Investigating the Effect of Animal Genotype on Milk Fat Production in Grazing Dairy Cows

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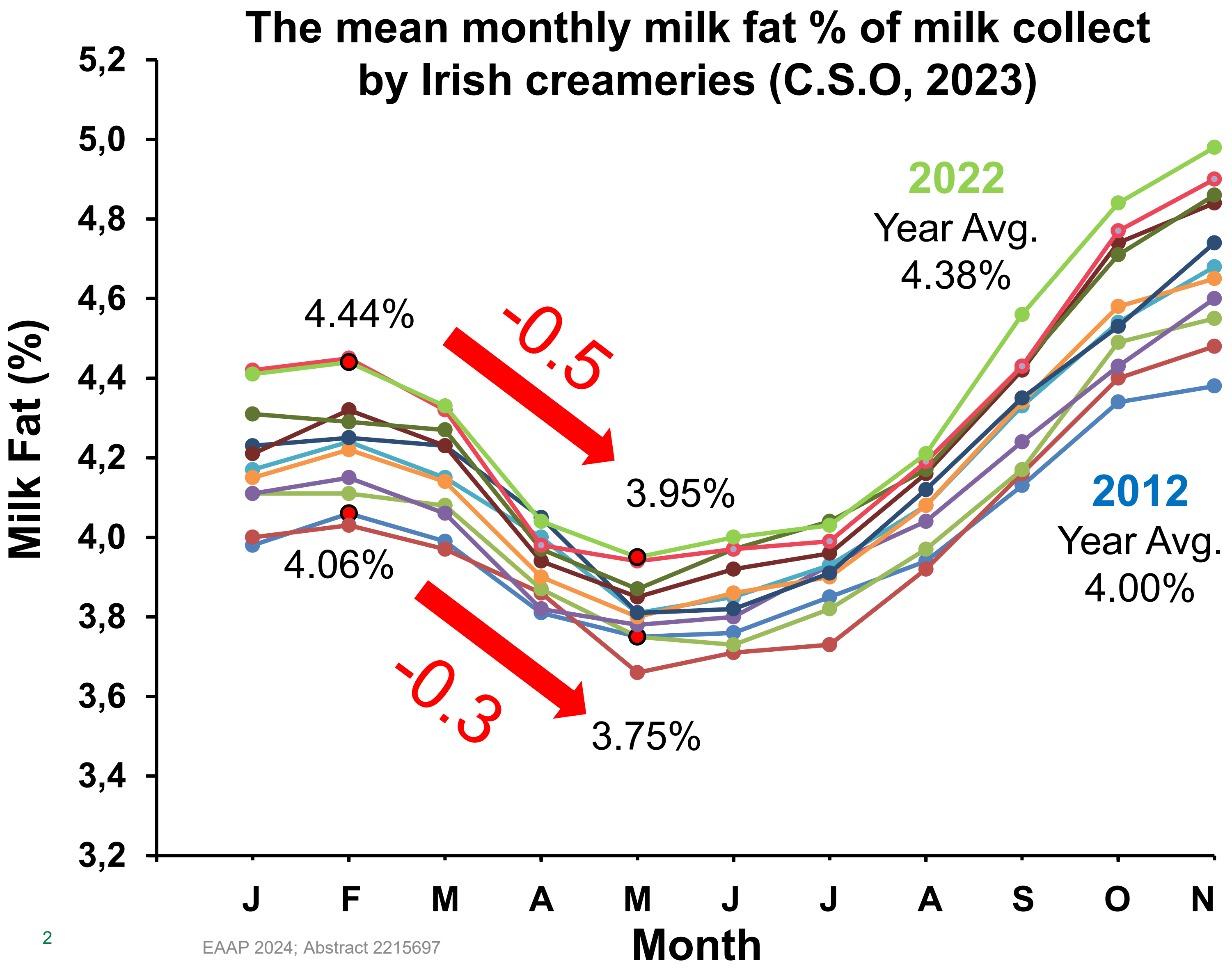
Background



- Annual milk fat concentration has been increasing over time
- However, consistent reduction during late spring/early summer
  - Coincides with peak milk production period
  - Large financial implications
- Severity of the reduction seems to be increasing

