COMPARISONS OF HIGH-DENSITY GENOMIC DATA IN HOLSTEINS DIFFERING IN COAT TYPE

Lourdes E. López-Nieves, Verónica M. Negrón-Pérez, Héctor L. Sánchez-Rodríguez, Joan M. Patiño-Chaparro, Guillermo Ortiz-Colón & Melvin Pagán-Morales

Department of Animal Science, College of Agricultural Sciences, University of Puerto Rico, Mayagüez Campus

melvin.pagan1@upr.edu

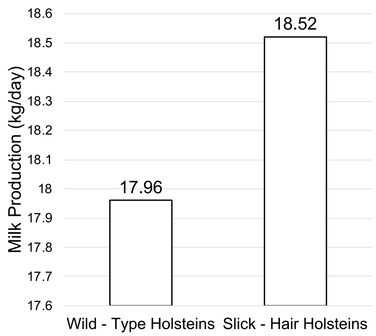
ABSTRACT

Preliminary studies have reported that wild type-haired (WT) Holstein cattle have greater productive potential at a genomic level than their slick-haired (SL) counterpart. The objective of the present study was to evaluate, through a panel of commercial genetic markers (Igenity Elite, Neogen Corp), 49 Holsteins descendants SL [32 SL (n=11 males and 21 females) and 17 WT (n=2 males and 15 females)] from the Agricultural Experiment Station of Puerto Rico. These animals received a predictive genomic transmission capacity (PTA) based on DNA tests using more than 100,000 bovine genome markers, which contain information from their parents for a more accurate measure of genetic potential. Traits evaluated included measures of productivity, health, type and other indexes such as: net merit, milk yield, somatic cell score, among others. Data was analyzed using Proc GLIMMIX in SAS and the differences between means were determined by the Tukey test. Various subsets of animals were compared; however, no main differences were found between SL and WT (P>0.05), except for stature (-1.07±0.17 vs -0.39±0.26; P=0.02, respectively). In a second subset, only lactating cows were evaluated (SL n=7 and WT n=7) and differences were found for: hypocalcemia (0.03±0.06 vs -0.21±0.06; P=0.01), mastitis (-0.11±0.24 vs 0.90±0.24; P=0.01), PTA type (-0.98±0.26 vs -0.11±0.26; P=0.03), udder composite (-0.96±0.26 vs -0.07±0.26; P=0.02), stature (-0.91±0.30 vs 0.04±0.30; P=0.04), dairy form (-1.64±0.26 vs -0.65±0.26; P=0.02), fore udder attachment (-0.77±0.30 vs 0.41±0.30; P=0.02), rear udder height (-1.39±0.34 vs -0.18±0.34; P=0.03) width (-1.42±0.29 vs -0.17±0.29; P=0.01), and udder depth (-0.73±0.27 vs 0.82±0.27; P=0.002), respectively. These results suggest that SL males and females are genomically similar to WT for the most important economic traits when descending from a SL dam and when compared as a single group. However, differences in type and health traits may occur if the females are compared alone.

INTRODUCTION

- An adaptive gene with a significant effect on heat stress is known as the "Slick" (SL) gene (Mariasegaram et al., 2007). Cattle with the dominant allele (SL) have short coats and can regulate temperature more effectively than Wild Type (WT) (Dickmen, et. Al, 2008) and are more productive due to their adaptability (Ortiz-Colón et al., 2018)

- Preliminary studies have reported that WT cattle have greater productive potential at the genomic level than their SL counterpart.



Comparison of milk production between wild-type Holsteins and Slick-hair Holsteins in Puerto Rico.

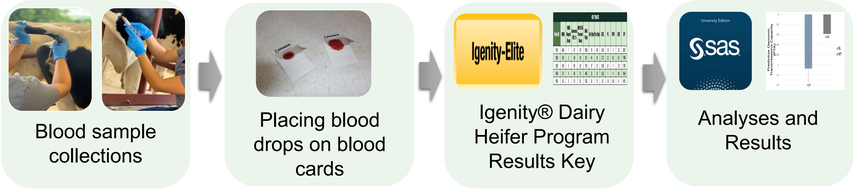
- About 49 Holstein cattle were selected from the Puerto Rico Agricultural Experiment Station, to assess the genetic potential of SL and WT cattle through measures of productivity, health, type, and others, through the Igenity Dairy Heifer Program.

- This objective measure allows the animals to be classified against all the others that are in the breed database and is very valuable for producers when making selection decisions.

OBJECTIVE

- Evaluate, through a panel of commercial genetic markers (nearly 150,000), 49 Holsteins descendant's SL and WT for indicators of productivity, health, type and other indices.

METHODOLOGY

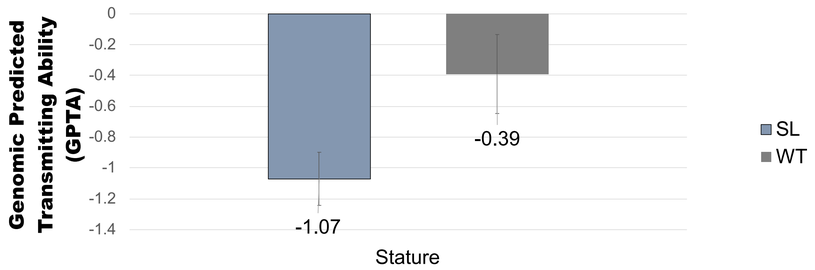


RESULTS — Subset 1

Table 1: Evaluation of traits measures of productivity and health. No main differences were found between SL and WT (P>0.05).

