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Full Length Research Paper

Effects of different levels of roasted soybeans in high forage-based rations on conjugated linoleic acid of longissimus dorsi muscle, subcutaneous fat and liver of beef cattle

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Twelve 24-month-old crossbred beef cattle with initial live weight of 532.6±20.9 kg were used to study the effect of feeding different levels of roasted soybeans on conjugated linoleic acid (CLA) and other fatty acids of longissimus dorsi muscle, subcutaneous fat and liver. The cattle were randomly divided into three groups with 4 cattle in each group and were fed rations containing 3.6, 10.1 and 15.7% of roasted soybeans as Treatments I, II and III, respectively. The cattle were slaughtered after feeding for 28 days and the samples of longissimus dorsi muscle, subcutaneous fat and liver were obtained. The fatty acid composition of the samples was analysed and statistically compared. In longissimus dorsi muscle, it was found that *c9t11*-CLA content was significantly increased with soybean level (P<0.01) whereas contents of C18:0, C18:1, C18:2*n-6*, C18:3, *t10c12*-CLA and total CLA were unchanged (P>0.05). In subcutaneous fat, both *c9t11*-CLA (P=0.056) and total CLA (P = 0.067) tended to increase with soybean level while all other fatty acids were unchanged (P > 0.05). In liver, content of C18:1 was significantly decreased while contents of C18:2*n-6* and C18:3 were significantly increased with soybean level (P < 0.01). Significant correlations were found between intake and contents of fatty acids C18:0, C18:1, C18:2*n-6* and C18:3 in liver. This study concludes that feeding beef cattle with soybeans up to 15.7% in high forage-based ration is not an effective way to increase total CLA content of tissues.

Key words: Soybeans, conjugated linoleic acid, longissimus dorsi muscle, subcutaneous fat, liver, beef cattle.

INTRODUCTION

Conjugated linoleic acids (CLA) reduces body fat accretion in neonatal pigs (Corl et al., 2008), increases lean body mass in obese humans (Steck et al., 2007), positively affects immunological variables in lactating sows and piglets (Bontempo et al., 2004) and reduces cancer risk in rats (Ip et al., 1999), therefore, CLA is beneficial for the health of animals and humans. Ruminant products such as beef and milk contain higher content of CLA than non-ruminant products (Larsen et al.,2003). In dairy cows, inclusion of 12% full fat extruded soybeans (Dhiman et al., 1999) or soybean oil (Huang et al., 2008) in the rations of Holstein cows increased CLA content of milk. In grazing Angus crossbred cows, supplementing 2 kg extruded soybeans per day increased CLA content of milk (Paradis et al., 2008). In beef cattle, supplementing 4% soybean oil (Engle et al., 2000) in the rations of finishing steers increased contents of C18-conjugated dienes and 18:1 trans isomer of longissimus dorsi muscle and inclusion of whole raw soybeans in the ration of steers tended to increase CLA content of longissimus dorsi muscle (Felton and Kerley, 2004). Some studies, however, indicated that supple-

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Abbreviation: CLA, Conjugated linoleic acid.

Table 1. Ingredients and chemical composition of experimental rations.

Parameters	Treatments		
	I	II	III
Components (g/kg DM)			
Corn	312.8	291.8	273.5
Roasted soybeans	36.0	100.6	157.2
Cottonseed hull	165.0	154.0	144.3
Wheat bran	102.3	95.5	89.5
Corn silage	249.3	232.6	218.0
Lucerne hay	134.5	125.5	117.6
Nutrients (g/kg DM)			
OM	944.1	941.0	938.3
CP	117.9	131.7	143.8
EE	187.8	196.5	204.0
NDF	318.3	303.5	290.7
NE (MJ/kg DM)	9.1	9.2	9.3
C18:0	0.6	0.9	1.1
C18:1	3.4	4.4	5.3
C18:2*n-6*	7.9	11.4	14.5
C18:3	1.2	1.8	2.3

C18:1 refers to the sum of C18:1 isomers, C18:2n-6 refers to the sum of positional isomers of C18:2 and C18:3 refers to the sum of all the positional isomers of C18:3. Treatments I, II and III refer to supplementing 3.6, 10.1 and 15.7% of soybeans in rations on DM basis, respectively). OM, organic matter; CP, crude protein; EE, ether extract; NDF, neutral detergent fibre; NE, net energy.

menting soybean oil or soybeans in the rations of beef cattle was not successful to increase total CLA content of tissues (Griswold et al., 2003; Beaulieu et al., 2002; Dhiman et al., 2005).

