OPEN ACCESS

J. Adv. Vet. Anim. Res., 1(3): 125-129.
Available at- *http://bdvets.org/JAVAR*

ORIGINAL ARTICLE

Volume 1 Issue 3 (September 2014)

DOI: 10.5455/javar.2014.a22

Influence of dietary supplementation of chromium on the carcass traits of crossbred pigs

Guikinglung Pamei[1]**,** P. Tensingh Gnanaraj[2], T. Sivakumar[3], K. Thilak Pon Jawahar[4], T. Muthuramalingam[2] and P. Pothiappan[2,*]

[1]Department of Livestock Production and Management, Madras Veterinary College, Vepery, Chennai-600 007, India;
[2]University Research Farm, Madhavaram Milk Colony, Chennai 600 0051, India;
[3]College of Food and Dairy Technology, Koduvalli, Chennai 600 052, India;
[4]Department of Animal Genetics and Breeding, VC&RI, Tirunelveli- 627 001, India.
[*]Corresponding author's e-mail: vetpothi@yahoo.co.in

ABSTRACT

This study was conducted to assess the influence of chromium on the carcass traits in crossbred (Large White Yorkshire X Landrace) pigs fed with swill feeding for a period of 5 months. Early-weaned crossbred piglets (n=24) were selected for this study, and the piglets were randomly divided into three equal groups; Group I, II, and III. The piglets were reared by following standard health coverage protocols. The feeds of Group I and II were supplemented with chromium in the form of chromium tripicolinate at 0.1 and 0.2 mg/kg of swill feed respectively, and Group III was kept as control. Carcass weight, carcass length, and bone percentage showed no significant difference among the three groups. However, better dressing percentage was observed in Group I ($p<0.05$). Liver and kidney weights were reduced in chromium supplemented groups ($p<0.05$). Chromium supplemented groups showed lower backfat thickness and fat percentage ($p<0.01$); whereas, loin eye areas and muscle percentage were increased as compared to the control group. Thus, it was concluded that chromium supplementation in feed of crossbred piglets influenced positively in their carcass traits.

Keywords

Carcass traits, Chromium, Crossbred pigs

Received : 30 May 2014, **Revised**: 03 June 2014,
Accepted : 16 June 2014, **Published online**: 16 June 2014.

INTRODUCTION

In India, about 62.70 million tons of meat is produced each year for human consumption, in which pork production is 0.33 million tons (FAO, 2010). The per capita availability of meat in India is 14 g/day, which is very low as against the recommended level of 125 gm/day, recommended by Indian Council of Medical Research (FAO, 2009). This situation indicates that there is a wide-gap between requirement and production of meat for human consumption in India.

In India, demands of leaner and healthier pork are increasing day by day. Improvement in genetics, expected understanding on nutrition, and invention of new technologies could help the producers to meet these increasing demands. Continued researches are also needed for finding out appropriate products that can be used as carcass modifier in swine. Most of the recent research trials conducted in pig has shown that addition of chromium to the feed of growing pigs improved the growth performance, and substantially reduced the carcass fat; thus, lean meat was produced (Lindemann et al., 1995). Boleman et al. (1995) reported that dietary supplementation of chromium tripicolinate increased muscle in pork carcasses by 3-4%, and increased loin muscle area by 10-20%, while decreasing the total carcass fat.

The major aim of swine enterprise is to produce good quality meat with maximum benefits for the farmers. Carcass quality at slaughter determines the economic value of the pig carcass; thus, knowledge of the relationship between feed efficiency and carcass quality is important for designing efficient pork production systems. Hence, the present study was aimed to find out the influence of dietary supplementation of chromium on the carcass traits in crossbred pigs.

MATERIALS AND METHODS

In this study, chromium tripicolinate (EnCroMix®) with a purity of 2.5 g/kg was used for the experiment trials. The experiment was carried out at a Private Organized Pig Farm located at Chennai, Tamil Nadu for a period of 5 months during October 2011 to February 2012.

Experimental design: Twenty-four early-weaned crossbred (Large White Yorkshire X Landrace) piglets of both sexes aging one month, and weighing between 7.20 and 8.60 kg were randomly selected for this study. The piglets were divided into three equal groups consisting of eight piglets in each. The piglets were housed in three separate pens with stone slab floors. Supplementation of chromium in feed has been mentioned in **Table 1**.

