Indian Journal of Animal Sciences **85** (4): 414–418, April 2015/Article

Effects of different fat sources on performance parameters and carcass characteristics of broiler chicks

HAQ NAWAZ[1], SHABANA RASHEED[2], AHSAN UL HAQ[3], MUHAMMAD YAQOOB[4] and MUHAMMAD MOHSAN SHAMI[5]

Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad, Pakistan

Received: 7 November 2014; Accepted: 11 November 2014

ABSTRACT

An experiment was conducted to investigate the effect of feeding different sources of supplemental fat (soybean oil, poultry fat, tallow and canola oil) on the live performance and carcass characteristics of broiler chicks. Statistical analysis showed nonsignificant differences in feed intake of broiler chicks fed diets containing different sources of supplemental fat. Significantly higher weight gain and better FCR were observed in birds fed diet containing poultry fat than those fed diets containing other sources of fat. Nonsignificant differences of added dietary fat sources were observed on carcass characteristics and blood pH. From this study, it is obvious that supplemental poultry fat showed beneficial effect on live weight gain and FCR of broiler chicks.

Key words: Broiler chicks, Carcass characteristics, Fat sources, Performance

The success in rearing broiler for maximum weight gain depends upon the strain of birds, quality of feed and management practices. Feed accounts about 60–70 % of production cost and is a considerable component of overheads in overall poultry farming (Khan 2001). Energy is vital component of poultry diet, and is mainly supplied by grains, but due to competition with human in utilization of grains, the balance must come from another source like supplemental fat and/or oils for caloric need. Studies revealed that addition of fat/oil in the broiler diet, improved growth rate, feed conversion ratio, tenderness, and juiciness of meat (Safamehr *et al*. 2008, Jamaly and Babaahmady 2012, Poorghasemi *et al*. 2013). The use of fats and oils in poultry diets has enabled the nutritionists to formulate high energy diets resulting in improvement in weight gain and feed utilization (Valencia *et al*. 1993).

Keeping in view all the aspects of adding fat in poultry diet, the experiment was conducted at Raja Muhammad Akram Animal Nutrition Research Centre, University of Agriculture, Faisalabad, Pakistan, to investigate the effect of different dietary fat sources (soybean oil, poultry fat, tallow and canola oil) on live performance and carcass characteristics of broiler chicks.

Present address: [1]Professor (dr_haq_nawaz@yahoo.com), [2,5]Postgraduate student (jhang_pk@yahoo.com, shamipk19@gmail.com), Institute of Animal Nutrition and Feed Technology; [3]Professor (deanhaqfah@gmail.com), Department of Poultry Science. [4]Professor (uaflm@yahoo.com), Department of Animal Production and Management, PMAS-Arid Agriculture University Rawalpindi.

MATERIALS AND METHODS

Day-old broiler chicks (240), procured commercially, were weighed on day first of the experiment and randomly divided into 12 replicates of 20 chicks each. The chicks of each replicate were reared from day 1–6 on a commercial diet purchased from the market and experimental diets were fed from day 7. Chicks of each replicate were kept in a separate pen (4´ × 3´ × 2.5´) which was allotted at random. Saw dust was used as litter, which was stirred regularly during the experimental period to keep it dry. The brooding temperature was kept at 95°F (35°C) during first week and it was gradually decreased by 5°F each week, till it reached at 75°F (27°C). Feed and water were offered *ad lib* round the clock and 24 h light was provided.

Four (A, B, C, D) iso-nitrogenous (CP 20%) and iso-caloric (ME 2850 kcal/kg) broiler starter and 4 (A, B, C, D) iso-nitrogenous (CP 18%) and iso-caloric (ME 2900 kcal/kg) broiler finisher diets were formulated (Table 1) containing 2% soybean oil, poultry fat, tallow and canola oil, respectively. Broiler starter and finisher diets were fed from 7–28 d and 29–42 d, respectively. The diets were also supplemented with necessary vitamins, minerals, and amino acids to satisfy the bird requirement (NRC 1994).

