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The effect of whole cottonseed and processing of canola on the milk production and composition of first lactation Holstein heifers

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Introduction

The use of whole oilseeds such as whole cottonseed (WCS) to increase the energy density of dairy cattle diets is common practice today. Research has shown that certain varieties of canola (previously called rapeseed) are well adapted to the Western Cape and the area planted is expanding fast. Canola has a similar protein content when compared to WCS but contains more than double the amount of fat (Macgregor, 1994). There are, however still some questions regarding the need to process canola and the effects thereof on milk composition.

Materials and Methods

Thirty first lactation Holstein heifers were used in randomised block design with the heifers being blocked on their average production from d 17 – d 20 post partum. After blocking the heifers were changed from a standard fresh cow diet to one of three experimental diets for a period of 60 d. The experimental diets were similar in chemical composition (17.0% CP 11.4 MJ ME/kg DM), were based on lucerne hay, oat hay and maize meal with the main difference the inclusion of oilseeds namely (i) 10% WCS, (ii) 10% crushed canola or iii) 10% whole canola seed. The canola was processed using a rollermill. Milk production and DMI intake were measured daily, milk samples were taken weekly for fat, protein and MUN analysis, and body condition and body weight was monitored every two weeks. Additional milk samples were taken on days 30, 40 and 50 post partum for analysis of the milk fatty acid profile. An ANOVA was performed using Genstat 5.

Results and Discussion

The effect of feeding WCS, crushed canola or whole canola seed on the productivity and milk fatty acid profiles of first lactation Holstein heifers is shown in Tables1 and 2 respectively.

Table 1: Effect of oilseed supplementation on productivity of first lactation Holstein heifers

	Diet[1]			
Item	WC	WCS	CC	P =
Milk (kg/d)	29.4	28.5	29.0	0.78
DMI (kg/d)	20.2	20.5	20.3	0.91
Fat (%)	3.84[a]	3.47[b]	3.95[a]	0.01
Protein (%)	3.08	3.01	3.05	0.55
MUN (mg%)	14.2	14.2	15.8	0.24
BCS	2.9	3.0	2.7	0.15
Body weight (kg)	547	553	549	0.97

[1]WC = whole canola; WCS = whole cottonseed; CC = crushed canola; [ab] $P < 0.05$

Dry matter intake and milk production did not differ between treatments. Heifers receiving the canola diets produced milk with a higher fat % ($P < 0.05$). Body weight and body condition score were not affected by treatment. Supplementation with crushed canola decreased the concentration of medium chain and increased long chain fatty acids in milk fat when compared to heifers receiving the whole cottonseed diet ($P < 0.05$).

Table 2: Effect of oilseed supplementation on milk fatty acids profiles

Fatty acids (g/100g)	Diet[1] WC	WCS	CC	P =
C14:0	6.23	6.78	5.83	0.59
C16:0	25.0[ab]	27.2[a]	23.1[b]	0.01
C18:0	16.6[b]	16.3[b]	20.5[a]	0.01
C18:1	40.1	36.1	39.5	0.28
C18:2	4.31[a]	4.57[a]	3.53[b]	0.01
C18:3	0.65	0.55	0.43	0.10
C18 total	61.6	57.6	64.0	0.07
C16:C18 total	0.41[a]	0.48[b]	0.36[a]	0.02

[1]WC = whole canola; WCS = whole cottonseed; CC = crushed canola; [ab] $P < 0.05$

Although the general recommendation is that canola seeds should be ground or crushed, processing did not influence production parameters in this study.This is in agreement with other results (Schingoethe, 1995). At higher intakes (> 25 kg DM/d), however it might be necessary to process canola due to the higher ruminal outflow rate. At higher outflow rates processing would probably increase the efficiency of utilisation of nutrients. The high concentration of C16:0 and C14:0 in milk continues to be a concern to many in the medical community. Thus, increasing the C18:0 and C18:1 fatty acids at the expense of C14:0 and C16:0 is considered desirable from a human health perspective. It also offers the benefit of a softer butter (Kennelly & Glimm, 1998). Substituting cottonseed for canola resulted in a "healthier" butterfat that was enhanced by processing of canola. Processing of canola decreased the C16:0 to C18 total fatty acid ratio from 0.48 to 0.36 ($P < 0.05$) when compared to heifers receiving the WCS diet.

Conclusion

There is no need to process canola seed when fed to cows with an intake of around 20 kg/d and production of 28-30 kg/d. At higher intakes (>25 kg/d) it might be necessary to process canola due to higher ruminal outflow rates. If the objective is to produce a "healthier" milk fat with reduced C16:C18 total fatty acid ratio, then processing would be necessary.

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