Table 1: Three experimental groups

Group	Piglets	Treatment
I	N=8	Chromium tripicolinate supplementation at the level of 0.1 mg/kg swill feed.
II	N=8	Chromium tripicolinate supplementation at the level of 0.2 mg/kg swill feed.
III	N=8	Control

Feeding regime: The piglets of all three experimental groups were provided with swill feed; the feed was collected from nearby hostels. The swill feed was fed at the rate of 1-1.3 kg/day during the initial period of the experimental trials (on 30 days of age), and the amount of feed supply was gradually increased to 3.8-4.25 kg/day (on 180 days of age) at the final stage of the experimental trial. The piglets had free access to water.

Carcass characteristics: The carcass characteristics studies were conducted at the Slaughter Hall of the Department of Meat Science and Technology, Madras Veterinary College, Chennai.

Carcass weight: Weight of dressed carcass after removal of head and shanks was recorded. The carcass was kept in the cold storage. Thereafter, each carcass was taken out from the cold storage and carcass characteristics were taken as per the procedure described by Singh et al. (1983).

Carcass length: Carcass length (in cm) was measured from the middle of the anterior edge of the first rib to the anterior edge of the aitch bone (pubis) as per the procedure described by Bereskin and Steele (1988).

Backfat thickness: Backfat thickness was measured along the vertebral column at the level of the first rib, last rib and last lumbar vertebrae using the backfat thickness gauge. The average of the three values was expressed as backfat thickness of the carcass. The thickness of the skin was also included in the measurement and expressed in inches (Ziegler, 1968).

Loin eye area: Loin eye area is the cross sectional area of the *longissimus dorsi* muscle between the 10th and 11th intercostal spaces (**Figure 1**). The area was traced on a butter paper by pressing the paper against the cut surface of the loin eye muscle. The traced eye muscle area was measured with compensation polar planimeter, and the value was expressed in cm^2 (Lefaucheur et al., 1991).

Meat, bone and fat ratio: After separating the meat, bone, fat and skin, the weight of each of them was recorded to calculate the meat-bone-fat ratio (**Figure 2**). The percentages of meat and bone were also considered (Neely et al., 1979).

Organs weight: The collected kidneys, heart, lungs, liver (excluding gall bladder) and spleen were weighed (**Figure 3**).

Statistical analysis: The collected data were statistically analyzed by one-way ANOVA using SPSS 17. The significance was tested using Duncan's multiple range test (Duncan, 1955). A *p*-value of <0.05 was considered as significant.

RESULTS AND DISCUSSION

Carcass weight: The carcass weight (in kg) of the chromium supplemented (Group I and II) and control (Group III) groups were recorded as 43.69±0.87, 43.60±0.79 and 43.24±0.60, respectively. Statistical analysis did not reveal out any significant difference in carcass weight among the three experimental groups. These findings were in support of Kornegay et al. (1997), who mentioned that chromium had no effect on carcass weight.

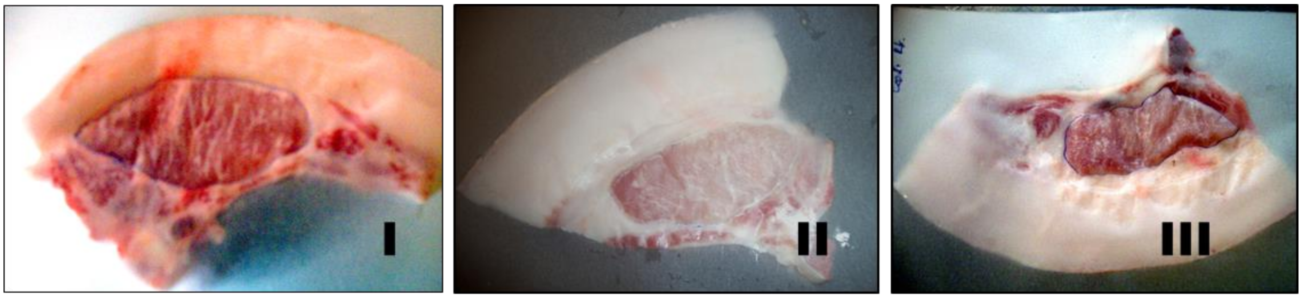

Figure 1: Loin eye areas in piglets; I=Group I, II=Group II, III=Group III.

Table 2: Mean (±SE) for dressing percentage of crossbred pigs fed on three different feeding trials.

Treatment Groups	Dressing Percentage
Group I	$72.11^{b} \pm 0.60$
Group II	$71.06^{ab} \pm 0.72$
Group III	$69.96^{a} \pm 0.42$
'F' value	3.78*

* Significant at one percent level ($p<0.05$). Means bearing at least one common superscript do not differ significantly.

Table 3: Mean (±SE) for loin eye area (cm^2) of crossbred pigs fed on three different feeding trials.

