Developent of Dairy Products Enriched with Healthy Lipids

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Introduction

Increasing the availability of these n-3 PUFA in dairy products for human consumption remains a challenge due to rumen biohydrogenation. Establishing a method in which biohydrogenation is reduced is mandatory for dietary PUFA to remain intact and transfer into the milk. Finding a mechanism for improving the fatty acid profile of dairy products without compromising sensory attributes would prove beneficial to the North American consumer.

Objectives

1
- To produce milk with elevated levels of n-3 fatty acids through dietary means

2
- To produce Havarti cheese from control and n-3 milk

3
- To evaluate the fatty acid profiles and sensory attributes of milk and cheese from control and n-3 milk

Methodology

Six multiparous, mid-lactating Holstein cows were sourced from the University of Saskatchewan's Greenbrae herd (Saskatoon, SK, Canada). Animals were fed a control ration followed by a ration supplemented with a co-extruded flaxseed product (LinPRO®-R70; 70% flaxseed) at 9% of TMR DM for 28 days. Milk samples were collected on day 28 from the three milking times and pooled proportionally based on milk weights. These samples were sent to CanWest DHI (Edmonton, AB) and Lipid Analytical Services (Guelph Ont.) for compositional and fatty acid analysis, respectively. Bulk samples of raw milk were also collected on day 28 and transported to the Saskatchewan Food Industry Development Centre (SFIDC, Saskatoon, SK, Canada) for manufacturing of Havarti Cheese and subsequent sensory trials.

Milk Sensory Evaluation):
A triangle sensory test was conducted to determine whether any differences in sensory characteristics were found in control milk and treatment milk. Three milk samples were served at refrigerated temperatures and presented to eleven panelist in random orders with two identical samples and one odd sample; panelists were then asked to identify the odd sample.

Cheese Sensory Evaluation:
1.5 cm^3 samples of Havarti cheese were collected from both the control and treatment cheeses, placed in serving containers and served to twenty panelists at room temperature. The panelists were instructed to evaluate the cheese on color, cheese flavor, taste and overall acceptability using a 6 point hedonic scale with 1 = dislike very much and 6 = like very much.

Results

Table 1: Comparison of LinPRO®-R supplementation with Control diet on composition and fatty acid profile of milk

Item	Mean Pre-treatment	Mean LinPRO®-R Trt	Difference (LPR-CTL)[a]	SED[b]	P value
Milk Fat (%)	3.70	3.24	-0.46	0.08	0.48
Milk Protein (%)	3.44	3.11	-0.33	0.02	<.0001
Fatty Acid (% FAME)					
C14:0	12.62	10.75	-1.87	0.18	<.0001
C16:0	40.56	28.20	-12.36	0.34	<.0001
C18:0	7.51	13.67	6.16	0.19	<.0001
C18:2n6	1.87	1.64	-0.23	0.04	<.0001
C18:3n3	0.49	0.95	0.46	0.03	<.0001
CLA	0.23	0.76	0.53	0.05	<.0001
C20:4n6	0.20	0.14	-0.06	0.01	<.0001
C20:5n3	0.04	0.07	0.03	0.00	<.0001
C22:5n3	0.06	0.08	0.02	0.01	0.153
C22:6n3	0.04	0.06	0.02	0.01	0.001
Sat. FA	75.07	63.61	-11.46	0.30	<.0001
MUFA	21.72	32.20	10.48	0.29	<.0001
PUFA	3.21	4.20	0.99	0.04	<.0001
n-3	0.67	1.25	0.56	0.03	<.0001
n-6	2.32	2.20	-0.12	0.04	0.024
n-6:n-3	3.42	1.77	-1.65	0.06	<.0001

[a] Paired t test, [b] standard error of difference, significance declared at P≤0.05, strong significance declared at P≤0.01

Figure 1: Havarti cheese samples from different milk

Results Cont'd

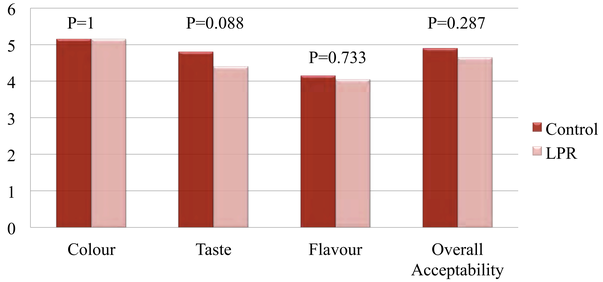
Table 2: Two Sample Comparison of Havarti cheese fatty acid profile formulated with milk from dairy cattle fed a LinPRO®-R70 (LPR) supplemented diet and Control (CTL)

	CTL	LPR
C18:0	7.3	12.5**
C18:2n6	1.69	1.49**
C18:3n3	0.35	0.87*
CLA	0.13	0.84**
C20:4n6	0.12	0.1
C20:5n3	0.04	0.07
C22:5n3	0.06	0.07
C22:6n3	0	0.02
SFA	76.95	62.54**
MUFA	20.53	33.77**
PUFA	2.52	3.7**
n-3	0.45	1.06**
n-6	1.96	1.8*
n-6:n-3	4.39	1.71**

*significant difference from control, P≤0.05

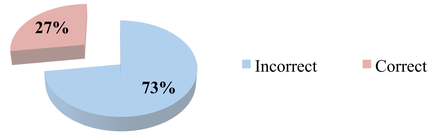
**strong significant difference from control, P≤0.01

Sensory comparison of Havarti Cheese



Results Cont'd

Triangle Milk Test: Identification of Odd Milk Sample



- There was a significant increase in the concentration of total n-3 fatty acids and a significant decrease in the total n-6 fatty acid content of the LPR milk and Havarti cheese (P<0.05).
- The concentration of C18:0 increased (P ≤0.01) in the LPR milk and cheese which may be due to the increased dietary PUFA and subsequent biohydrogenation.
- The n-6:n-3 ratio significantly decreased in the LPR milk and cheese compared to the control (P≤0.01).
- Panelists were unable to identify the LPR milk in the triangle test indicating no significant difference in taste with elevated n-3 PUFAs (P>0.05)[1].
- No significant differences were detected between the LPR and CTL Havarti cheese in any of the sensory panel categories (P>0.05).

Summary

Feeding dairy cattle a diet supplemented with LinPRO®-R70 at 9% of TMR DM resulted in a significant increase of n-3 PUFA in the milk and subsequent cheese product. Sensory tests indicated that panelists were unable to detect any significant differences between the LinPRO®-R70 dairy products and the control.

Conclusions

Inclusion of the co-extruded flaxseed product (LinPRO®-R70) at 9% DM of lactating dairy cows' TMR is an effective means of improving the fatty acid composition of the milk and subsequent cheese products without negatively affecting taste and consumer acceptance.

References

1. Roesslet,E.B., Pangborn,R.M., Sidel, J.L. and Stone, H. 1978. Expanded tables for estimating significance in paired-preference, paired-difference, duo-trio and triangle tests. J.Food Sci. 43. 940-947

Acknowledgements: