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Metabolic parameters in lactating cows fed sugar cane-based diets with different levels of sunflower oil

S Motta de Souza[1], F C Ferraz Lopes[2], S de Campos Valadares Filho[2], L Navajas Rennó[2], M A Sundfeld da Gama[2]
[1]Embrapa Dairy Cattle, Juiz de Fora/MG, Brazil, [2]Federal University of Viçosa, Viçosa/MG, Brazil
Email:motta.shirley@hotmail.com

Introduction Fats are supplemented to increase ration energy density, in this context, fat is the most variable component in milk and is markedly affected by diet, in other words, nutrition affects both the quantity and composition of milk fat and a striking example is milk fat depression. Sugarcane is exceptional among tropical gramineous plants because of its potential for dry matter production per unit area and low-cost per dry matter unit produced. Also, sunflower oil (SFO) provides 13% of the worldwide production of edible vegetable oils, and it has excellent nutrition characteristics, including a high ratio of polyunsaturated to saturated fatty acids (65.3% and 11.6%, respectively). The polyunsaturated fatty acid content almost entirely comprises linoleic acid (65%), which is classified as essential because it is not synthesised by the animal and is involved in several physiological functions (Andrade, 1994). However, no studies in the literature have reported its potential use or association with vegetable oils because virtually all research has been performed in temperate areas, and little research has been conducted in the tropics. Thus, the purpose of this study was to assess diets based on sugarcane with different concentrations of sunflower oil (SFO) with respect to the metabolic parameters in dairy cattle.

Material and methods Four multiparous Holstein x Gir cows with a 107 ± 10 lactation days and average milk production of 15 ± 5 kg/d with cannulas in the rumen received four dietary treatments (levels of SFO inclusion, % diet dry matter, DM) in a 4 x 4 Latin Square design composed of 19-day experimental periods (10 days for adaptation and the last 9 days for data collection).The treatments were: 1) Control: diet without SFO; 2) SFO1: diet containing 1.5% of SO; 3) SFO2: diet containing 3.0% of SFO and 4) SFO3: diet containing 4.5% of SFO. The diets were isoproteic (14.5% CP) in accordance with the National Research Council (NRC, 2001) and fed once a day as total mixed rations (TMR) composed of sugarcane and a concentrate mixture (60:40, % of diet DM). Blood samples were collected on day 16 using coccygeal venipuncture and test tubes (Vacutainer, Becton-Dickinson, Rutherford, NJ) with an anticoagulant (ethylenediaminetetraacetic acid – EDTA); they were centrifuged immediately at 3,000 x g for 15 minutes, after were collected, placed in capped plastic tubes and stored at $-20°C$ for future analyses of nonesterified fatty acids (NEFA), glucose, cholesterol, triglycerides and high-density lipoprotein (HDL).. A commercial kit was used to measure the serum levels of NEFA (kit FA 115 - Randox®, UK), and the glucose, triglycerides and total cholesterol serum levels were measured using the enzymatic colorimetric method described by Trinder (1969). Humane animal care and handling procedures were followed in accordance with the Federal University of Viçosa guidelines (Viçosa, MG, Brazil). The results were analysed through regression with the *Statistical Analysis System* software (SAS, 2002) at a 5% probability.

Results The serum concentration of cholesterol and HDL had quadratic effect (P<0.05) in the cows fed increasing levels of SFO (Table 1). This increase in the serum lipid concentration may be explained as a function of the higher intake of fatty acids associated with the experimental diets, which increased the corresponding fractions of fatty acids related to lipid metabolism in the blood.

Table 1 - Mean blood parameters in lactating cows fed different levels of SFO

Variable	SFO levels				MSE[1]	Effect (P value)	
	0.0	1.5	3.0	4.5		L	Q
Glucose (mg/dL)	52.52	52.91	58.46	56.26	1.63	ns[2]	ns
NEFA (mmol/L)	0.17	0.22	0.24	0.16	0.04	ns	ns
Cholesterol (mg/dL)	88.73	137.3	186.66	159.28	12.75	<0.01	0.03
HDL (mg/dL)	47.76	80.13	74.21	60.53	10.14	ns	0.02
Triglycerides (mg/dL)	3.27	3.43	3.86	4.44	0.97	ns	ns
Regression equations							r^2
Cholesterol (mg/dL)	$\hat{y} = 84.855 + 55.376*X - 8.439*X^2$						0.73
HDL (mg/dL)	$\hat{y} = 49.289 + 25.184*X - 5.117*X^2$						0.85

[1]MSE = Mean standard error; [2]ns = not significant (P>0.05); r^2 = coefficient of determination

Conclusions Inclusion of up to 4.5% SFO in sugarcane-based diets has no effect on blood-lipid metabolism, however had quadratic effect in the serum concentration of cholesterol and HDL in Holstein x Gir.

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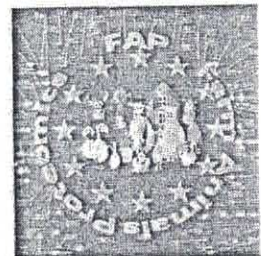
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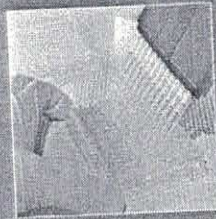This book is part of a series which is a companion to the journal ANIMAL

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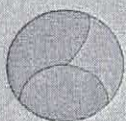
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