Establishing the impact of improved feeding on the quality of dairy products, using correlative analytical technology (e-nose)

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INTRODUCTION

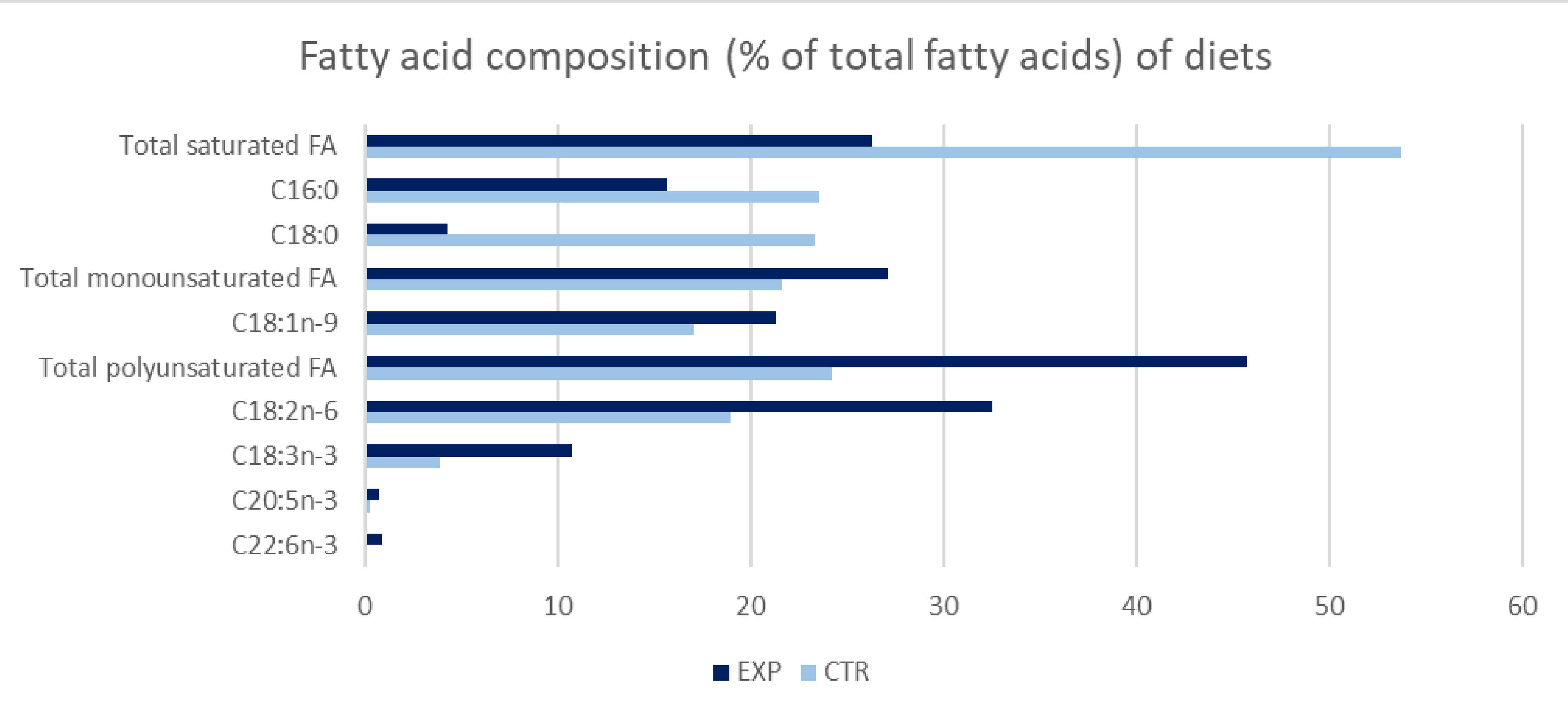
- Nutritional and sensory qualities of dairy products are major concerns for consumers.
- The quality of feed influences the sensory properties of milk.
- The sensory properties of milk over the years have been done by conventional means such as human sensory test. There is a need for more durable, automatable, cost effective techniques.
- Electronic nose (e-nose) has been employed as an alternative rapid correlative tool in the analysis of sensory properties of dairy products.