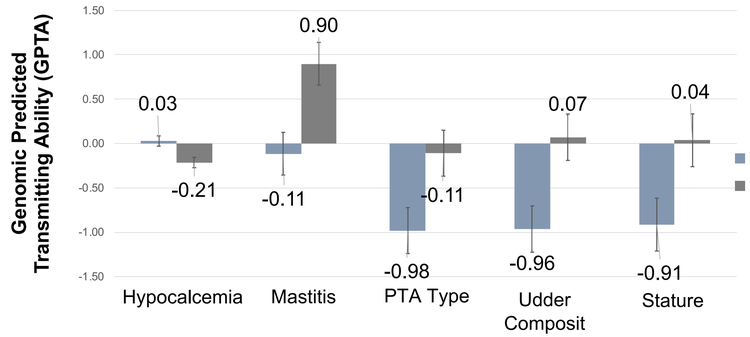
Variable	LS Means ± SE		Tukey-Kramer Adj P
	SL	WT	
Net Merit $	49.75 ± 28.16	52.14 ± 41.87	0.96
Milk Yield	119.59 ± 126.77	106.13 ± 188.49	0.95
Fluid Merit Dollars	52.23 ± 28.89	59.71 ± 42.96	0.88
Cheese Merit Dollars	49.40 ± 28.33	49.61 ± 42.13	0.99
Somatic Cell Score	2.90 ± 0.02	2.91 ± 0.03	0.75
Productive Life	2.03 ± 0.21	1.70 ± 0.32	0.37
Cow Livability	1.56 ± 0.25	1.58 ± 0.37	0.97
Hypocalcemia	-0.03 ± 0.03	-0.08 ± 0.04	0.29
Ketosis	0.17 ± 0.04	0.10 ± 0.05	0.24
Mastitis	0.71 ± 0.21	0.72 ± 0.31	0.96
Metritis	0.30 ± 0.06	0.20 ± 0.10	0.40
Retained Placenta	0.03 ± 0.03	-0.04 ± 0.05	0.24
Daughter Pregnancy Rate	0.86 ± 0.29	0.60 ± 0.43	0.59
Daughter Calving Ease	6.80 ± 0.20	6.79 ± 0.29	0.96
Igenity Production Index	1630.26 ± 36.83	1645.06 ± 54.76	0.81
PTA Type	-0.77 ± 0.16	-0.35 ± 0.24	0.13
Grazing Merit Dollars	50.66 ± 23.51	49.83 ± 34.96	0.98
Sire Calving Ease	7.57 ± 0.15	7.55 ± 0.22	0.93
Cow Conception Rate	0.87 ± 0.33	0.62 ± 0.49	0.66
Heifer Conception Rate	0.67 ± 0.20	0.56 ± 0.30	0.75
Gestation Length	-0.96 ± 0.20	-0.78 ± 0.30	0.59

Graphic 1: Stature Evaluation. Differences were found between SL and WT only for stature (P=0.02).

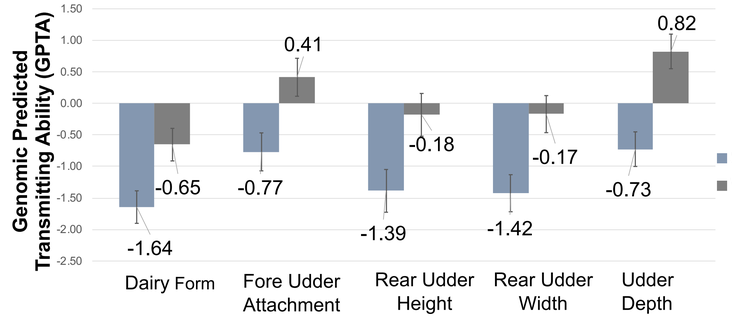


RESULTS — Subset 2

Graphic 2: Evaluation of hypocalcemia, mastitis, PTA Type, udder composite and stature. Main differences were found between SL and WT (P<0.05).



Graphic 3: Evaluation of dairy form, fore udder attachment, rear udder height, rear udder width and udder depth. Main differences were found between SL and WT (P<0.05).



CONCLUSION

- Results suggest that SL males and females are genomically similar to WT for the most important economic traits when descending from a SL dam and when compared as a single group.
- However, differences in type and health traits may occur if the females are compared alone.

REFERENCES

- Mariasegaram, M., Chase, C., Chaparro, J., Olson, T., Brenneman, R., & Niedz, R. (2007). The slick hair coat locus maps to chromosome 20 in Senepol-derived cattle. *Animal Genetics*, *38*(1), 54-59. doi: 10.1111/j.1365-2052.2007.01560.x
- Littlejohn, M., Henty, K., Tiplady, K., Johnson, T., Harland, C., & Lopdell, T. et al. (2014). Functionally reciprocal mutations of the prolactin signalling pathway define hairy and slick cattle. *Nature Communications*, *5*(1). doi: 10.1038/ncomms6861
- Dikmen, S., Alava, E., Pontes, E., Fear, J., Dikmen, B., Olson, T., & Hansen, P. (2008). Differences in Thermoregulatory Ability Between Slick-Haired and Wild-Type Lactating Holstein Cows in Response to Acute Heat Stress. *Journal Of Dairy Science*, *91*(9), 3395-3402. doi: 10.3168/jds.2008-1072
- Ortiz-Colón, G., Fain, S., Parés, I., Curbelo-Rodríguez, J., Jiménez-Cabán, E., Pagán-Morales, M., & Gould, W. (2018). Assessing climate vulnerabilities and adaptive strategies for resilient beef and dairy operations in the tropics. *Climatic Change*, *146*(1-2), 47-58. doi: 10.1007/s10584-017-2110-1