The data on initial body weight on day 7, weekly feed intake and body weight gain were recorded, and feed conversion ratio was calculated at 28th and 42nd day. At the end of the experiment, 3 birds from each replicate were randomly picked to collect the blood sample for pH determination and then birds were slaughtered and de-feathered to record the data on dressing percentage,

Table 1. Percent ingredient and nutrient composition of broiler diets containing different fat sources

Ingredients	Starter diets				Finisher diets			
	A (Soybean oil)	B (Poultry fat)	C (Tallow)	D (Canola oil)	A (Soybean oil)	B (Poultry fat)	C (Tallow)	D (Canola oil)
Maize grains	35.50	35.50	35.00	35.50	35.51	35.80	35.60	35.60
Wheat	2.00	2.00	2.00	2.00	2.88	2.50	2.66	2.50
Rice tips	14.72	14.73	15.25	14.74	16.00	16.10	16.10	16.30
Rice polishing	3.00	3.00	3.00	3.00	3.50	3.50	3.50	3.50
Soybean meal	11.00	11.00	11.00	11.00	9.80	9.80	9.80	9.79
Canola meal	4.50	4.50	4.49	4.50	5.00	4.98	5.00	4.98
Cotton seed meal	5.41	5.40	5.40	5.40	5.98	6.00	6.00	5.98
Sunflower meal	6.55	6.55	6.54	6.54	4.99	5.00	4.99	5.01
Fish meal	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00
Corn gluten meal (60%)	3.00	3.00	3.00	3.00	3.10	3.10	3.10	3.10
Soybean oil	2.00	-	-	-	2.00	-	-	-
Poultry fat	-	2.00	-	-	-	2.00	-	-
Tallow	-	-	2.00	-	-	-	2.00	-
Canola oil	-	-	-	2.00	-	-	-	2.00
Molasses	4.00	4.00	4.00	4.00	4.00	3.98	4.00	4.00
Lime stone	1.30	1.30	1.30	1.30	1.00	1.00	1.00	1.00
DCP	1.23	1.23	1.23	1.23	1.45	1.45	1.46	1.45
Vit. min. premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
DL-Methionine	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
L-Lysine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Total	100	100	100	100	100	100	100	100
ME kcal/kg	2850	2850	2850	2850	2900	2900	2900	2900
CP %	20.00	20.00	20.00	20.00	18.00	18.00	18.00	18.00
CF %	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Ca %	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Av. phosphorus %	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Lysine %	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
Methionine %	0.54	0.54	0.54	0.54	0.5.	0.50	0.50	0.50
Threonine %	0.83	0.83	0.83	0.83	0.80	0.80	0.80	0.80
Protein : calorie	1: 143	1: 143	1: 143	1: 143	1: 160	1: 160	1: 160	1: 160

abdominal fat, and organs weights (liver, heart, gizzard, spleen and kidney).

Statistical analysis: The data thus collected were subjected to statistical analysis using completely randomized design using the general linear model procedure of SAS (2004). Means were compared using Duncan's multiple range (DMR) test (Steel *et al*. 1997).

RESULTS AND DISCUSSION

Feed intake: The statistical analysis showed nonsignificant differences in feed intake of birds fed diets containing different sources of supplemental fat during all the phases. However, apparently maximum feed intake was observed in chicks fed diet containing 2 % dietary poultry fat from 7–42 days (Table 2). These results supported the findings of Olomu and Baracos (1991) and Mohammadi *et al*. (2011) who reported that different supplemental fat sources had equal effect (P>0.05) on feed intake in broiler chicks. Nistan *et al.* (1997) and Tancharoenrat *et al*. (2014) also reported nonsignificant differences in feed intake due to feeding difference fat sources to broiler chicks. However, our results were not in line with those of Crespo and Esteve-Garcia (2001) and Jamaly and Babaahmady (2012) who reported that different dietary fat sources showed significant effect on feed intake in broiler chicks. Safamehr *et al*. (2008) fed diets containing 0, 1, 2, and 3 % fish oil to male broiler chicks and observed no significant effect on feed intake. However, our results were in contrast with the findings of Chashniedel *et al*. (2010) who reported that feed intake decreased in broiler chicks fed diets containing different levels of fish oil. Contrary to our results Abas *et al*. (2004) reported that fat sources (fish oil, linseed oil, sunflower oil and soy oil) affected feed intake in broiler chicks.