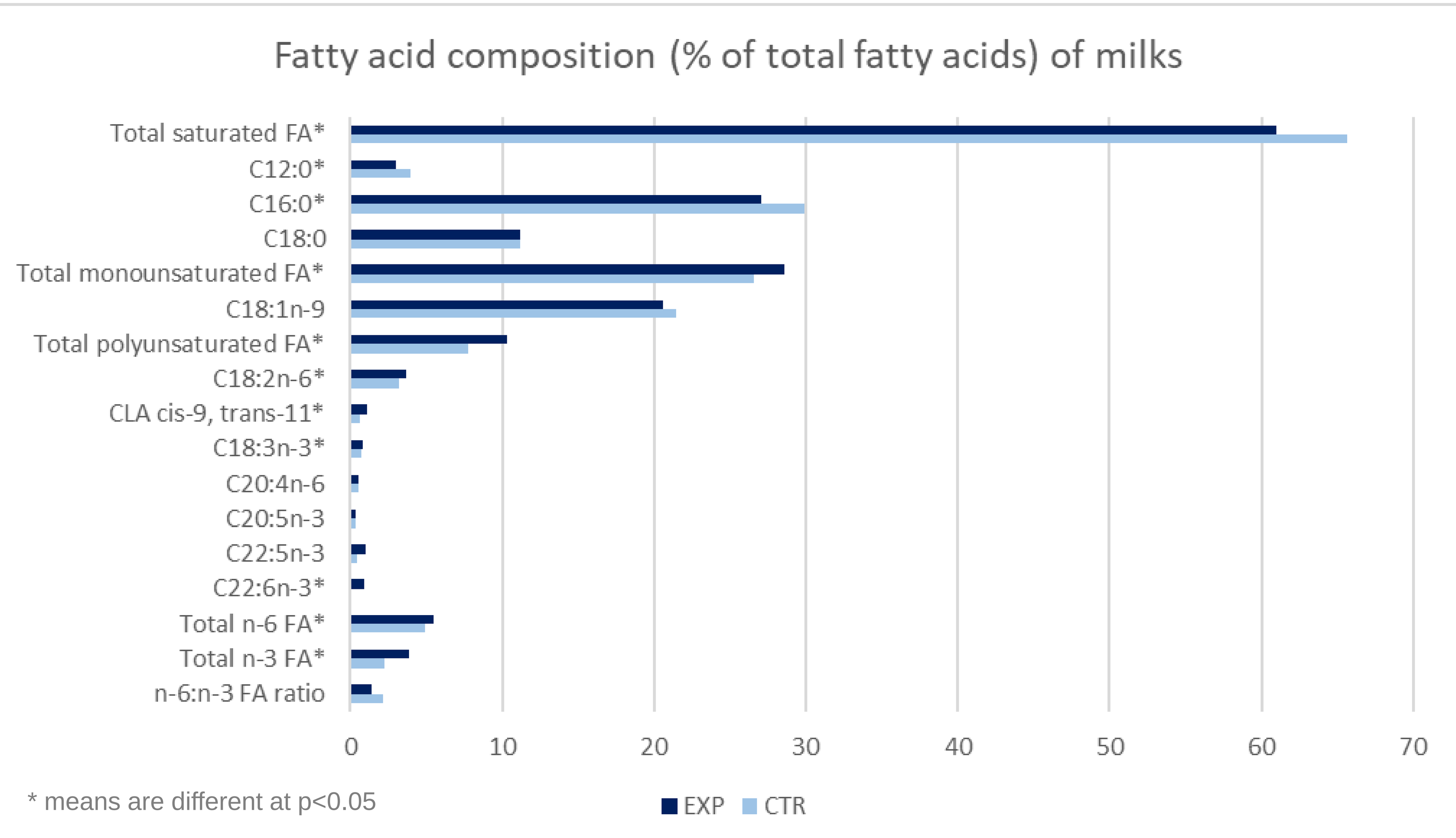
AIM OF THE STUDY

- **This study was designed to test the applicability of e-nose in the evaluation of the sensory properties of dairy products (milk, yogurt and cheese) obtained from dairy cows fed diets with different amounts of n-3 polyunsaturated fatty acids.**