The studies afore mentioned indicated total CLA content of milk in dairy cows or total CLA content of tissues in beef cattle fed with high-concentrate rations could be manipulated by supplementing soybeans or soybean oil to some extent. In China, however, the finishing rations for beef cattle usually contain more than 70% of forages. It is unclear whether CLA content of tissues of beef cattle fed with high forage-based rations could be successfully manipulated by supplementing soybeans at a certain level.

The objective of the study was to evaluate the effects of feeding different levels of coarsely ground roasted soybeans on CLA and other fatty acids in longissimus dorsi muscle, subcutaneous fat and liver of beef cattle fed with high-forage based rations.

MATERIALS AND METHODS

Animals

Twelve 24-month-old Luxi×Limousin crossbred bulls with an initial live weight of 532.6±20.9 kg were used as experimental animals. The cattle were randomly divided into three groups with 4 cattle in each group.

Formulation of rations and treatments

Soybeans were roasted for approximately 10 min at 240°C to inactivate anti-nutritional factors; the soybeans were then milled to pass through a sieve with 3 mm in pore diameter. Since the effective level of supplementing soybeans to manipulate CLA content of tissues in beef cattle fed forage-based rations was unknown, the treatments used in the experiment were based on the soybean levels formerly reported (Dhiman et al., 1999; Felton and Kerley, 2004) and three rations containing 3.6, 10.1 and 15.7% of roasted soybeans were used as Treatments I, II and III, respectively. The components and nutrient contents of the experimental rations are shown in Table 1. The formulation of the rations and nutrient supply were according to “Nutrient Requirements and Feeding Standard for Beef Cattle” of China (Feng, 2000).

Feeding and management of cattle

Four days before the experiment started, each cattle was fed with 25 g anthelmintic (produced by Sichuan Qiquan Animal Pharmaceutical Co., Ltd., Suining, China) daily for 4 successive days to destroy intestinal parasites. During the experiment, all cattle were fed with total mixed ration in two equal meals, at 7:00 am and 5:00 pm daily, respectively. The feed offered and feed left of each cattle were recorded daily. Drinking water was given after feeding twice daily. The feeding experiment lasted for 28 days.

Slaughtering trial and tissue sampling

At the end of the feeding experiment, the cattle were fasted

overnight but had free access to drinking water. The cattle were then transported to a commercial abattoir which was only about 1 km away and slaughtered. About 100 g of longissimus dorsi muscle, subcutaneous fat and liver were sampled, respectively. All the samples were labeled and immediately frozen in liquid nitrogen and then transferred to a freezer at -70°C for later analysis.

Determination and chemical analysis

The gross energy (GE) of feeds was determined using an oxygen bomb calorimeter (Parr 6300-CALORIMETER, Parr Instrument Co., Moline, IL, USA). Dry matter (DM), crude protein (CP), ether extract (EE), neutral detergent fibre (NDF) and ash of feeds were determined according to AOAC (1990) using the methods of No. 934.01, 954.01, 920.39, 2002.04 and 942.05, respectively. Lipids of the tissue samples were extracted according to the procedures of Bligh and Dyer (1959).

Fatty acid composition of longissimus dorsi muscle, subcutaneous fat and liver was analyzed using gas chromatography according to Sukhija and Palmquist (1988).

Calculations and statistical analysis

Feed intake (kg/d) = Feed offered (kg/d) − Feed left (kg/d)
Organic matter (OM, %/DM) = DM(%) − Ash (%/DM)
Nutrient intake (kg/d) = Nutrient offered (kg/d) − Nutrient left (kg/d),

Where, nutrient refers to DM, OM, CP or EE.

NE intake (MJ/d) = NE offered (MJ/d) −NE left (MJ/d)

Net energy (NE) was calculated from GE according to Feng (2000) as follows:

DE/GE = 94.2808 − 61.5370(NDF/OM)
$K_m = 0.1875 \times (DE/GE) + 0.4579$
$K_f = 0.5230 \times (DE/GE) + 0.0059$
$K_{mf} = (K_m \times K_f \times APL)/(Kf + (APL-1)\ K_m)$
DE = GE × (DE/GE)
$NE_{mf} = DE \times K_{mf} = DE \times (K_m \times K_f \times 1.5)/(K_f + 0.5\ K_m)$

Where, DE is the digestible energy; DE/GE is the digestibility of GE, %; K_m is the conversion efficiency of DE to NE for maintenance, %; K_f is the conversion efficiency of DE to NE for fattening, %; K_{mf} is the conversion efficiency of DE to integrated NE, %; APL is the (NE supply)/(NE for maintenance) and NE_{mf} is the integrated NE, including NE_m and NE_f.The data of different treatments were statistically compared and the correlations between the intake of fatty acids and the content of fatty acids in liver were analysed using SPSS® 10.0 (SPSS, 2000). The model used for comparison was:

$Yi = \mu + Ri + \varepsilon i$

Where, *Yi* is the observation; μ is the general mean; *Ri* is the effect of ration (*i* = 1 to 3) and ε*i* is the residual error. Effects were considered to be significant at $P<0.05$ and a *P* value between 0.05 and 0.10 was considered a trend. The model for correlations between fatty acids intake and fatty acid content in tissues was: $Y = bX + a$, where *Y* is the fatty acid content in tissues, g/100 g total fatty acids; *X* is the fatty acid ingested daily, g/d. Correlations were considered to be significant at $P<0.05$.

RESULTS AND DISCUSSION

Nutrient intake

Effects of feeding soybean oil or soybeans on feed intake of cattle are shown in Table 2. No significant differences were found in intakes of DM, OM, CP, EE and NE between different treatments (P>0.05), while intakes of DM and OM decreased linearly with soybean level (P=0.038, P=0.034, respectively). Intake of NDF was significantly decreased with soybean level (P<0.05) while intakes of C18:0, C18:2 *n-6* and C18:3 were significantly increased with soybean level (P<0.05). No significant differences were found in the intake of C18:1 among different treatments (P>0.05).

Griswold et al. (2003) added 4 or 8% soybean oil (DM basis) at two levels of forage (20 and 40%) in the ration of steers for 42 days and found that DM intake and feed efficiency were not influenced by soybean oil. Beaulieu et al. (2002) supplemented 2.5, 5.0 or 7.5% (DM basis) soybean oil into high corn-ration (80% cracked corn) of steers for 28 days and found that DM intake was not affected by soybean oil. Huang et al. (2008) also found that adding 5% soybean oil in the ration of Holstein cows for 4 weeks did not influence DM intake. However, Engle et al. (2000) found that supplementation of 4% soybean oil in high concentrate ration (based on corn) of finishing Angus steers for 130 days reduced DM intake. Hess et al. (2008) reviewed the effect of inclusion of fat in the rations of ruminants and suggested that supplemental fat less than 2% (DM basis) were not likely to produce negative associative effects in ruminants consuming forage-based diets, while less than 3% (DM basis) would obtain the most benefit from the energy contained within the fat and other dietary components in high-forage diets. Supplementing fat at 6% is expected to have minimal impacts on utilization of other dietary components for ruminants fed high-concentrate rations (Hess et al., 2008).

Since supplementation of soybeans in rations of cattle would be much more convenient than soybean oil and less negative influence on rumen fermentation, many researchers used soybeans instead of soybean oil into rations of cattle. Paradis et al. (2008) reported that supplementing grazing Angus crossbred cows with 2 kg/d of extruded soybeans for 111 days did not influence DM intake. Dhiman et al. (1999) fed dairy cows with forage-based rations containing 12% full fat extruded soybeans for 5 weeks and found that DM intake was increased. However, Felton and Kerley (2004) reported that inclusion of 16% of soybeans in the ration of steers for 76 days tended to decrease DM intake (P=0.08). Gorocica-Buenfil et al. (2007) fed Angus-crossbred steers with a corn-based diet containing 20% roasted soybeans (DM basis) for 168 days and found that inclusion of soybeans significantly decreased the DM intake. In the present study, the highest level of coarsely ground roasted soybeans included in the ration was 15.7% (Treatment III). No problems were found in excretion of urine and faeces of cattle and the activities of eating and rumination of the cattle were normal, intakes of DM, OM and NDF were decreased linearly with soybean level. The results are in agreement with that of Felton and Kerley (2004)

Table 2. Nutrient intake of cattle.