Weight gain: The statistical analysis revealed that birds fed diet containing 2 % poultry fat gained significantly higher ($P < 0.05$) weight during all the phases than those fed other sources of supplemental fat (Table 2). Poorghasemi *et al*. (2013) supported our findings as they reported that

Table 2. Feed intake, weight gain and feed conversion ratio (FCR) of broiler chicks as affected by different fat sources

Diets	Feed intake (g)			Weight gain (g)			FCR		
	7–28	29–42 days	7–42	7–28	29–42 days	7–42	7–28	29–42 days	7–42
A (Soybean oil)	1,486	2,251	3,737	590	1,490^{b}	2,080^{c}	2.52	1.51^{b}	1.8^{b}
B (Poultry fat)	1,509	2,254	3,763	617	1,557^{a}	2,174^{a}	2.45	1.45^{a}	1.7^{a}
C (Tallow)	1,497	2,256	3,753	602	1,442^{b}	2,044^{b}	2.49	1.57^{c}	1.8^{b}
D (Canola oil)	1,477	2,248	3,725	589	1,380^{c}	1,969^{d}	2.51	1.63^{d}	1.9^{c}
Pooled SEM	23.20	38.25	57	15.13	22.56	39.07	0.032	0.005	0.049

vegetable and animal fat sources increased weight gain in broiler chicks. These results supported the findings of Fajimi *et al.* (1993) and Shahryar *et al*. (2011) who reported that different dietary fat sources showed positive effect on body weight gain of broiler chicks. These results were also in line with those of Safamehr *et al*. (2008) who fed diets containing different levels of fish oil (0, 1, 2, and 3 %) to male broiler chicks and observed significant increase in weight gain. Nobakht and Mehmannavaz (2012) also supported the findings of the present study who reported higher daily weight gain in broiler chicks fed diet containing supplemental fat. However, present results did not support the findings of Crespo and Esteve-Garcia (2001) and Mohammadi *et al*. (2011) who observed no differences in body weight gain of broiler chicks fed 4 different fat sources. The present results did not support the findings of Valencia *et al*. (1993) who observed nonsignificant differences in body weight gain of broiler chicks fed diets supplemented with refined palm oil, palm kernel oil, poultry oil or corn oil. Possible reason is that during early stages of bird's life digestive system is not fully developed, so secretion of bile salt is not sufficient in very young chicks to digest the feed nutrients, therefore, during early life fat/oils are poorly digested. There is also speculation that availability of fatty acid binding protein may limit fat absorption in young birds (Lesson and Summers 2001). Wiseman and Salvador (1991) also reported that during early age, when growth rate of broiler is rapid but fat digestibility is low, fat supplementation is not beneficial.

