*Daffa alla AA et al. / International Journal of Biological & Pharmaceutical Research.* **2015; 6(2): 91-95.**

e- ISSN 0976 - 3651
Print ISSN 2229 - 7480

**International Journal of Biological & Pharmaceutical Research**
Journal homepage: www.ijbpr.com

IJBPR

# RESPONSE OF BROILER CHICKS TO DIETARY SAFFLOWER CAKE WITH AND WITHOUT ENZYME

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**ABSTRACT**

The experiment was carried out to determine the effect of various levels (o , 5 ,10 ,15 and 20 % )of safflower seed cake with and without commercial enzyme (xylem 500 ) containing as source of protein on the performance and carcass character of broiler chicks and their economic impact .Two hundred and ten, seven day old unsexed broiler chicks were used in to evaluate the inclusion of graded levels of safflower cake (0.0, 5, 10, 15, and 20%) with and without enzyme as a source of plant protein. Chicks were randomly distributed to ten treatments with three replicates, each replicate with seven chicks. Five iso caloric, iso nitrogenous diets were formulated, the first five groups were fed on diets containing graded levels of safflower cake (0.0,5,10,15, and 20%)without enzyme , other groups were fed on the same diets but supplemented with enzyme . experimental parameters covered , body weight , feed intake , body weight gain feed conversion ratio, rate of mortality , carcass yield and economic appraised. Results showed that undecorticated safflower seed cake can replace the groundnut cake up to 20% without adverse effects on broiler chick's performance. Weight gain of broiler chicks improved with the increase of safflower seed cake levels in the diets, however, chicks fed on 15% and 20% undecorticated safflower seed cake with and without enzyme recorded significant improvement in body weight gain compared to other treatment groups, also all experimental chicks showed significant improvement in feed conversion ratio (FCR) .Supplementation of enzyme increase the feed intake in all experimental groups except group fed on diets containing 5% and 10% safflower cake. Economically chicks fed on safflower seed cake (SFC) supplemented with enzyme (xylem 500) recorded the highest profit..

## INTRODUCTION

The safflower cake meal is made from the seed that remain after oil extraction. The quality of safflower cake is variable and depends on the amount of hull and the extent of the oil extraction.

The by-product which result after the extraction of edible oil from safflower seed contain about 60% fiber and 18-20% protein if the seed are de hulled before extraction , the resulting safflower meal has 35-50% protein and 10-15% fiber (Dortica *et al*., 2009). The analysis of sample used recorded; 0.12 moisture %, 31.0 CP%, 1.5 Fat %, 27.0 Crude Fiber % 4.38 Ash % and ether extract %30.5.

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The value of safflower meal depend on, process oil content varies from 1% for solvent extracted to 15% for mechanical extracted ones protein content is about 20-25% in un decorticated meal but that can over 40% in decorticated ones (Dajue *et al*., 1996; Gohi, 1982). Crude fiber content is about 30-40% for un decorticated for safflower meal and can be lower than 10% in de hulled meal (GRDC, 2010), Safflower meal does not seem to show toxicity.

The application of exogenous enzyme in poultry nutrition has been driven by accruing benefits in terms of improved dietary nutrient utilization and growth performance; it increased viscosity of the intestinal content (Nutrex, 2000), also change gut function by modifying endogenous secretion of water, proteins electrolytes and lipids (Johnson and Gee, 1981; Angkanaporn *et al*., 1994). Generally high gut viscosity decreases the rate of diffusion substrates and digestive enzymes and hinders their

effective interaction at mucosal surface (Edwards *et al*., 1988; Lkegami, 1990). The use of enzyme can be categorized into five areas, firstly by removal of ant-nutritional factors. Secondly by increasing the digestibility existing nutrients, thirdly by making a certain nutrient more available for absorption in intestine, fourthly supplementing host endogenous enzyme for example at young age. Fifthly effect of micro-flora in the gastro intestinal tract. (Colsukosi *et al.*, 2007, Class and Richard, 1999). Exogenous enzymes improved nutrient digestibility and broiler chicken performance, probably by improving the absorption capacity of the small intestine through increased villas surface and intestinal concentration of conjugated bile acid.