Parameters	Treatments				Significance	Contrast	
	I	II	III	SEM	(P)	Linear	Quadratic
Nutrient intake (kg/d)							
DM	9.92±0.71	8.82±0.70	7.86±0.50	0.91	0.131	0.038	0.130
OM	9.33±1.03	8.29±1.15	7.38±1.32	0.86	0.121	0.034	0.122
CP	1.17±0.08	1.16±0.09	1.13±0.07	0.12	0.939	0.733	0.941
EE	1.86±0.13	1.73±0.14	1.61±0.10	0.18	0.382	0.154	0.382
NDF	3.16±0.23^{a}	2.68±0.21^{ab}	2.28±0.14^{b}	0.28	0.037	0.008	0.043
NE, MJ/d	118.83±11.08	113.89±12.13	102.90±10.25	8.35	0.177	0.056	0.183
Fatty acid intake (g/d)							
C18:0	6.24±0.45^{b}	0.27±0.65^{b}	0.48±0.60^{a}	0.76	0.017	0.005	0.021
C18:1	37.70±2.71^{b}	43.43±3.42^{ab}	6.39±2.94^{a}	3.85	0.169	0.056	0.173
C18:2*n-6*	88.72±6.37^{b}	111.82±8.82^{ab}	125.23±7.94^{a}	9.90	0.017	0.004	0.020
C18:3	12.61±0.91^{b}	6.99±1.34^{b}	9.63±1.24^{a}	1.55	0.010	0.002	0.011

Within a row, means without a common superscript letter differ significantly (P<0.05). C18:1 refers to the sum of C18:1 isomers, C18:2n-6 refers to the sum of positional isomers of C18:2 and C18:3 refers to the sum of all the positional isomers of C18:3. Treatments I, II and III refer to supplementing 3.6, 10.1 and 15.7% of soybeans in rations on DM basis, respectively. OM, organic matter; DM, dry matter; CP, crude protein; EE, ether extract; NDF, neutral detergent fibre; NE, net energy.

who reported that the DM intake of cattle tended to decrease when 16% of whole soybeans was included in the ration.

The EE content of the soybeans used in the present study was 31.6% (DM basis) and the supplementation levels of soybeans in Treatments I, II and III were 3.6%, 10.1% and 15.7%, respectively. The actual supplementation level of soybean oil added to the rations of Treatments I, II and III could be calculated by EE content of soybeans multiplied by supplementation level of soybeans, that is, 1.14% (3.6 × 31.6%), 3.19% (10.1 × 31.6%) and 4.96% (15.7 × 31.6%), respectively. The contents of C18:0, C18:2 *n-6* and C18:3 of the rations (Table 1) and the intakes of C18:0, C18:2*n-6* and C18:3 of the cattle in Treatments I, II and III were increased with soybean level (Table 2).

Fatty acid composition of different tissues

Fatty acid composition of longissimus dorsi muscle, subcutaneous fat and liver are shown in Table 3. In longissimus dorsi muscle, it was found that the *c9t11*-CLA content significantly increased with the increase of soybean level (P<0.01) whereas the contents of C18:0, C18:1, C18:2*n-6*, C18:3, *t10c12*-CLA and total CLA were unchanged (P>0.05). In subcutaneous fat, *c9t11*-CLA, total CLA and all other fatty acids were unchanged by soybeans level (P>0.05). In the liver, the content of C18:1 was significantly decreased while the contents of C18:2*n-6* and C18:3 were significantly increased (P<0.01). The content of C18:0 was unchanged (P>0.05) while total CLA content was decreased with the increase of soybean level (P<0.05).

In dairy cows, inclusion of 12% full fat extruded soybeans or 12% full fat extruded cottonseed in the rations increased the CLA content of milk and cheese (Dhiman et al., 1999). Adding 5% soybean oil in the ration of Holstein cows increased the CLA content in milk fat and yield (Huang et al., 2008). Supplementing grazing Angus crossbred cows with 2 kg/d of extruded soybeans also increased the CLA content in milk and adipose tissue of suckling calves (Paradis et al., 2008).