MATERIALS AND METHODS

- ***Feeding***: CTR and EXP cows fed supplementary feeds which were based on hydrogenated palm oil (CTR) or mixture of linseed and fish oil (EXP).
- ***Milk collection***: milk samples were collected after 2 weeks of dairy cow adaption (CTR vs EXP).
- ***Yogurt preparation***: using milk from both CTR and EXP (2 independent productions) with 3 classes of bacteria culture (none-probiotic, moderate and probiotic).
- ***Cheese***: commercial cheese were produced from the CTR and EXP milk with 4 and 8 weeks maturation.





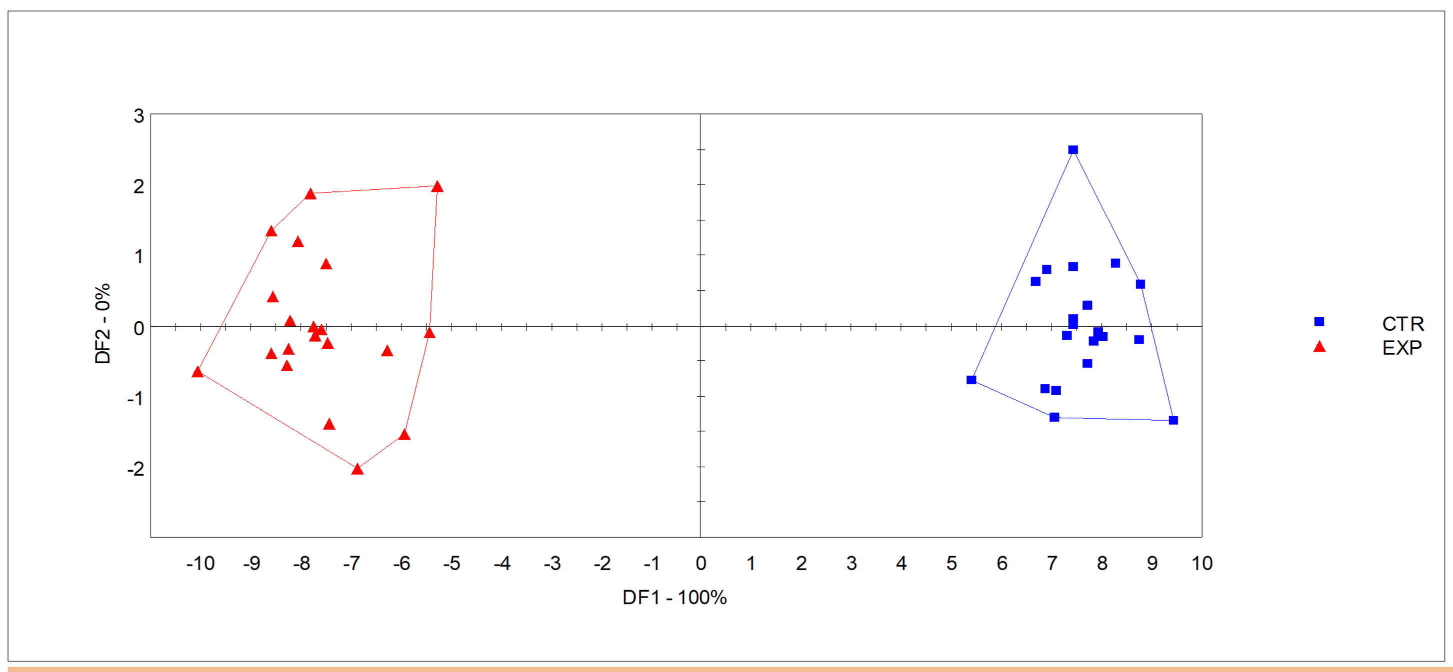
- ***Sample preparation for e-nose measurement***

- TMR and cheese: 3 replicates by measuring 3-times 1 g each
- Milk and yogurt: 3 replicates by measuring 1 mL per sample
- Instrument: A Heracles Neo (Alpha MOS, Toulouse, France) flash gas chromatography (FGC) with two columns (MXT-5 and MXT-1701, Restek, USA) equipped with a HS 100 (PAL Systems, Switzerland) auto-sampler; carrier gas: hydrogen, 99.999% purity; incubation: 50 °C for TMR, Milk, Yogurt and 70 °C for Cheese.
- Head space measurement: done in a 20mL sealed vials with PTFE+silicon septum with 5 mL headspace injection.

