

The effect of physiological state, milk production traits and environmental conditions on milk fat globule size in bovine milk.

Leonie Walter^{1,2*}, Sue Finch³, Brendan Cullen¹, Richard Fry¹, Amy Logan², Brian J Leury¹

¹ Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Parkville, Victoria, Australia 3010

² CSIRO Agriculture and Food, Werribee, Victoria, Australia 3030

³ School of Mathematics and Statistics, Statistical Consulting Centre, The University of Melbourne, Parkville, Australia 3010

Short title: **Impact factors on milk fat globule size**

*Correspondence: Leonie Walter

Building 184 Royal Parade

Parkville, Victoria, Australia 3010

Phone: +61 412247481

Email: leonie.walter@unimelb.edu.au

Summary

This research paper quantifies the effects of a range of impact factors on milk fat globule (MFG) size for a herd managed through an automatic milking system with year-round calving. We hypothesised that the overall variation in average MFG size observed between individual animals of the same herd cannot sufficiently be explained by the magnitude of the effects of factors that could be manipulated on-farm. Hence, we aimed to conduct an extensive analysis of possible determinants of MFG size, including physiological characteristics (parity, days in milk, days pregnant, weight, age, rumination minutes, somatic cell count) and milk production traits (number of milkings, milk yield, fat yield, protein and fat content, fat-protein ratio) on the individual animal level, and environmental conditions (feed composition, weather, day) for the whole herd. Our results show that when analysed in isolation, many of the studied variables have a detectable effect on MFG size. However, analysis of their additive effects identified days in milk, parity and milk yield as the most important factors. In accordance with our hypothesis, the estimated effects of these factors, calculated using a multiple variable linear mixed model, do not sufficiently explain the overall variation between cows, ranging from 2.70 to 5.69 μm in average MFG size. We further show that environmental factors, such as sampling day (across seasons) or the proportion of pasture and silage in the diet, have limited effects on MFG size and that physiological differences outweigh the effects of milk production traits and environmental conditions. This presents further evidence that the selection of individual animals is more important than the adjustment of on-farm factors to control MFG size.