## MATERIALS AND METHODS

This experiment was carried out at experimental farm of Department of Animal Production, Collage of Agricultural Studies, Sudan University of Science and Technology, Khartoum North, Shambat.

Total of two hundred and ten, seven days old unsexed commercial broiler chicks (cob 500) were purchased. The chicks were fed on control for 7 days before start of the experiment. Then they were weight and distributed to ten experimental groups, each group was further subdivided into three replicates each with 7 chicks. Chicks were vaccinated against Gumboro at 13 days of age and against Newcastle disease at 8 days .Soluble multivitamins compound and antibiotic were given to the chicks before and after vaccination in order to guard against stress.

Chicks were kept in cleaned, disinfected semi closed house. The house dimensions were 25 m. length, 8.8 m. width and 3.05 m.The roof ceiling was made of trapezoid corrugated aluminum sheet and was insulated of (100mm) glass wool with thermal conductivity (0.04 $w/m^2$) .The wall of the house on the northern and southern side were built from red blocks to the level of 0.69 m., the house was equipped with adjustable sider wall curtains to control the flow of air into the house. The top and bottom of the curtain opening was equipped with a curtain rod to minimized draft when fully closed.

Mechanical ventilation system used in poultry house to generate a dimensional air flow to provide the required levels of uniformity of air distribution over wide range of climatic condition. Two exhaust fan (fan diameter 1.29 with air 44500 $m^2$ / h) sited in the middle of the west wall, were installed to maintain negative pressure in poultry house. The temperature inside the house was maintained at 27-30 c through the experimental period, wood shaves (5cm) thick was laid on the floor as litter. Each pen was provided by (5 kg) rounded feeder and (2.5 lit.) baby drinker which were adjusted to the progressive growth of chicks. Light was provided 24 hours light from 1-3 days and 23 hours day for the rest period.

According to result of approximate analysis of un decorticated safflower cake ten experimental diets, were formulated containing safflower cake (mechanical processed) at levels (0, 5, 10, 15 and 20%) with and without enzyme (50g/Kg, xylem 500), to meet the nutritional requirements of broiler chicks as recommended by NRC (1994), diet (A) without enzyme and safflower cake considered as control diet .Diet 2 was positive control, diets 3,4,5 and 6 were formulated to contain graded levels (5, 10, 15 and 20%) of SFC respectively, diets 7, 8, 9 and 10 were similar diets to 3, 4, 5 and 6 but they were supplemented with 50 g/Kg xylam 500 enzyme (composed of Endo-1.4-B- xylanse 126 u/g and amylase 800 u/g, it is produced by Nutrex Company for feed enzyme Production Acherstemhoek 5,22275 Lille Belgiu) respectively. The composition and calculated analysis of the experiment diets were presented in table (1).

Experimental continued for 42 days , chicks of each replicate were weighted weekly, feed intake was recorded at weighting, feed conversion ratio (FCR) and body weight gain were calculated weekly, mortality was recorded daily althrough out the experiment period.

At the end of the experiment the chicks were fasted overnight except from water, the chicks were weighted and 3 chicks were randomly selected from each group, weighted individually and slaughtered, after bleeding they were scaled in hot water and further plucked manually, then washed, the skull, feet and shanks were removed at the hook joint and eviscerated for carcass characteristics, hot carcass, heart, head, Gizzard, abdominal fat and liver without gall bladder were measures.

The carcass were divided into two halves each half was divided into commercial cuts (drumstick, high and breast) they were washed and deboned, meat of each was stored at refrigerate till analysis and panel taste. Pieces of meat were slightly seasoned wrapped individually in aluminum tot and toasted at 190° c for 70 minutes. Ten well trained taste panelists were used to score, color, flavor, tenderness and juiciness of the meat (Cross, 1978).
The commercial cuts were calculated as percentage of hot carcass, non-carcass components (heart, head, legs, Gizzard and liver) abdominal fat were expressed as percentage of live weight, meat and of each cut were expressed as percentage of the weight of their cuts.

The data obtained were subjected to analysis of variance following complete randomizes block design and comparison of means determined by Duncan's range test (Duncan, 1955).

