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Research Article

Energy utilisation of fats as influenced by the age of broilers

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Abstract

A study was conducted to investigate the influence of age of broilers on the apparent metabolisable energy (AME) of different types of fats (tallow, soybean oil, poultry fat and palm oil). The assay diets were developed by substituting the different fats for 4 % (w/w) of a maize-soybean meal basal diet. The diets were offered *ad libitum* in mash form to six replicate cages of broilers (6 birds/cage) from day 1 to day 35 post-hatching. Total excreta collection was made during the first, second, third and fifth weeks for the determination of AME. The results showed that these were no fat type x age interaction ($P>0.05$), indicating that the effect of age on the AME of fats was similar for all fat types. The AME of palm oil, soybean oil and poultry fat were determined to be high, whereas tallow AME was lower ($P<0.05$). Age of broilers significantly affected the AME of fats. The AME was markedly lower ($P<0.05$) during week 1, but improved during week 2. There were no further improvements ($P>0.05$) in the AME after week 2. These data highlight the physiological limitation in young birds to effectively digest and utilise fats and also confirm the poor digestibility of animal fats in poultry.

Keywords: poultry, animal feed, broiler chick, apparent metabolizable energy

Introduction

Animal fats and vegetable oils are usually added to poultry diets to increase dietary energy concentrations. Many different types of fats and oils are used by the poultry industry and these vary in fatty acid composition and in their contribution to metabolisable energy [1]. It is also known that the energy utilisation of different fat sources by chickens differ widely, with vegetable oils containing higher proportions of unsaturated fatty acids being better digested

and metabolised than the animal fats containing higher proportions of saturated fatty acids [2, 3, 4].

Another major factor affecting the metabolizable energy value of fats and oils is the age of birds. The physiological ability to digest and metabolise fats is poorly developed in young birds, especially during the first week of life, but markedly improves with age [5, 6]. It has been reported that both the digestibility [7, 8], and the apparent metabolisable energy (AME) of fats are improved with advancing age [3]. The objective of this study was to investigate the influence of age of broilers on the AME of different types of fats.

Research Methodology

Experimental design and diets

The experiment was conducted as a completely randomised design with six treatments: A maize-soybean meal basal diet was formulated (Table 1) and, from this, five assay diets were developed by substituting tallow, soybean oil, poultry fat, palm oil and, a 50:50 mixture of tallow and soybean oil for 4% (w/w) of the basal diet. The diets were offered in mash form.

Table1. Percentage composition of the basal diet used in the AME assay.

Ingredient	%
Maize	60.70
Soybean meal	35.18
Dicalcium phosphate	2.17
Limestone	0.78
Salt	0.20
Sodium bicarbonate	0.23
DL methionine	0.26
L-lysine	0.18
Trace mineral premix	0.25
Vitamin premix	0.05

Birds and conduct of the trial

Day-old broilers (Ross 308) were obtained from a commercial hatchery, individually weighed, and assigned to 36 cages (6 birds per cage). Diets were offered *ad libitum* from day 1 to 35. Water was available at all times**.**

Measurements

During weeks 1 (d 5 to 7), 2 (d 13 to 15), 3 (d 19 to 21) and 5 (d 33 to 35), feed intake and excreta output were recorded quantitatively per cage for three days for the determination of AME. Excreta from each cage were pooled, mixed, sub-sampled and freeze-dried. The dried excreta samples, together with samples of the diets, were subsequently ground to pass through 0.5-mm sieve and stored in airtight plastic containers for analysis of dry matter and gross energy.

Calculations and data analysis

AME of fats were calculated using the difference method, which assumes that there is no interaction between the basal diet and the fats.

The data were analysed by repeated measures analysis and one way ANOVA using SAS 9.1. Differences were considered significant at $P < 0.05$.

Results and Discussion

The influence of the fat type and age of birds on the AME of fats is summarised in Table 2. The main effects and statistical probabilities are presented in Table 3.

No interaction ($P > 0.05$) was observed between the fat type and age of birds, indicating that the effect of age on the AME of fats was similar, irrespective of the fat type. The AME was influenced ($P<0.001$) by the type of fat. The AME of tallow was lower ($P < 0.05$) than those of soybean oil, palm oil and poultry fat, but similar ($P > 0.05$) to that of tallow: soybean oil mixture. The AME of soybean oil, poultry fat and palm oil were found to be similar ($P < 0.05$). The AME of fat was affected ($P<0.001$) by the age of birds, with the value being lower ($P < 0.05$) during week 1. The AME values of all fat types were increased ($P < 0.05$) during week 2 and there was no further increase ($P > 0.05$) beyond week 2. These results are in agreement with those of Wiseman and Salvador (1989) who demonstrated that the AME of various fat types improved with the age of birds.

Table 2. Influence of fat type and age of birds on the AME of fats (MJ/kg dry matter)[1]

Fat type	Age of birds (week)	AME
Tallow	1	13.90
	2	23.58
	3	31.78
	5	28.17
Soybean oil	1	19.31
	2	34.71
	3	38.94
	5	36.56
Tallow: soybean oil (50:50)	1	16.79
	2	30.30
	3	32.24
	5	35.44
Poultry fat	1	16.96
	2	32.78
	3	35.01
	5	33.28
Palm oil	1	19.96
	2	36.79
	3	39.55
	5	38.35
SEM[2]		1.97

[1] Each value represents the mean of six replicates (six birds per replicate).
[2] Pooled standard error of mean

Table 3. Influence of fat type and age of birds on the AME of fats (MJ/kg dry matter) – Main effect means and statistical probabilities

	AME
Fat type	
Tallow	24.36 [c]
Soybean oil	32.38 [ab]
Tallow: soybean oil (50:50)	28.69 [bc]
Poultry fat	29.51 [ab]
Palm oil	33.66 [a]
SEM[1]	1.18
Age of birds (week)	
1	17.38 [b]
2	31.63 [a]
3	35.50 [a]
5	34.36 [a]
SEM[1]	1.06
Probabilities, P ≤	
Fat type	***
Age of birds	***
Fat type x age of birds	NS

NS, not significant; *** P < 0..0001.
[1] Pooled standard error of mean.
[a, b] Means in a column not sharing a common superscript are significantly different (P < 0.05)

Conclusions

The present data showed marked differences in the AME of different fat types. Soybean oil, poultry fat and palm oil were found to be better utilized by broiler chickens. On the other hand, as expected, tallow was poorly utilised. It was also found that, irrespective of fat type, the energy utilisation was markedly lower during week 1, but improved during week 2. There were no further improvements in the AME after week 2.

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