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Metabolisable energy of Canola acid oil and Famarol acid oil for broiler chickens

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Introduction

Fats and oils are now commonly added to poultry diets as an economic means of producing energy-rich formulations. However, due to their chemical composition, they are of variable nutritive value. The degree of saturation of the constituent fatty acids, their chain length and the proportion of free fatty acids present within a blend all have a pronounced effect upon the dietary energy value of fats and oils (Wiseman *et al*., 1991). Acid oils are one of the by-products of the chemical refining of crude oils and have a high free fatty acid content. It was the objective of the current study to determine the metabolisable energy value of Canola acid oil (CAO) and a South African commercial feed acid oil (Famarol -FAO).

Materials and Methods

Both the CAO and FAO were obtained from commercial oil refineries in Cape Town. FAO, a commercial feed oil used by the South African poultry industry is a mixture of different vegetable and marine oils. Oil samples were analysed for fatty acid composition (Table 1) by gas chromatography according to standard procedures. CAO contained a higher percentage of unsaturated fatty acids than FAO oil (91% vs. 79%, respectively).

Table 1 Fatty acid profiles of Canola oil and Famarol oil (% recoverable fatty acids)

Fatty acids	Famarol oil	Canola oil
C12:0	0.29	-
C14:0	0.46	0.07
C16:0	13.72	5.34
C18:0	4.43	2.40
C20:0	0.75	0.35
C22:0	0.65	-
Total saturated fatty acids	20.3	8.16
C18:1n9	38.72	58.82
C18:2n6	31.70	21.08
C18:3n3	8.08	10.81
C20:1n9	0.81	0.41
Total unsaturated fatty acids	79.31	91.12
U:S	3.9	11.2
Unknowns	0.39	0.72

Each of the two oils were blended with the basal diet (maize) in the following ratios: 100% Basal; 96% Basal: 4% Oil; 92% Basal: 8% Oil. Each of these diets were fed at two intake levels, namely *ad libitum* intake and 40% of *ad libitum* intake (Du Preez *et al*., 1986). One hundred and twenty 21-day-old male broiler chickens were allocated to 40 wire cages (3 broilers per cage) in an environmentally controlled room where an artificial lighting pattern of 23¾ hours of light alternating with ¼ hour of darkness was maintained. The experimental diets were fed for an acclimatisation period of 4 days, followed by a collection period of 3 days during which feed intake and excreta production were recorded. Gross energies (GE) of the dried and finely ground excreta and experimental diets were determined in a solid state bomb calorimeter (Model CP 500). Nitrogen (N) was measured according to the macro-Kjeldahl procedure (AOAC, 1995). Simple linear models were used to describe the metabolisability of the oil samples. The Dual Semi-quick (DSQ) method of Du Preez *et al*. (1986) allowing for different levels of feed intake was used to calculate TMEn values. The complement of the regression coefficients multiplied by the gross energy value of the oil gave the TMEn. The central assumption made in all assays for TMEn is that energy voided as excreta is linearly related to the energy input (McNab, 1990).

Results and Discussion

Table 2 The TMEn (MJ/kg) of the basal diet and the two acid oils (all values differed ($P < 0.05$)).

Basal diet (100% maize)	Canola oil	Famarol oil
13.6 ± 0.804	30.6 ± 0.374	25.9 ± 0.454

Both the Canola and Famarol oils are acid oils produced during the refining of crude oils and will contain free fatty acids, impurities and denatured fatty matter together with a quantity of the original crude oil. Most of the compounds contained in acid oils will have little nutritional value, hence the lower ME values obtained for acid oils compared to refined oils (Wiseman *et al*., 1992). Wiseman (1995) reported the ratio of unsaturated to saturated fatty acids as the major determinant of the AME of lipids. Long-chain saturated fatty acids are considered to be poorly absorbed in comparison with long-chain unsaturated fatty acids. The TMEn values of CAO and FAO differed ($P < 0.05$; Table 2). The lower TMEn value observed for FAO (a marine-based oil) in comparison with the more unsaturated CAO is in agreement with previous research, showing the superiority of vegetable oils over marine oils as an energy source for broilers (Wiseman *et al*., 1986; Vila & Esteve-Garcia, 1996). This improvement is therefore probably a reflection of the higher percentage of long-chain unsaturated fatty acids in CAO compared to FAO (Table 1). Lipid digestion and absorption require the formation of bile salt micelles before the absorption of the final products of lipolysis (2-monoglycerides and free fatty acids) can take place. Long-chain polyunsaturated fatty acids (polar solutes) are absorbed more readily than long-chain saturated fatty acids (non-polar solutes) because of the differential solubility of the products in the bile salt solution (Wiseman *et al.*, 1986).

Conclusion

It was found that CAO has a higher TMEn value than FAO and yields more energy available for the broiler chicken per kg of feed. CAO would thus be a more “nutritious” substitute for FAO in commercial broiler diets.

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