ACID VALUE OF VEGETABLE OILS AND POULTRY FEED AS AFECTED BY STORAGE PERIOD AND ANTIOXIDANTS

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ABSTRACT

A study to assess acid values in soyabean, cotton seed and sunflower oil commonly used in poultry ration was conducted. It was observed that mean acid value of oils kept in open were significantly high (7.67) than oil kept in sealed form (1.296). The mean acid value was higher in soyabean oil ($P<0.01$) than the values in cotton seed oil and sunflower oil. While determining the effect of Santaquin, BHT and Oxistat as antioxidant, in the ration stored at 40 °C for 2 months, it was observed that the acid values in untreated control ration was 18.20 while with the added antioxidants were 4.88, 4.85 and 4.83, respectively showing a significant increase with each week of the storage.

Key words: Soyabean oil, Cotton seed oil, sunflower oil, Acid value, Antioxidant

INTRODUCTION

Vegetable oils rich in polyunsaturated fatty acids (PUFA) are highly digestible for chickens as compared to saturated fats. However, the fats containing PUFA are prone to oxidation especially when stored at high temperature. The presence of fats and oils in poultry rations provides a suitable medium for rancidity and nutrients react with oxygen to form free radicals (Sherwin, 1978). The products of oxidation include shorter chain fatty acids, fatty acid polymers, aldehydes, ketones, epoxides and hydrocarbons (Wiseman, 1986). These highly reactive compounds can damage animal cells and have been implicated in certain degerative diseases (Barber and Barnheim, 1967). These compounds formed of oxidation can be measured by acid, peroxide and thiobarbituric acid value (AOAC,1990). Rancidity deteriorates nutritive value of feeds and thus cause economic losses by adversely influencing performance and health of chickens (Engberg *et al*., 1996), may be leading to encephalomalacia (Jones *et al*., 1986), decreased body weight and depressed feed efficiency (Cabel and Waldroup, 1988).

Rancidity can be prevented or checked by the addition of antioxidants in feeds. Antioxidants inhibit oxidation by reacting with free radicals thus blocking the formation of fatty acid radicals and terminating the chain reaction. The relative protective effect of antioxidants against oxidative rancidity depends on storage time (Chahine, 1978). Thus study was conducted to determine the effect of storage period at room temperature on sealed and opened vegetable oils commonly used in poultry rations by feed mills and to CRD. Means of significant compare the efficacy of synthetic antioxidants being used in breeder rations containing level of added vegetable oil and stored at high temperature.

MATERIALS AND METHODS

A study to assess acid values in vegetable oils commonly used in poultry rations was conducted. A total of 180 samples 60 each of sunflower, soybean and cotton seed oils were obtained from different local feed mills. The samples of each oil were divided into two groups A and B (each having 3 sub groups). The group A was kept in open air whereas group B was kept in sealed coloured bottles. Both the groups were stored at room temperature for 9 months and room temperature was also recorded on daily basis. The acid values in samples of both the groups were determined on monthly interval basis (AOAC, 1990). In order to assess the effects of antioxidants used in breeder rations, four basal isocaloric and isonitrogenous breeder rations (Table 1) containing 2.5% vegetable oil were formulated and designated as A (without Antioxidant), B (Santoquin, 150 mg/kg). Each of the four mixed rations (in replicates form) were packed in small bags of the same polythene material which is traditionally used for feed packing. These bags containing rations were stored at 40 °C in a chamber fitted with a thermostatically controlled heater. At the start of the experiment and there after at weekly intervals of total 2 months storage period, triplicate bags of each ration were analyzed for acid value (AOAC, 1990). The data was subjected to statistical analysis for interpretation of results by using analysis of variance technique withresults were compared by Duncan's multiple range test (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

The mean acid values of three vegetable oils i.e. soyabean, cotton seed and sunflower oil as affected by storage period is shown in Table 2. Data showing that mean acid values of oils as open group (A), were higher ($P<0.01$) after two months of storage. The rate of increase in mean acid value with increase in storage period was noted to be significant at the end of 9 months. It was noted that after 9 months of storage, the oils became rancid in open group could be due to exposure to light, air and temperature. Data also showed that mean acid values of oils in sealed group (B), was significantly higher after two months of storage. These values were non-significantly affected in next two months due to low temperature. After 5 months of storage, mean acid values were increased ($P<0.01$) till end of 9 months. However, it was noted that after 9 months of storage, the mean acid values were not too high in sealed groups due to less rancidity rate of oils. The storage period did not affect oil rancidity due to protection from moisture, temperature and light in sealed group.

The overall result in both groups showed that rancidity was found to be higher in soyabean oil ($P<0.01$) as compared to sunflower oil and cotton seed oil. The reason could be that soyabean oil contains high polyunsaturated fatty acids (i.e. Linoleic acid and linolenic acid) as compared to cotton seed oil and sunflower oil (Banerjee, 1991). Trebusiewicz (1980) reported increased acid value in stored feed containing 4 % beef tallow from 8.66 to 14.33 in darkness and 21.99 in light in starting feed and from 9.49 to 19.39 and 26.38 in finishing feeds. Too much acid values in this study is due to use of beef tallow having high acid value (i.e. 8.66 and 9.49 in starter and finishing ration, respectively). Similarly, Hilton (1989) concluded that high level of dietary polyunsaturated fat increased the potential for diet rancidity during long term storage.