Feed conversion ratio (FCR): The statistical analysis showed significant difference ($P < 0.05$) in FCR of birds fed diets containing different sources of supplemental fat from 7–42 days (Table 2). Significantly better FCR (1.7) was found in birds fed diet containing 2 % poultry fat, whereas, poor FCR (1.9) was noted in birds fed diet containing 2% canola oil. The better FCR might be due to better absorption of the nutrients which indicate that fat addition in basal diets significantly helps in efficient utilization of feed. These results indicated that the FCR can be improved in broiler diets by supplementing different dietary fat sources (soybean oil, poultry fat, tallow and canola oil). The results of the present study are in accordance with the findings of Crespo and Esteve-Garcia (2001) who reported better FCR in birds fed diet containing 10 % added fat. The present results supported the findings of Witt *et al*. (2009) who reported improved FCR in broiler chicks fed diets containing 6 % dietary high oleic sunflower oil, sunflower oil and fish oil. They further reported that the broiler chicks fed diet containing 3 % tallow showed poor FCR. The better FCR might be due to higher metabolizable energy content of fat/oil. These results are also in line with the findings of Malakian *et al.* (2011) who reported better FCR in broiler birds fed diet containing various levels of full-fat safflower seed. Nobakht and Mehmannavaz (2012) reported better FCR in broiler birds fed 4% dietary beef tallow in starter phase and 4% dietary canola oil and beef tallow blend (2% beef tallow + 2% canola oil). Poorghasemi *et al*. (2013) also reported better FCR in broiler chicks fed diet containing blend of tallow and canola oil. However, these results are not in agreement with those of Abas *et al.* (2004) who observed no significant difference in feed efficiency in broiler chicks fed diets containing different fat sources (fish oil, linseed oil, sunflower oil and soy oil). However, Meng *et al*. (2004) noted poor feed/gain ratio in broiler chicks fed diet containing beef tallow.

Dressing percentage: The statistical analysis showed nonsignificant difference ($P > 0.05$) in dressing percentage among different treatment groups (Table 3). However, apparently higher dressing percentage (63.8) was found in birds fed diet containing 2 % added tallow, whereas, lower dressing percentage (62.8) was noted in birds fed diet containing 2 % canola oil. These results were in line with those of Mohammadi *et al*. (2012) who reported no significant effect of dietary fat source on carcass characteristics except for abdominal fat pad. These results supported the findings of Valencia *et al*. (1993) who found nonsignificant difference in dressing percentage of broiler chicks fed diet containing crude palm oil, palm kernel or poultry oil. Safamehr *et al*. (2008) also supported the findings of present study who fed diets containing 0, 1, 2 and 3 % fish oil to male broiler chicks and observed no significant effect on dressing percentage. Similar, results were also observed by Crespo and Esteve-Garcia (2001) who fed supplemental fat to broiler chicks. Contrary to results of present study, Nobakht (2012) reported that the highest % of carcass (70.4) was obtained from broiler chicks fed diet containing 4 % poultry fat, whereas, the lowest percent (68.8) was obtained from broiler chicks fed diets

Table 3. Carcass characteristics and blood pH of broiler chicks fed with different dietary fat sources

Diets	Dressing (%)	Abdominal fat (g/100 g BW)	Relative organs weights (g/100 g BW)					Blood pH
			Liver	Heart	Gizzard	Spleen	Kidney	
A (soybean oil)	63.4	1.02	4.17	0.70	2.71	0.35	0.97	7.8
B (poultry fat)	63.2	0.99	4.10	0.77	2.72	0.32	0.97	7.9
C (tallow)	63.8	0.97	4.06	0.83	2.69	0.31	0.97	7.6
D (canola oil)	62.8	1.01	4.00	0.90	2.64	0.34	0.96	7.4
Pooled SEM	2.45	1.04	0.05	0.03	0.08	0.06	0.03	0.09

containing 2 % poultry fat.