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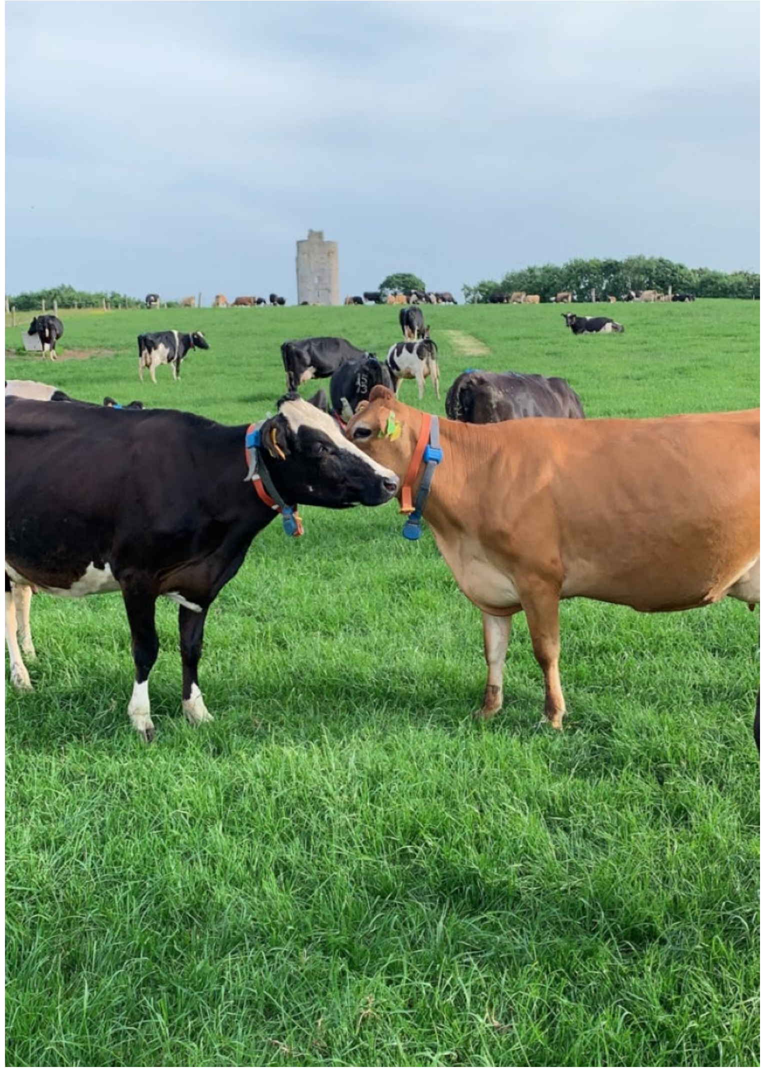
Potential Causative Factors

- Stage of lactation typically implicated due to higher milk production
- Investigations suggest that the reduction is independent of stage of lactation/DIM (Carty et al., 2017)
- Nutritional mechanisms;
  - Acetate supply
  - Biohydrogenation theory
    - » Polyunsaturated Fatty Acid Load
    - » Low levels of NDF combined with rapidly digestible carbohydrates
    - » Low rumen pH
- While nutritional strategies can help maintain milk fat concentration, often an underlying animal genetic component is at play



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Experimental Design

	Holstein-Friesian		Jersey
Item	**Elite**	**NA**	**JE**
Animal No.	60	60	60
EBI	225	157	168
Sub Index			
Milk	72	48	67
Fertility	103	74	50
Calving	42	31	38
Beef	-15	-15	-52
Maintenance	15	14	52
Health	6	3	5
PTA			
Milk, kg	26	48	-390
Fat, %	0.20	0.11	0.53
Protein, %	0.13	0.08	0.26
Fat, kg	12.3	7.9	13.1
Protein, kg	8.4	6.1	0.9

- Our objective was to investigate the effect of animal genotype during a high risk period for reduced milk fat synthesis
- 45 primiparous and 135 multiparous averaging 48 ±18 DIM were blocked and randomly assigned to 1 of 3 dietary treatment groups

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Trial Outline

19 Week Trial Length
2 Week Covariate
Late March – Early April
11 Week Experimental Period
Early April – End June
6 Week Carry Over Period
July – Early August

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Materials & Methods

- Daily milk yields
- Weekly milk sampling
- Pre- and post-grazing sward heights
- Pre-grazing sward sampling
- Repeated measures mixed model
  - Fixed effects of parity, week, diet, genotype and their interactions
  - Random effect of cow
  - Repeated effect of week

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Yield and Fat Production Results

Item	GG			SEM	*P*-value
	Elite	NA	JE		
Milk yield, kg d^{-1}	26.6^{A}	26.8^{A}	21.4^{B}	0.28	<0.01
ECM yield, kg d^{-1}	31.6^{A}	30.3^{B}	29.2^{C}	0.29	<0.01
Fat, %	4.63^{B}	4.25^{C}	5.72^{A}	0.04	<0.01
De novo, g $100g^{-1}$ of fat	26.0^{B}	25.7^{B}	27.4^{A}	0.13	<0.01
Mixed, g $100g^{-1}$ of fat	32.5^{B}	31.8^{C}	35.4^{A}	0.13	<0.01
Preformed, g $100g^{-1}$ of fat	40.2^{B}	41.2^{A}	36.1^{C}	0.21	<0.01
Fat, kg d^{-1}	1.22^{A}	1.14^{B}	1.22^{A}	0.01	<0.01

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Protein, Lactose and Milk Solids Results

	GG				
Item	Elite	NA	JE	SEM	*P*-value
Protein, %	3.68^{B}	3.53^{C}	4.13^{A}	0.02	<0.01
Protein, kg d^{-1}	0.97^{A}	0.94^{B}	0.88^{C}	0.01	<0.01
Lactose, %	4.84^{C}	4.87^{B}	4.90^{A}	0.01	<0.01
Lactose, kg d^{-1}	1.28^{A}	1.31^{A}	1.05^{B}	0.01	<0.01
Milk solids, kg d^{-1}	2.19^{A}	2.08^{B}	2.10^{B}	0.02	<0.01

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Conclusion

- High EBI HF and JE cows produced higher milk fat concentration and milk fat yield compared with `national average EBI HF
- JE produced milk fat with higher de novo, higher mixed and lower preformed fatty acids when compared with HF
- Animal genotype plays an important role in milk fat production during the high-risk period
- It is important that producers consider animal genetics in combination with nutritional strategies when investigating a milk fat concentration issue

Thank You for Your Attention, Any Questions?

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