The results of mean acid values of breeder rations containing antioxidants sources as affected by storage period is shown in Table 3. The results of statistical analysis revealed that mean acid value of all rations increased ($P<0.01$) after each week interval of storage. However, it was further found that control ration (A) was high mean acid values than other rations containing different antioxidants. When compared these rations to each other, it was revealed that there is non-significant difference in mean acid values among rations B, C and D containing different antioxidants, while mean acid value of control ration (A) was significantly ($P<0.01$) higher than rations containing different antioxidants. It may be inferred from the results (Table 3) that the effect of antioxidants with storage period significantly affected the acid values of the feeds. Similar results were reported by Jones *et al.* (1986) when compared the efficiency of Ethoxyquin, Endox and BHT for preservation of broiler feeds. They concluded that all antioxidants are equal in effectiveness when feed was stored for 30 days. In the present study, ration "B" contained Santaquin as antioxident and it was observed that this antioxidant was equally efficient in preventing the rancidity in feed. Similar results were reported by different workers after using this antioxidant in different feed (McGeachin, 1992; Wang *et al*, 1997; Waheed, 1998; Anjum, 1999). Overall results revealed that all antioxidants are equally efficient, thus it may be suggested to feed manufacturer that any antioxidants may be used on least cost basis to safeguard rations against rancidity. It may, however, be further suggested that the oils to be used in poultry rations should be kept in sealed containers to avoid exposure to moisture and light and if feed is to be stored for longer periods antioxidants should be added.

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Table 1: Composition of breeder rations used in the experiments

Ingredients	Rations (%)			
	A	B	C	D
Corn	29	29	29	29
Wheat	09	09	09	09
Rice	15	15	15	15
Rice polishing	10	10	10	10
Cotton Seed Meal	3.5	3.5	3.5	3.5
Rape Seed Meal	4.0	4.0	4.0	4.0
Soyabean Meal	9.0	9.0	9.0	9.0
Fish Meal	7.0	7.0	7.0	7.0
Vegetable oil	2.5	2.5	2.5	2.5
Santoquin	---	0.0150	---	---
BHT	---	---	0.0150	---
Oxistat	---	---	---	0.0150
DCP	0.7	0.685	0.685	0.685
Limestone	8.0	8.0	8.0	8.0
Molassis	1.80	1.80	1.80	1.80
Premix	0.500	0.500	0.500	0.500
Crude protein	16.05	16.05	16.05	16.05
Metabolizeable energy (Kcal/Kg)	2856.6	2856.6	2856.6	2856.6
Crude fibre	3.936	3.936	3.936	3.936
Crude Fat	6.07	6.07	6.07	6.07
Available Phosphurus	0.35	0.35	0.35	0.35
Calcium	3.25	3.25	3.25	3.25
Lysine	0.78	0.78	0.78	0.78
Methionine	0.49	0.49	0.49	0.49

A = Ration without antioxidant B = Ration with Santoquin
C = Ration with Butylated hydroxytoluene (BHT) D = Ration with oxistat

Table 2: Mean acid values of different vegetable oil sources as affected by storage period

Storage period in months	Opened Group (A)			Sealed Group (B)		
	Soya Oil	C.S. Oil	S.F. Oil	Soya Oil	C.S. Oil	S.F. Oil
September	0.673	0.645	0.561	0.673	0.645	0.561
October	0.676	0.652	0.567	0.673	0.646	0.561
November	0.786	0.761	0.680	0.678	0.654	0.566
December	0.901	0.876	0.795	0.685	0.663	0.570
January	1.060	0.992	0.912	0.690	0.667	0.572
February	2.070	2.00	1.850	0.754	0.731	0.650
March	3.120	2.99	2.90	0.829	0.806	0.725
April	4.961	4.789	4.682	0.951	0.930	0.848
May	6.412	6.243	6.124	1.086	1.064	0.981
June	7.850	7.646	7.523	1.342	1.316	1.230
Mean	2.851^{a}	2.760^{b}	2.659^{c}	0.836^{a}	0.812^{b}	0.726^{c}
S.E.	± 2.657	± 2.590	± 2.575	± 0.226	± 0.226	±0.228

Mean differ significantly (P<0.01) CS = Cotton seed SF = Sun flower

Table 3: Mean acid values of breeder rations containing different antioxidants sources as affected by storage period

Storate period (weeks)	A	B	C	D
---	3.05^{a}	3.05^{a}	3.05^{a}	3.05^{a}
1	4.36^{b}	3.22^{b}	4.26^{b}	3.30^{b}
2	5.11^{c}	3.38^{c}	3.35^{c}	3.40^{c}
3	6.44^{d}	3.52^{d}	3.52^{d}	3.53^{d}
4	7.13e	3.77^{e}	3.80^{e}	3.82^{e}
5	8.85^{f}	4.16^{f}	4.15^{f}	4.13^{f}
6	11.20^{+}	4.35^{g}	4.32^{g}	4.33^{g}
7	14.25^{h}	4.50^{h}	4.50^{h}	4.52^{h}
8.	18.20^{I}	4.88^{i}	4.85^{i}	4.83^{I}
Mean:	8.73_{a}	3.87_{b}	3.86_{b}	3.87_{b}
S.E.	±4.98	± 0.63	±0.58	± 0.61

- Superscript in Columns indicate weekly difference ($P<0.01$) within treatment
- Subscript in rows indicate treatment difference ($P<0.01$) during 8 weeks

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