In beef cattle, supplementation of 4% soybean oil in corn-based high concentrate ration of Angus finishing steers increased the C18-conjugated dienes of longissimus dorsi muscle (Engle et al., 2000). Inclusion of 16% of standard variety of whole raw soybeans in the ration of steers tended to have a greater concentration of CLA of longissimus dorsi muscle than samples from corn/soybean meal-based ration (P=0.08) (Felton and Kerley, 2004). In the present study, the total CLA contents of longissimus dorsi muscle and subcutaneous fat were not significantly affected by soybeans even though the *c9t11*-CLA content of longissimus dorsi muscle was significantly increased. Some studies indicated quite different results from these mentioned above. Beaulieu et al. (2002) reported that supplementing high-corn diets with 5% soybean oil did not increase *c9t11*-CLA contents in the tissues of fattening heifers. Griswold et al. (2003) studied three levels of soybean oil, that is, 0, 4 and 8% of diet DM and two levels of forage (20 and 40%) on fatty acid composition of tissues of Angus×Hereford steers and found that the CLA content in lean tissues was decreased with soybean oil-containing diets. Dhiman et al. (2005) concluded that supplementing high-grain finishing diets

Table 3. Fatty acid composition in longissimus dorsi muscle, subcutaneous fat and liver (g/kg total fatty acids).

Parameters	Treatments				Significance	Contrast	
	I	II	III	SEM	(*P*)	Linear	Quadratic
Longissimus dorsi muscle							
C18:0	127.35±11.16	146.05±4.41	148.40±11.82	13.75	0.294	0.147	0.292
C18:1	343.48±12.27	331.88±18.17	375.93±9.76	19.60	0.119	0.157	0.123
C18:2*n-6*	36.70±5.46	48.75±12.04	38.23±6.22	11.93	0.567	0.902	0.571
C18:3	1.88±0.03	2.08±0.27	2.00±0.39	0.39	0.876	0.745	0.881
c9t11-CLA	2.90±0.17^{b}	2.83±0.22^{b}	4.08±0.28^{a}	0.32	0.006	0.013	0.012
t10c12-CLA	0.13±0.03	0.13±0.03	0.13±0.03	0.04	1.000	1.000	1.000
Total CLA	3.03±0.16	2.95±0.23	4.20±0.29	0.47	0.227	0.117	0.232
Subcutaneous fat							
C18:0	127.55±16.89	167.48±19.32	121.30±7.69	21.87	0.127	0.815	0.132
C18:1	411.80±9.29	404.90±14.00	421.43±11.83	16.78	0.628	0.572	0.632
C18:2*n-6*	12.63±1.03	19.65±3.60	16.38±1.18	3.20	0.145	0.319	0.151
C18:3	1.13±0.17	1.45±0.16	1.23±0.18	0.24	0.414	0.695	0.413
c9t11-CLA	6.20±0.17	5.80±0.22	7.10±0.51	0.47	0.056	0.128	0.062
t10c12-CLA	0.15±0.03	0.20±0.00	0.23±0.05	0.05	0.296	0.116	0.303
Total CLA	6.35±0.18	6.00±0.22	7.33±0.55	0.51	0.067	0.117	0.071
Liver							
C18:0	292.58±7.07	314.50±9.20	312.15±7.50	11.29	0.159	0.122	0.161
C18:1	135.83±4.64^{a}	93.20±4.66^{b}	94.30±7.50^{b}	8.14	0.001	0.004	0.001
C18:2n-6	101.83±5.12^{b}	132.95±1.94^{a}	140.18±5.19^{a}	6.16	0.001	0.000	0.000
C18:3	4.15±0.23^{b}	5.25±0.20^{a}	5.85±0.39^{a}	0.41	0.007	0.002	0.010
c9t11-CLA	3.65±0.06	2.80±0.16	3.10±0.35	0.32	0.067	0.165	0.071
t10c12-CLA	0.38±0.05	0.28±0.05	0.25±0.03	0.06	0.144	0.059	0.143
Total CLA	4.03±0.09^{a}	3.08±0.19^{b}	3.35±0.35^{ab}	0.33	0.048	0.111	0.052

Within a row, means without a common superscript letter differ significantly (P<0.05). C18:1 refers to the sum of C18:1 isomers, C18:2n-6 refers to the sum of positional isomers of C18:2 and C18:3 refers to the sum of all the positional isomers of C18:3. Total CLA refers to the sum of *c9t11*-CLA and *t10c12*-CLA. Treatments I, II and III refer to supplementing 3.6, 10.1 and 15.7% of soybeans in rations on DM basis, respectively.

(954 g corn based concentrates/kg DM) with 40 g soybean oil/kg DM increased C18:2 *trans-10, cis-12* CLA in adipose tissue of longissimus dorsi muscle but is not an effective way to enhance the C18:2 *cis-9, trans-11* isomer of CLA in beef. One reason for the differences between different studies could be that the rations in the present study were roughage-based rations whereas the rations in the two studies mentioned above were concentrate-based rations. Another reason could be that the breeds of cattle and feeding periods were different.

