# Dairy products from grass are simply better

## A pasture-based diet improves nutritional the composition and quality of milk, butter and cheddar cheese

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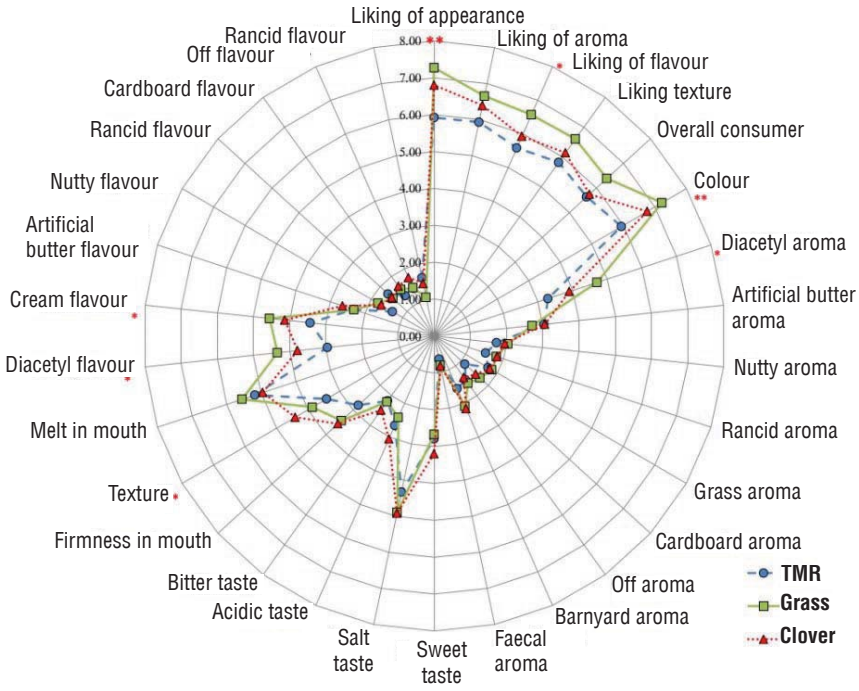
Only 10% of global milk production originates from pasture-based systems of production similar to traditional Irish systems. The use of a high-input confinement total mixed ration (TMR) feeding system is widely used in the US, parts of Europe and the southern hemisphere.

The TMR diet typically includes a formulated mix of forages, grains, by-products, minerals and vitamins, and is designed to enable the cow to achieve high dry matter intake and high milk yield. By its nature, however, a TMR system is an expensive and high-input enterprise, requiring specialised machinery and housing.

While TMR feeding results in increased milk yield, it does not necessarily improve the nutritional composition of the milk. Profiling Milk from Grass is a Teagasc-funded, multidisciplinary, collaborative project between the Teagasc Food Research Centre, the Teagasc Animal and Grassland Research and Innovation Centre and the APC Microbiome Institute. Key aims of the project are to compare the compositional, functional, and processing characteristics of milk and dairy products derived from a pasture-based feeding system of perennial ryegrass; a perennial ryegrass/white clover mixed sward; and a TMR-feeding system.

**Figure 1:** Sensory analysis of sweet cream mid-lactation butter produced from cows on TMR, GRS and CLV feeding systems. Sensory panellists were required to score each butter on a scale from 0 to 10 in terms of preference or intensity of attribute; 0 (none) to 10 (extreme). Points shown are the average results of a 26-person sensory panel for butter produced from each feeding system




### Experimental design

Fifty-four spring-calving Holstein Friesian cows were allocated to three groups at the Moorepark dairy unit. Three feeding systems were compared over a full lactation:

- **Treatment one** was housed indoors and fed a TMR diet.
- **Treatment two** was maintained outdoors on perennial ryegrass pasture only (GRS).
- **Treatment three** was maintained outdoors on a perennial ryegrass/white clover pasture (CLV).

Cows on the TMR diet were offered, on a dry matter basis (DM), 7.15kg of grass silage, 7.15kg of maize silage and 8.3kg of concentrates daily. Cows on the pasture-based systems were offered about 18 kg DM/day (>4cm). The CLV sward contained approximately 20 % white clover. In order to obtain a representative sample of milk, the cows in each of the three feeding systems were milked separately into designated 5,000-litre refrigerated tanks.

The evening milk was stored at 4°C

Cows on the TMR diet were offered, on a dry matter basis (DM), 7.15kg of grass silage, 7.15kg of maize silage and 8.3kg of concentrates daily.

overnight, the morning milk was then added and the milk was agitated before collection. Bulk milk samples were collected after the morning milking weekly throughout lactation and stored at 4°C until analysis. Bulk milk samples were also collected to produce mid-lactation sweet cream butter and mid-late lactation cheddar cheese.

### Effects of feeding system on raw milk composition

The GRS feeding system produced milk with higher concentrations of fat (4.65% v 4.39%) and protein (3.65% v 3.38%) compared with the TMR system. Moreover, the GRS feeding system produced milk with better quality protein with increased true protein concentrations compared with the TMR system (3.46% v 3.19%).

### Effects of feeding system on sweet cream butter

This study evaluated the effects of the cow feeding system on the characteristics, quality and consumer perception of butter. Feeding system resulted in significant differences in fatty acid composition. These differences contributed to significant differences in textural, thermal, sensory and volatile properties of the butter produced. Pasture-derived (GRS and CLV) milk produced butter with improved nutritional characteristics.

Sensory panellist data revealed that GRS-derived butter achieved significantly higher scores for several attributes including "liking" of appearance, flavour and colour (Figure 1).

### Effects of feeding system on cheddar cheese

The nutritional composition of cheddar cheese was improved on the pasture-based feeding systems (GRS or CLV). Pasture-derived cheddar cheese was shown to have significantly higher omega-3 fatty acid content, while TMR cheese had significantly higher omega-6 fatty acid content. The consumption of CLA has been proposed to have several potential health benefits.

### Conclusions

The results of the current study demonstrated the superior nutritional quality of milk produced from pasture-based systems compared with TMR systems of milk production in terms of fatty acid and macronutrient composition. Additionally, higher scores for a combination of appearance, flavour and colour were recorded for butter and cheddar cheese manufactured using milk derived from pasture-based systems compared with a TMR system. The study also highlighted the possibility of using milk fatty acid profiling to distinguish milk and different dairy products derived from a pasture versus a TMR-based diet.

## Key messages

- A study was conducted to compare milk derived from cows fed different diets based on grazed grass, grazed grass plus clover or an indoor TMR.
- Milk from pasture-based systems had higher fat and protein content and improved protein quality compared with milk from the TMR system
- The fatty acid composition of milk from the pasture-based systems was nutritionally superior, and resulted in butter and cheddar cheese with more favourable thrombogenicity ( a measure of processability) scores.
- Sensory analysis revealed a consumer preference for the dairy products derived from the pasture-based system compared with the TMR-based system. The preference was based on a combination of appearance, flavour and colour.
- The study highlighted the possibility of using milk fatty acid profiling to distinguish between milk derived from a pasture diet and milk derived from TMR-based diet.