## RESULTS

The results of feeding broiler chicks on different levels of safflower cake (SFC) with and without enzyme presented in table 2 .Group of chicks fed on both control diets, 5% safflower with and without enzyme and group fed on 10% SFC with and without enzyme showed no

significant (P>0.05) differences in body weights (BW). While chicks fed on diet containing 10% (SFC) without enzyme recorded significantly (P>0.05) the lowest value for (BW) although group fed 15% (SFC) with enzyme and 20% (SFC) with enzyme showed significantly (P<0.05) the heaviest weight gain compared to other experimental group. The addition of SFC in broiler diets gradually with and without enzyme significantly (P<0.05) improved the body weight gain of the chicks.

The similar results were obtained for feed intake (FI). Results recorded no significant (P>0.05) difference in feed conversion ratio (FCR) between both control groups, chicks group fed on diet containing 5 %( SFC) without enzyme recorded significantly (P<0.05) the best value of (FCR) followed by chicks fed on 10% (SFC) without enzyme and 20% (SFC) without enzyme while chicks fed control group with enzyme showed significantly (P>0.05) the lowest in (FCR). The mortality percentage showed no significant (P>0.05) different among the experimental groups.

Results concerning dressing, legs, lungs and neck percentages showed no significant (P>0.05) difference between all treatment groups except chicks group fed on 20% (SFC) with enzyme recorded significantly (P<0.05) high percentage in dressing compared to other tested groups.

Results of non-carcass components (liver, heart, gizzard and abdominal fat) percentage values (table 3) showed no significant (P >0.05) in liver percentage values between both control groups, although they recorded significantly (P> 0.05) lower percentage values compared to other tested groups while there was a significant difference between groups fed on diet containing SFC with and without enzyme in liver and heart percentages. For gizzard chicks fed on control groups without enzyme recorded significantly (P>0.05) the lowest percentage value compared to other tested groups, although there was no significant difference between all treated groups in the percentage of abdominal fat. Results obtained for commercial cuts (Breast, thigh, drumsticks, and their meat /bone ratio) showed no significant (P>0.05) difference between all treatment groups in all parameters (table 4).

The average subjective meat quality score (Color, tenderness, flavor and juiciness) were not differing significant among all treatment groups, scores given for all parameter are above moderate acceptability.

The result showed that it is profitable to include safflower cake in broiler diets; however chicks fed on 20 % safflower cake with enzyme showed higher profit compare to control, also the profitability increased with enzyme supplementation.

**Table 1a. Experimental Diets Composition Calculated**

| **Ingredients** | **0%** | **5%** | **10%** | **15%** | **20%** |
|---|---|---|---|---|---|
| Dura (Fetareita) | 65.70 | 63.0 | 57.0 | 51.6 | 45.1 |
| G.N. Cake | 13 | 12 | 12.0 | 11.0 | 11.14 |
| Sesame Cake | 13 | 13.6 | 12.9 | 13.7 | 14.0 |
| Safflower cake | - | 5.0 | 10 | 15.0 | 20.0 |
| Concentrate* | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Oyster | 1.0 | 0.53 | 0.5 | 0.4 | 0.27 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Vitamin** | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Lysine | 0.08 | 0.1 | 0.05 | 0.06 | 0.04 |
| Methionine | 0.17 | 0.1 | - | 0.04 | - |
| Vegetable oil | 2.2 | 0.22 | 0.1 | 2.75 | 4.0 |
| Wheat Bean | - | - | 2.0 | - | - |

**Table 1b. Calculated Composition**

| | | | | | |
|---|---|---|---|---|---|
| ME./Kcal* | 3106.87 | 3100.4 | 3100.4 | 3100.6 | 3100.3 |
| CP% | 22 | 22 | 22 | 21.77 | 21.91 |
| Lysine | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| Methionine | 0.52 | 0.52 | 0.51 | 0.51 | 0.51 |
| Ca | 1.0 | 1 | 1 | 1.01 | 1.0 |
| Available P | 0.62 | 0.65 | 0.61 | 0.67 | 0.69 |
| CF | 4.22 | 4.64 | 5.26 | 6.02 | 6.75 |
| EE | 4.38 | 5.69 | 6.92 | 8.44 | 9.83 |
| Ash | 4.52 | 4.39 | 4.24 | 4.39 | 4.42 |