In the present study, the C18:0, C18:1, C18:2*n-6* and C18:3 of longissiumus dorsi muscle and subcutaneous fat were unchanged by feeding soybeans whereas the C18:1 was decreased and the C18:2*n-6* and C18:3 of liver were significantly increased with the increase of soybean level. The results were not in agreement with that of Griswold et al. (2003) who reported that the addition of 4 and 8% of soybean oil to rations of steers linearly increased linoleic acid (18:2*n-6*) and tended to increase linolenic acid (18:3*n-3*) in muscle tissues and that of Dhiman et al. (2005) who reported that feeding 40 g/kg DM soybean oil increased the proportion of *trans*-C18:1 in beef lipid as compared to the control and the 20 g/kg DM treatment. The difference could be related to the feeding periods. In the study of Griswold et al. (2003), the feeding period was 6 weeks while in the study of Dhiman et al. (2005), the feeding period was 105 days. In the present study, the feeding period was 28 days, which were shorter than that of the two other studies mentioned above. It should be noted that the total CLA content of liver was decreased with the increase of soybean level. The reason could be that the contents of C18:2*n-6* and C18:3 were increased with the increase of soybean level therefore resulting in the relative decrease of the total CLA content.

In this study, it was found that the total CLA content of subcutaneous fat was higher than that of longissimus dorsi muscle and liver, which was in agreement with that of Beaulieu et al. (2002) who reported that the content of *c9t11*-CLA was greatest in subcutaneous adipose tissue.

The results suggest that the adipose tissue might be the major site for the endogenous synthesis of CLA as compared with longissimus dorsi muscle and liver. The results might have been resulted from the higher activity of Δ^9-desaturase in adipose tissue that improved *c9t11*-CLA synthesis from other unsaturated fatty acids (Cameron et al., 1994).

The results of the present study also indicated that the *c9t11*-CLA content was higher than *t10c12*-CLA content in longissimus dorsi muscle, subcutaneous fat and liver. The possible reasons could be that on one hand, the *t11* pathway (synthesis of *c9t11*-CLA) in rumen biohydrogenation of unsaturated fatty acids is more effective than the t10 pathway (synthesis of *t10c12*-CLA). On another hand, the Δ^9-desaturase is relatively more active in adipose tissue of steers (Cameron et al., 1994) and mainly improves *c9t11*-CLA synthesis from *trans-11* C18:1.

Correlation between the intake of fatty acids and the content of fatty acids in liver

Significant correlations were found between the intake and the content of certain fatty acids in liver:

C18:0 : Y=0.606X+25.868, r^2=0.367, P=0.037, n=12

C18:1 : Y=0.751X+21.677, r^2=0.564, P=0.005, n=12

C18:2*n-6* : Y=0.791X+5.084, r^2=0.626, P=0.002, n=12

C18:3 : Y=0.733X+0.205, r^2=0.537, P=0.007, n=12

Where, X refers to the daily intake of certain fatty acid, g/d; Y refers to the content of certain fatty acid in liver (g/100 g total fatty acids). No significant correlations were found between the intake and the content of CLA in liver, longissimus dorsi muscle and subcutaneous fat (P>0.05), or between the intakes and the contents of C18:0, C18:1, C18:2*n-6* and C18:3 in longissimus dorsi muscle and subcutaneous fat (P>0.05).

The results indicated that liver was more easily affected by dietary fatty acid composition than longissimus dorsi muscle and subcutaneous fat. The reason could be that the fatty acids absorbed would reach the liver first and the liver served as the crucial organ for the metabolism of fatty acids. It might take a longer time for the fatty acid metabolism of longissimus dorsi muscle and subcutaneous fat to be affected. Based on the correlations, it may be possible to predict contents of C18:0, C18:1, C18:2*n-6* and C18:3 of liver by intakes of these fatty acids.

Conclusions

Feeding beef cattle with soybeans up to 15.7% in high forage-based rations increased the *c9t11*-CLA content of longissimus dorsi muscle, but did not affect the contents of the total CLA and the C18:0, C18:1, C18:2*n-6* and C18:3 of longissimus dorsi muscle and subcutaneous fat. The contents of the total CLA and the C18:1 of liver decreased while the contents of C18:2*n-6* and C18:3 increased with the increase of soybean level. Feeding beef cattle with soybeans up to 15.7% in high forage-based rations is not an effective way to increase the total CLA content of tissues.

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