

Bovine Genetic Disease Frequencies:

A national perspective on commercial and pedigree cattle in Ireland

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Introduction

Historically, one only discovered if an animal was a carrier for a genetic disease after it had produced an affected offspring. Once identified the livestock producer typically had two choices 1) cull any ancestor or relative of the affected progeny, or 2) risk producing another affected calf. As molecular tests for causative mutations became available carrier animals could be identified, but often only AI bulls or elite pedigree animals were tested. Commercial producers tried to minimize their genetic disease risk by purchasing bulls assumed to be free of genetic diseases. To aid cattle genomics we developed a low cost, custom bovine Illumina single nucleotide polymorphism (SNP) genotype panel (International Dairy & Beef panel; IDB) which contains 39 validated probes for Mendelian diseases. Currently, >140,000 Irish commercial and pedigree beef and dairy animals have been genotyped with the IDBv2. Reports are generated to provide producers with their animal's genetic disease status and allow more informed breeding decisions.

Examples of Farmer Reports

Farm report of Genetic Disease/Major Gene Report

Mr/Mrs SMITH
 Herd IE1513 / BTEnumber

Number of animals currently present in your herd: 529
 # Number of beef animals genotyped for disease/major genes: 4
 # Number of dairy animals genotyped for disease/major genes: 361

To increase accuracy an animal must have a genotype call rate of >95% to have its genetic disease and major gene allele status reported

More information about genetic diseases and Major genes reported below can be found at www.icbf.com

Summary for your dairy animals - Number of dairy animals genotyped: 361
 The frequencies shown in the graphs are based on the number of genotyped animals

TYPE OF GENOTYPE: LETHAL (see Table 1.3 for details by animals)

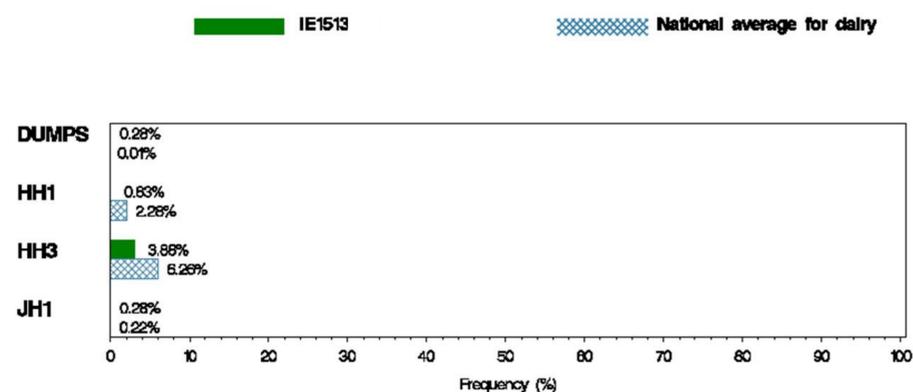


Table 3. Summary for DAIRY animals

Jumbo	Animal tag	Colour	Disease	Major gene	Lethal	Non lethal	Phys. trait	Not genot.
4388	IE1513 4388	BLACK_E		CAPN1_316 CAPN1_4751 CAPN1_530 CAST_2870 CAST_2959 DGAT1 LGB		KC		
4390	IE1513 4390	BLACK_E		CAPN1_316 CAST_2870 CAST_2959 DGAT1 LGB		KC		
4391	IE1513 4391	BLACK_E RED_E		CAPN1_316 CAST_2870 CAST_2959 DGAT1 LGB		KC		
4393	IE1513 4393	BLACK_E		CAST_2959 DGAT1				
4394	IE1513 4394	BLACK_E		CAPN1_316 CAST_2959 DGAT1 LGB	HH3			
4395	IE1513 4395	BLACK_E		CAST_2870 CAST_2959 DGAT1 LGB		KC		
4397	IE1513 4397	BLACK_E		CAPN1_316 CAST_2870 DGAT1		KC		
4398	IE1513 4398	BLACK_E		CAPN1_4751 CAPN1_530 CAST_2870 DGAT1 LGB		KC		
4400	IE1513 4400	BLACK_E		CAST_2959 DGAT1 LGB		KC		
4401	IE1513 4401	BLACK_E		CAPN1_316 CAST_2870 CAST_2959 DGAT1 LGB	HH3	KC		
4403	IE1513 4403	BLACK_E		CAPN1_316 CAPN1_4751 CAPN1_530 CAST_2870 CAST_2959 DGAT1		KC		
4405	IE1513 4405	BLACK_E		CAPN1_316 CAST_2870 CAST_2959 LGB		KC		
4406	IE1513 4406	BLACK_E		CAPN1_4751 CAPN1_530 CAST_2959 LGB		KC		
4408	IE1513 4408	BLACK_E		CAPN1_316 CAPN1_4751 CAPN1_530 CAST_2870 CAST_2959 LGB		KC		