**Table 2. Body weight gain, feed intake and feed conversion ratio of experimental chicks**

| Treatment/ Parameter | Enzyme | | % safflower cake | | | | CV% | $Lsd_{0.05}$ | SE± |
|---|---|---|---|---|---|---|---|---|---|
| | | Control | 5 | 10 | 15 | 20 | | | |
| Body weight gain (gm) | With | 1333.00$^{b}$ | 1336.00$^{b}$ | 1360.00$^{b}$ | 1515.00$^{c}$ | 1539.00$^{c}$ | 3.00% | 71.49$^{**}$ | 24.06 |
| | Without | 1313.00$^{b}$ | 1307.00$^{b}$ | 1266.00$^{a}$ | 1416.00$^{c}$ | 1486c00$^{c}$ | | | |
| Feed intake (gm) | With | 3034..00$^{a}$ | 2742.00$^{b}$ | 2870.00$^{b}$ | 3042.00$^{ab}$ | 3142.00$^{a}$ | 4.55% | 223.2$^{*}$ | 75.11 |
| | Without | 2921.00$^{ab}$ | 2440.00$^{c}$ | 2418.00$^{c}$ | 3027.00$^{ab}$ | 2959..00$^{ab}$ | | | |
| FCR | With | 2.28$^{a}$ | 2.05$^{b}$ | 2.11$^{ab}$ | 2.00$^{a}$ | 1.53$^{ab}$ | 5.63% | 0.1956$^{*}$ | 0.06583 |
| | Without | .2.23$^{ab}$ | 1.87$^{c}$ | 1.91$^{c}$ | 2.14$^{b}$ | 1..29$^{c}$ | | | |

Means having different superscripts within a row are significantly different (P≥0.05)

**Table 3. Liver, heart, gizzard and abdominal as % of body weight**

| Treatment/ Parameter | Enzyme | | % safflower cake | | | | CV% | $Lsd_{0.05}$ | SE± |
|---|---|---|---|---|---|---|---|---|---|
| | | Control | 5 | 10 | 15 | 20 | | | |
| Liver | With | 0.20$^{b}$ | 2.14$^{a}$ | 2.09$^{a}$ | 2.14$^{a}$ | 2.43$^{a}$ | 15.83% | 0.5287$^{*}$ | 0.178 |
| | Without | 014$^{b}$ | 2.12$^{a}$ | 2.19$^{a}$ | 1.85$^{a}$ | 1.98$^{a}$ | | | |
| Heart | With | 0.49$^{a}$ | 0.52$^{b}$ | 0.57$^{b}$ | 0.55$^{b}$ | .0.56$_{b}$ | 17.49% | 0.435$^{*}$ | 0.0483 |
| | Without | 0.48a | 0.58$^{b}$ | 0.56$^{b}$ | 0.55$^{b}$ | 0.54$^{b}$ | | | |
| Gizzard | With | 1.89$^{b}$ | 1.80$^{a}$ | 1.82$^{a}$ | 1.97$^{a}$ | 1.97$^{a}$ | 15.69% | 0.5001$^{*}$ | 0.1683 |
| | Without | 1.46$^{a}$ | 1.86$^{a}$ | 1.85$^{a}$ | 1.72a | 1.89$^{a}$ | | | |
| Abdominal | With | 1.39$^{a}$ | 152$^{a}$ | 1.29$^{a}$ | 1.30$^{a}$ | 1.37$^{a}$ | 24.53% | 0.5817$^{*}$ | 0.1958 |
| | Without | 1.33$^{a}$ | 1.42$^{a}$ | 1.53$^{a}$ | 1.40$^{a}$ | 1.35$^{a}$ | | | |

Means having different superscripts within a row are significantly different (P≥0.05).