- ***Multivariate data analyses***

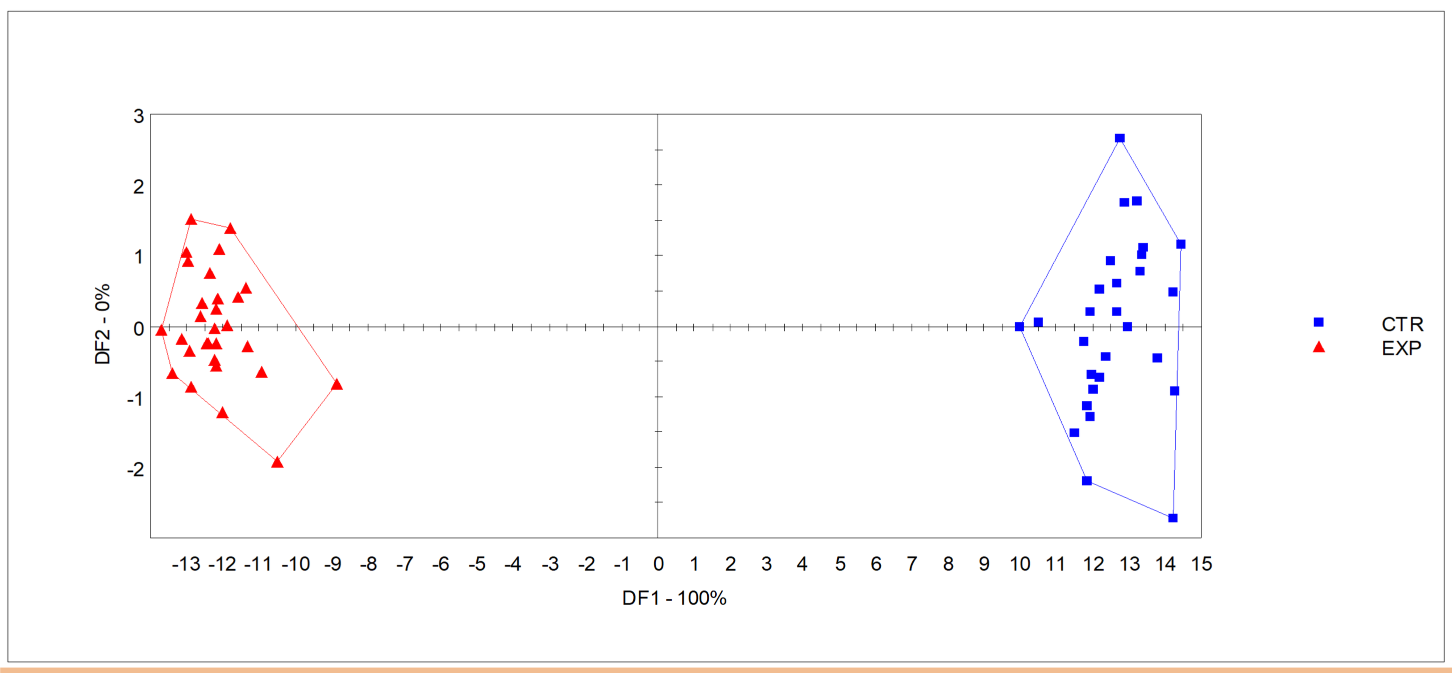
- Data acquisition: chromatogram peaks were used as sensor data representing the smell fingerprints of the samples.
- Classification methods: discriminant factor analysis (DFA).
- Statistical software: AlphaSoft V12 (Alpha MOS).

