; Williams et

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TABLE 1.—*Phenotypic comparison between slick and wild type-haired Puerto Rican Holstein cows.*

	Slick-haired	Wild type-haired
Poll	Very short hair that seems to have been clipped.	Hair considerably longer than the body's hair coat even during summer. Hair swirls are frequently visible.
Head and neck	Very short hair. Skin wrinkles are easily observed above the eyes and on the top and sides of the neck. Veins at both sides of the nose bridge are easily visualized.	No wrinkles observed in the skin. Veins at the nose bridge are not observed or difficult to visualize.
Loin and rump	Top view hair coat looks short and frequently glossy; appears to have been washed and brushed.	Top view looks hairy, sometimes seems not brushed. Hair coat is frequently not glossy. Hair swirls pointing upward are easier to observe.
Tail base	Sleek and clean, sometimes resulting in a thicker appearance. Hair swirls pointing backward are not commonly observed, or smaller when present.	Hairy, with hair swirls pointing backward. May retain dirt.
Body core	Very short and clean hair. Veins and wrinkles frequently visible. Sometimes glossier hair coat.	Longer hair coat that may retain more dirt. Veins and wrinkles not observed or difficult to visualize. Dull hair coat color seen frequently.
Switch	Frequently smaller, with shorter hairs, although there is variability. Some slick-haired animals may present tail switches similar in size to those observed in wild type-haired cows.	Larger in size with longer hairs.

Even in tropical countries like Puerto Rico, all cows shed their hair for a sleeker hair coat in the hot season of the year. Thus, differences between phenotypes in hair coats may be easier to visualize during winter than in summer (July 2022) when the current study was performed. Independent evaluators were trained to distinguish slick from wild type-haired cows based on these characteristics in the following order: (1) poll, head, and neck; (2) loin and rump; and (3) tail base and switch. Cows were evaluated following this order until a hair coat classification was established. For instance, if a definite hair coat classification could be determined by evaluating only the poll, head, and neck of the cow, no further examination was carried out.



FIGURE 1. Phenotypic differences between slick (left side image) and wild type-haired (right side image) Puerto Rican Holstein cows. Pictures taken in August, when wild type-haired cows present summer hair coats, decreasing the hair coat differences between phenotypes. In slick-haired cows, hair coats are considerably shorter, resulting in: (Panel A) polls and front faces that seem to have been hair clipped, with wrinkles above the eyes and veins in the nose bridge clearly observed; (Panel B) loins and tail bases sleeker with smaller hair swirls and a cleaner appearance; (Panel C) face sides and necks with easily observed wrinkles; and frequently (Panel D) smaller tail switches.

al., 2013). These changes are especially notable in wild type-haired *Bos taurus* cattle (Yeates, 1954). Under Puerto Rico's tropical conditions, winter coats in slick-haired cattle still look sleek. Thus, the current study was performed in summer when phenotypic differences between hair coat groups are considerably diminished. Evaluations performed during cooler months of the year may allow for an easier visual classification, probably resulting in even greater sensitivity values. Moreover, most cows were successfully visually classified by evaluating the poll, face, and neck, averaging less than one minute per cow. Only an average of five cows (about 5% of the cows evaluated) required further evaluation of the loin, rump, and tail. This suggests the convenience and feasibility of assessing hair coat type when cows are restricted in the headlocks as part of their regular management. Also, the evaluators in this study received minimal training prior to conducting the visual assessment, which logically suggests the possibility of achieving faster and more accurate classification by providing additional training / practice sessions.

TABLE 2.—Probability that the genomic hair coat type classifications were successfully identified by visual assessment in the lactating Holstein herd at the Lajas Agricultural Experiment Substation.

	Genomic test: Slick		Genomic test: Wild Type		Genomic test: Slick		Genomic test: Wild Type	
	Visual classification: Slick (%)	96.45	Visual classification: Wild Type (%)	98.14	Visual classification: Wild Type (%)	1.86	Visual classification: Slick (%)	3.55
All evaluators together (n=6)								
Evaluators' experience level								
None (n=2)	91.43		98.36		1.64		8.57	
Moderate (n=2)	98.36		96.12		3.88		1.64	
High (n=2)	100.00		100.00		0.00		0.00	

Data were analyzed considering all evaluators together and by each evaluator's level of experience with hair coat type classification.

In our study, visual assessment of hair coat type in the lactating Puerto Rican Holstein cows at the University of Puerto Rico resulted in a feasible, accurate, fast, and inexpensive predictor of the respective genomic classifications that can be successfully performed on farm and after minimal training. Thus, visual classification of hair coat types should be considered an alternative when genomic testing is limited or not possible. Future studies should evaluate the sensitivity of this technique in younger cattle, including dairy calves.

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