**Table 4. Breast, thigh, drumstick and wing as %hot weight**

| Treatment/ Parameter | Enzyme | | % safflower cake | | | | CV% | $Lsd_{0.05}$ | SE± |
|---|---|---|---|---|---|---|---|---|---|
| | | Control | 5 | 10 | 15 | 20 | | | |
| Breast | With | 18.25$^{a}$ | 17.39$^{a}$ | 17.81$^{a}$ | 17.35$^{a}$ | 17.92$^{a}$ | 6.45% | 1.931$^{*}$ | 0.6499 |
| | Without | 17.93$^{a}$ | 18.78$^{a}$ | 17.68$^{a}$ | 17.35$^{a}$ | 17.64$^{a}$ | | | |
| Thigh | With | 6.99$^{a}$ | 6.50$^{a}$ | 7.55$^{a}$ | 6.94$^{a}$ | 6.69$^{a}$ | 10.17% | 1.207$^{ns}$ | 0.4062 |
| | Without | 7.12$^{a}$ | 7.25$^{a}$ | 6.93$^{a}$ | 7.10$^{a}$ | 6.77$^{a}$ | | | |
| Drumstick | With | 8.68$^{a}$ | 8.61$^{a}$ | 8.63$^{a}$ | 8.50$^{a}$ | 8.19$^{a}$ | 7.70% | 1.142$^{*}$ | 0.3843 |
| | Without | 8.70$^{a}$ | 8.69$^{a}$ | 8.56$^{a}$ | 8.56$^{a}$ | 8.54$^{a}$ | | | |
| Wing | With | 6.14$^{a}$ | 5.82$^{a}$ | 5.90$^{a}$ | 5.99$^{a}$ | 5.81$^{a}$ | 937% | 0.9487$^{ns}$ | 0.3194 |
| | Without | 5.99$^{a}$ | 5.87$^{a}$ | 5.91$^{a}$ | 5.87$^{a}$ | 6.11$^{a}$ | | | |

## DISCUSSION

In the second experiment, the nutritive value of safflower seed cake is depending on the method of oil extraction. The quality of safflower cake is variable and depends on the amount of hull and the extent of the oil extraction. (Gowda *et al.*,2004) in general the vitamins content of safflower meal is low and it contained phenolic glacoside which are reported to be associated with bitterness and cathartic activity also the high level of fiber contributes to a reduction in the energy digestibility of diets . However, limited research is available regarding the effects of dietary safflower cake on broiler chick's performance.

Body weight gain of chicks fed on graded levels of safflower cake improved with increase of safflower seed cake in diets supplemented with enzyme, however group fed on 15 % and 20 % safflower cake with and without enzyme recorded significant improvement in body weight gain compared to other tested groups .Chicks fed on 10 % safflower seed cake without enzyme recorded significantly the lowest body weight gain value.

Feed consumptions for chicks fed on diet containing 5 % and 10 % safflower seed cake with and without enzyme consumed significantly low compared to other tested groups .However, enzyme supplementation increased the feed intake.

Feed conversion ratio (FCR) for chicks fed on diets containing safflower cake (SFC) with or without enzyme significantly improved compared to both control groups, however chicks fed on diets containing 20 % safflower cake with or without enzyme showed significantly the best values. Feed to gain ratio was significantly improved in chicks in safflower seed cake groups .These results are in line with studies reporting that FCR is associated with higher weight gain .

These negligible results might be due to high fiber content, deficient in essential amino acids and low content of vitamins in SFC. These results were in line with

finding of Oguz and Oguz, (2007). Results obtained for dressing percentages, legs. Lung, neck, non-carcass components (liver, heart, and gizzard) abdominal fat and commercial cuts and their meat/bone ratio showed no significant effect neither to the SFC inclusion level nor enzyme supplementation.

The result of the study showed that meat yield and the average of subjective meat quality scores (color, flavor, juiciness and tenderness) was not affected by dietary treatment at different levels, all being at moderate values. These results were in line with the findings of Mukhtar *et al*., (2013a).

The apparent health of the experimental chicks was good throughout the experimental period and in all treatments. Environmental temperature during the experimental period fell within thermo neutral zone and good sanitation, so no mortality was recorded. The result was in a agreement with findings of (Oguz and Oguz, 2007), who reported that the pharmacological properties of safflower seed have been explored to identify a role in cardiovascular health.

The supplementation of SFC to broiler diets improved the performance of chicks and resulted in economical benefits. The group fed on diet containing 20% SFC with enzyme recorded the highest profit value for the tested groups (1.267), also result indicate that the profitability ratio increased with the enzyme supplementation compared to non-enzyme. The result was in line with the findings of Idris (1984) and Mukhtar and Abdal-Rahim (2012).

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