Abdominal fat: The statistical analysis showed nonsignificant difference (P>0.05) among groups fed different sources of supplemental fat (Table 3). However, apparently maximum abdominal fat (1.02 g/100g BW) was found in birds fed diet containing 2 % soybean oil, whereas, birds receiving diet having 2 % added tallow had minimum abdominal fat (0.97 g/100g BW). The results of this study supported the findings of Jayalakshmi *et al*. (2006) who reported that dietary sunflower oil did not affect abdominal fat pad weight and thickness of broiler chicks. These results are in agreement with those of Valentia *et al*. (1993) who found nonsignificant difference in abdominal fat content of broiler birds fed diets containing crude palm oil, crude palm kernel oil or poultry oil. Nistan *et al*. (1997) also reported nonsignificant difference in adiposity, measured as abdominal adipose tissue due to added soybean oil in broiler chicks. Potenca *et al*. (2009) reported no influence of animal (poultry offal oil and beef tallow) or vegetable oil (soybean oil and cotton seed oil) on abdominal fat of broiler chicks, however, results of this study were in contrast with the results of Vila and Esteve-Garcia (1996) who observed that chicks fed diets containing tallow deposited larger amount of abdominal fat. Crespo and Esteve-Garcia (2001) observed that polyunsaturated fatty acids produced lower abdominal fat content in broiler birds that those fed diets containing saturated or monounsaturated fatty acids. Poorghasemi *et al.* (2013) observed lower abdominal fat pad in birds fed diet containing dietary sunflower oil than those fed diets containing tallow, canola oil and blend of tallow plus canola oil.

Organs weight: The statistical analysis did not show any significant difference on relative weight of liver, heart, gizzard, spleen and kidney (Table 3). Our results are in accordance with those of Fajimi *et al*. (1993) who noted nonsignificant differences in relative weights of internal organs due to feeding different fat sources (palm oil and rubber seed oil) to broiler chicks. However Safamehr *et al*. (2008) reported increase in spleen weight of male broiler chicks fed diets containing 0, 1, 2 and 3 % fish oil. Nobakht and Mehmannavaz (2012) also reported nonsignificant difference in carcass parameters except liver weight which was significantly lower in birds fed diets containing 4 % canola oil.

Blood pH: The statistical analysis showed nonsignificant difference (P>0.05) in blood pH of different treatment groups (Table 3). Maximum blood pH (7.9) was noted in birds fed diet containing 2 % poultry fat but not statistically different from those fed diet containing soybean oil, whereas, minimum blood pH (7.4) was observed in birds receiving diet containing 2 % canola oil.

From this study, it is concluded that the fat sources had effect on body weight gain and FCR of broiler chicks.

REFERENCES

Abas I, Özpinar H, Kahraman R, Kutay H C, Eseceli H and Grashorn M A. 2004. Effect of different diatery fat sources and their levels on performance of broilers. *Arch. Geflügelk* **68** (4) 145–52.

Chashnidel Y, Moravej H, Towhidi A, Asadi F and Zeinodini S. 2010. Influence of different levels of n-3 supplemented (fish oil) diet on performance, crcass quality and fat status in boilers. *African Journal of Biotechnology* **9** (5): 687–91**.**

Crespo N and Esteve-Garcia E. 2001. Dietary fatty acid profile modifies abdominal fat deposition in broiler chicken. *Poultry Science* **80**: 71–78.

Fajimi A O, Babatunde G M, Ogunlanaa F F and Oyejideb A. 1993. Comparative utilization of rubber seed oil and palm oil by broilers in a humid tropical environment. *Animal Feed Science and Technology* **43**: 177–88.

Jamaly J and Babaahmady E. 2012 Effect of saturated and unsaturated fatty acids in broiler diets. *International Journal of Plant, Animal and Environmental Sciences* **2** (3): 53–55.

Jayalakshmi N S, Mathivanan R, Amoutha R, Advin Sc and Viswanathan K. 2006. Production performance and carcass traits of broilers fed with sunflower acid oil. *International Journal of Poultry Science* **5** (9): 890–94.

Khan M L. 2001. *Poultry Feeds and Nutrition*. Kitabistan Publishing Co., Lahore, Pakistan.

Lesson S and Summers J D. 2001. *Nutrition of the Chicken*. 4th edn. University Books P. O. Box 1326 Canada.

Malakian M, Hassanabadi A and Heidariniya A. 2011. Effect of safflower seed on performance crcass traits on performance, carcass traits and blood parameters of broilers. *Research Journal of Poultry Science* **4** (2): 18–21.