RESULTS AND DISCUSSION



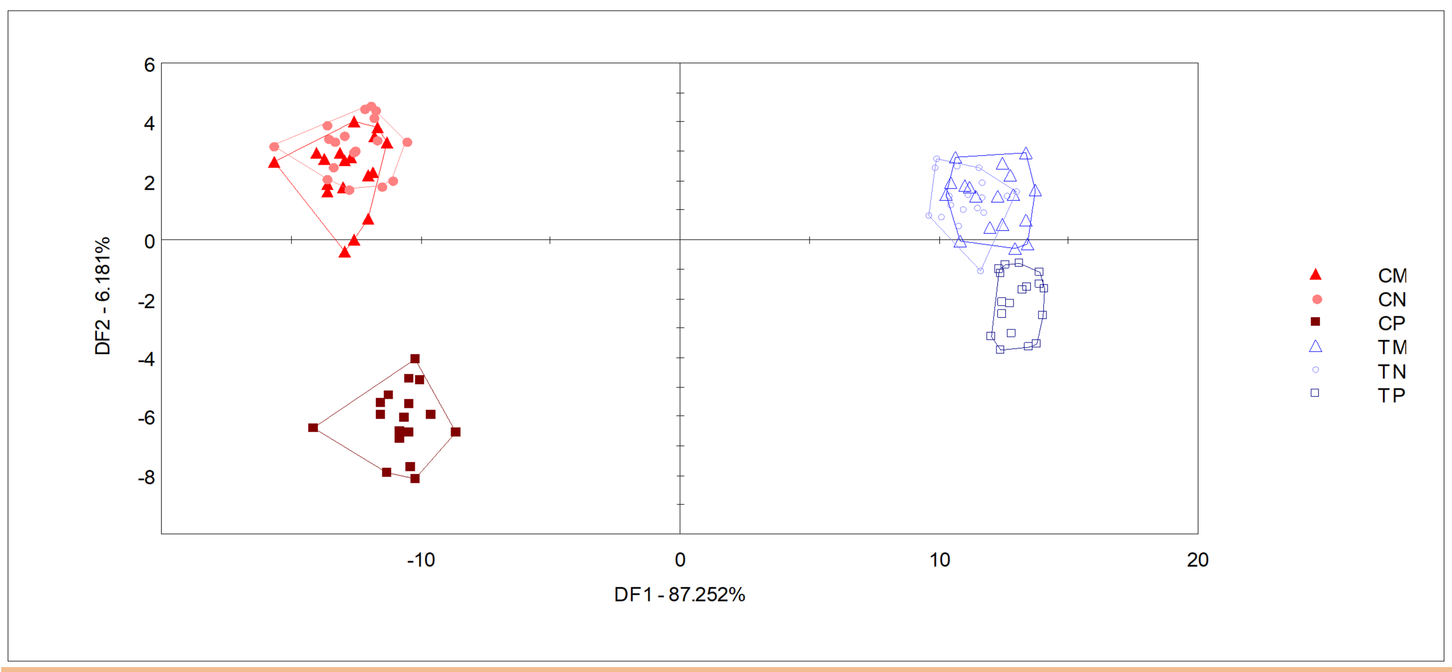
- distinct classification of CTR and EXP diets (DF1) based on smell fingerprints

Figure 1. DFA score plot of CTR and EXP diets performed using all sensors (cross-validation score = 98 %)