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Disease Carrier Frequencies in Ireland by Animal Type

Trait	Breeds Reported In	Dairy	Pure Beef	Crossbred
Alpha Mannosidosis 662	Galloway	0.000%	0.000%	0.003%
Beta Mannosidosis	Salers	0.000%	0.000%	0.031%
Bovine Leukocyte Adhesion Deficiency	Holstein	0.637%	0.003%	0.209%
Brachyspina	Holstein	1.663%	0.006%	0.294%
Bulldog Dwarfism, Condrysplaiia BD1	Dexter, Dahomey	0.000%	0.000%	0.003%
Citrullinaemia		0.096%	0.000%	0.104%
Coat Colour Dilution and Hypotrichosis	Hereford, Simmental, Galloway, Highland	0.019%	3.937%	10.607%
Complex Vertebral Malformation	Holstein	2.482%	0.017%	0.640%
Congenital Muscular Dystonia 1	Belgian Blue	0.010%	0.115%	0.328%
Congenital Muscular Dystonia 2	Belgian Blue	0.000%	0.040%	0.133%
Crooked tail syndrome	Belgian Blue	0.029%	0.230%	0.819%
Deficiency of Uridine Monophosphate Synthase	Holstein	0.005%	0.000%	0.001%
Dystrophic Epidermolysis Bullosa	Rotes Hohenvieh	0.000%	0.000%	0.000%
HH1	Holstein	2.464%	0.003%	0.271%
HH3	Holstein	7.376%	0.000%	0.044%
HH4	Holstein	0.393%	0.000%	0.012%
Hypotrichosis-KRT71	Hereford	0.010%	0.325%	0.457%
Idiopathic Epilepsy	Hereford	0.000%	0.000%	0.000%
JH1	Jersey	0.144%	0.000%	0.001%
Maple Syrup Urine - Shorthorn	Shorthorn	0.000%	0.000%	0.000%
MH2	Montbeliarde	0.115%	0.003%	0.057%
Myoclonus, congenital	Hereford	0.000%	0.000%	0.000%
Neuropathic Hydrocephalus	Angus	0.000%	0.006%	0.000%
Osteopetrosis	Red Angus	0.000%	0.020%	0.003%
Paunch Calf Syndrome	Romagnola	0.000%	0.014%	0.003%
Protoporphyrria	Blond de'Aquitaine, Limousin	0.005%	1.674%	0.564%
Pseudomyotonia-c.491G>A	Chianina,	0.000%	0.000%	0.000%
Pseudomyotonia-c.632G>T	Romagnola	0.000%	0.003%	0.008%
Pseudomyotonia-c.857G>T	Romagnola	0.005%	0.003%	0.007%
Pulmonary Hypoplasia with Anascarca 1	Main, Chi, Shorthorn	0.010%	0.000%	0.001%
RNF11	Belgian Bue	0.000%	0.359%	0.313%
Spinal Muscular Atrophy	Brown Swiss	0.005%	0.000%	0.009%
STAT1	Holstein	36.445%	23.287%	27.356%
STAT3-19069	Holstein	43.947%	34.813%	44.143%
STAT3-25402	Holstein	41.834%	39.585%	48.026%
STAT5-13244	Holstein	47.161%	43.475%	47.404%
STAT5-13319	Holstein	8.594%	13.268%	12.790%
STAT5-13516	Holstein	47.181%	43.516%	47.421%
Tibial Hemimelia-Improver	Simmental, Shorthorn, Galloway	0.000%	0.213%	0.229%

Dairy = animal's pedigree is ≥92% dairy breed

Pure Beef = ≥92% of a single beef breed

Crossbred = all others

Breeds reported in = Breeds disease historically reported in

Conclusions

Genetic disease carrier animals were identified for all but 5 of the validated disease probes and 2 of those (Dystrophic Epidermolysis Bullosa and Pseudomyotonia-c.491G>A) are only reported in breeds not present in Ireland (Rotes Honevnieh and Chianina, respectively). Disease carriers for many diseases were found across the breed type (Dairy, Purebred Breed, and Crossbreds) likely reflecting the high level of beef x dairy crossbreeding in Ireland, or that these diseases truly are historically present in multiple breeds.

By providing farmers with reports that identify carrier animals they will be able to design a mating strategy that to reduces their disease risk while maximizing their genetic gain.