Meng X, Slominski B A and Guenter W. 2004. The effect of fat type, carbohydrase, and lipase addition on growth performance and nutrient utilization of young broilers fed wheat-based diets. *Poultry Science* **83**: 1718–27.

Mohammadi Y, Yousefi J, Kuhi H D and Ahmadi M. 2011 Effect of dietary saturated and unsaturated fats on body performance and accumulation of abdominal in broiler chicken. *Iranian Journal of Applied Animal Science* **1**(2): 87–90.

Nistan Z A, Dvorin A, Zoref Z and Mokady S. 1997. Effect of

added soybean oil and dietary energy on metabolizable and net energy of boiler diets. *Poultry Science* **38**: 101–06.

Nobakht A. 2012 The effects of different levels of poultry fat with vitamin-E on performance and carcass traits of broilers. *African Journal of Agricultural Research* **7** (5): 1420–24.

Nobakht A and Mehmannavaz Y. 2012. Effects of saturated and unsaturated fats in starter and grower feeds on performance and carcass traits of broilers. Journal of Basic and Applied Scientific Research **2** (2): 967–70.

NRC. 1994. *Nutrient Requirements of Poultry*. 9th Rev. edn. National Academy Press, Washington DC.

Olomu J M and Baracos V E. 1991. Influence of dietary flaxseed oil on the performance, muscle protein deposition, and fatty acid composition of broiler chicks. *Poultry Science* **70**: 1403–11.

Poorghasemi M, Seidavi A and Qotbi A A A . 2013. Influence of dietary fat source on growth performance responses and carcass traits of broiler chicks. *Asian Australasian Journal of Animal Sciences* **26** (5): 705–10.

Potenca A, Murakami A E, Fernandes J I M, Matsushita M and Nakagawa E L. 2009. Performance, abdominal fat deposition and bone characteristics of broilers fed diets containing different lipid sources. *Brazilian Journal of Poultry Science* **10**: 239–44.

Safamehr A, Aghaei N and Mehmannavas Y. 2008. The influence of different levels of dietary fish oil on the performance, carcass traits and blood parameters of broiler chicken. *Research Journal of Biological Sciences* **3**: 1202–07.

SAS. 2004. Institute. SAS® Qualification Tools User's Guide. Version 9.1.2. SAS Institute Inc., Cary, NC.USA.

Shahryar H A, Nobar R S, Lak A and Lotfi A. 2011. Effect of dietary supplemented canola oil and poultry fat on the performance and carcass characterizes of broiler chickens. *Current Research Journal of Biological Sciences* **3** (4): 388–12

Steel R G D, Torrie J H, and Dicky D A. 1997. *Principles and Procedures of Statistics. A Biometrical Approach.* 3rd edn. McGraw Hill Book Co. Inc., New York, USA.

Tancharoenrat P, Ravindran V, Molan A L and Ravindran G. 2014. Influence of fat source and xylanase supplementation on performance utilisation of energy and fat, and caecal microbiota counts in broiler starter fed wheat – based diets. *Journal of Poultry Science* **51**: 172–79.

Valencia M E, Watkins S E, Waldroup A L, Waldroup P W and Fletcher D L.1993. Utilization of crud and refined palm and palm kernel oils in broiler diets. *Poultry Science* **72**: 2200–15.

Vila B and Esteve-Garcia E. 1996. Studies on acid oil and fatty acids for chickens. 1. Influence of age, rate of inclusion and degree of saturation on fat digestibility and metabolizable energy of acid oils. *British Poultry Science* **37**: 105–17.

Wiseman J and Salvador F. 1991. The influence of free fatty acid content and degree of saturation on the apparent metabolizable energy value of fats fed to broiler. *Poultry Science* **70**: 573–82.

Witt F H de, Els S P, Merwe H J van der, Hugo A and Fair M D. 2009. Effect of dietary lipid sources on production performance of broilers. *South African Journal of Animal Science* **39**: 45–48.