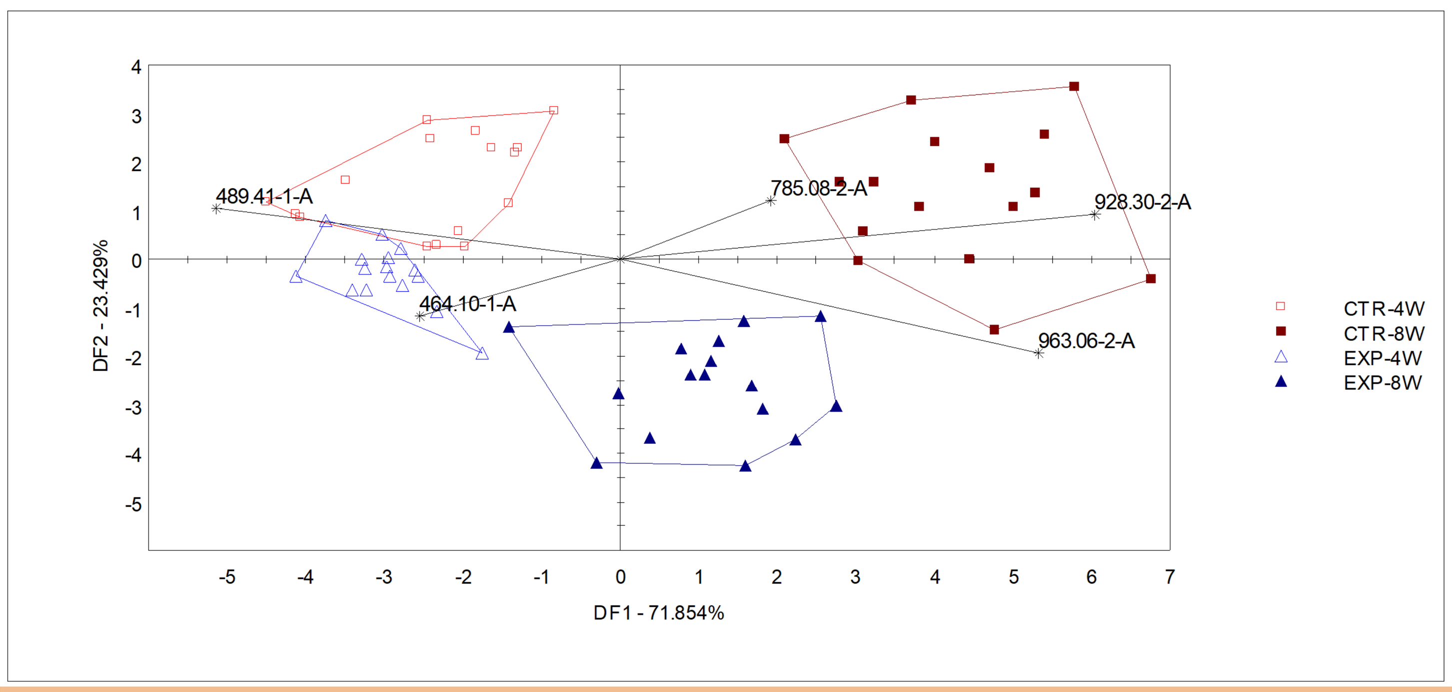
- distinct classification of CTR and EXP milk (DF1) based on smell fingerprints

Figure 2. DFA score plot of CTR and EXP milk performed using all sensors (cross-validation score = 63 %)



- classification of CTR and EXP yogurts (DF1) and type of the bacteria culture (DF2) based on smell fingerprints

Figure 3. DFA score plot of CTR and EXP yogurts with the 3 classes of culture (CM: moderate probiotic of control; CN: none-probiotic of control; CP: probiotic of control; TM: moderate probiotic of experimental; TN: non-probiotic of experimental; and TP: probiotic of experimental) performed using all sensors



- classification of CTR and EXP cheeses (DF2) and weeks of production (DF1) based on smell fingerprints

Figure 4. DFA score plot of CTR and EXP cheeses of 4 and 8 weeks production (CTR-4W: 4th week production from control milk; CTR-8W: 8th week production from control milk; EXP-4W: 4th week production from experimental milk; EXP-8W: 8th week production from experimental milk) performed using selected sensors

CONCLUSIONS

The CTR and EXP diets influenced the odor profiles of the dairy products; with the distinct classification of CTR milk from EXP milk; group differences of CTR and EXP yogurts; and group differences CTR and EXP cheeses of different production weeks (4 vs. 8 weeks). Probiotic culture caused major smell difference in both CTR and EXP yogurts, while the difference of probiotic from non-probiotic or moderate groups was bigger in the CTR yogurt. The smell difference of CTR and EXP cheeses increased during the maturation, while maturation caused less changes of smell in EXP cheese.

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