Treatment Groups	Loin Eye Area
Group I	$23.58^{c} \pm 0.27$
Group II	$22.09^{b} \pm 0.29$
Group III	$20.74^{a} \pm 0.22$
'F' value	29.17**

** Significant at one percent level ($p<0.01$). Means bearing different superscript in columns differ significantly.

Table 4: Mean (±SE) for backfat thickness (inches) of crossbred pigs fed on three different feeding trials.

Treatment Groups	Backfat Thickness
Group I	$1.30^{a} \pm 0.05$
Group II	$1.66^{b} \pm 0.08$
Group III	$2.04^{c} \pm 0.06$
'F' value	30.98**

** Significant at one percent level ($p<0.01$)
Means bearing different superscript in columns differ significantly.

Figure 2: Meat, bone, fat and skin; M=Meat, B=Bone, F=Fat, S=Skin.

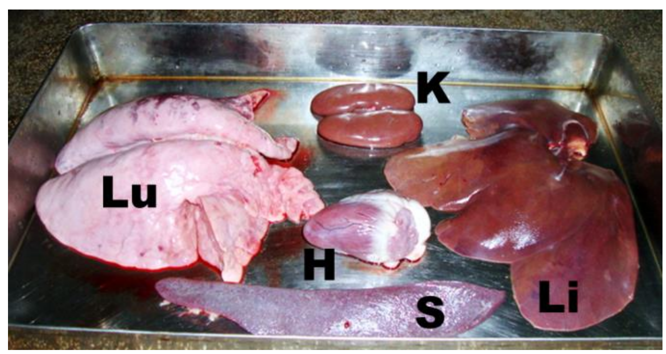

Figure 3: Different organs of piglet; Lu=Lungs, K=Kidney, H=Heart, S=Spleen, Li=Liver.

Dressing percentage: Dressing percentage of the pigs of all three groups revealed a significant difference ($p<0.05$) as shown in **Table 2**. In mean comparison, higher dressing percentage ($p<0.05$) was found in the group I that was given supplementation of chromium at 0.01 mg/kg swill feed, as compared to the control group. This was in accordance with Page et al. (1993) who reported an increased dressing percentage could be found in growing-finishing pigs.

Carcass Length: Carcass lengths (in cm) of the pigs of all three groups were recorded as 70.25±0.39, 70.05±0.29 and 70.35±0.34, respectively. However, no significant difference was observed among the three experimental groups. These findings were in agreement with Shelton et al. (2003). Thus, we concluded that chromium might not have significant role in skeletal development.

Loin eye area: The loin eye area (in cm^2) was significantly ($p<0.01$) larger in chromium supplemented groups (23.58±0.27 and 22.09±0.29) as compared to control group (20.74 ± 0.22) (**Table 3**). In mean comparison, all the three experimental groups differed significantly ($p<0.01$; **Table 3**). This was in accordance with the finding of Wang et al. (2009) who observed a significantly larger loin eye area. Significant increase in loin eye area in chromium supplemented groups could be attributed with the effect of chromium in potentiating the anabolic effect of insulin and conversion of thyroxine to tri-iodothyronine (Fakler et al., 2000) contributing to the promotion of RNA synthesis, and subsequently increasing translation process for proteins in muscle cells (Jiajun et al., 2011).

Backfat thickness: The results are shown in **Table 4**. The results revealed a highly significant relation ($p<0.01$) in losing backfat thickness among all three experimental groups. This was in agreement with Min et al. (1997).

Organs weight: Weights of hearts in the Group I, II and III were recorded as 0.20±0.00, 0.20±0.00 and 0.19±0.01 kg, respectively. Weights of lungs were revealed as 0.64±0.01, 0.63±0.01 and 0.63±0.01 kg, respectively. Similarly, weights of the spleens of the three groups were 0.43±0.16, 0.53±0.16 and 0.43±0.16 kg, respectively. However, no significant difference was observed in weights of heart, lung and spleen among the three experimental groups. On the other hand, liver and kidney weights were significantly ($p<0.05$) reduced in the present study, which was in agreement with Van de Ligt et al. (2002) and Jackson et al. (2009).

Meat, fat and bone percentage: The crossbred pigs supplemented with chromium tripicolinate produced higher meat fat percentage ($p<0.01$), and lower fat percentage ($p<0.01$) as compared to the control group. There was no significant difference in bone percentage among the experimental groups. The higher meat percentage and lower fat percentage in chromium tripicolinate supplemented groups could be attributed with the effect of chromium in potentiating the anabolic effect of insulin and conversion of thyroxine to triiodothyronine (Fakler et al., 2000), which contributed to the promotion of RNA synthesis and regulated the translation processes for protein synthesis in muscle cells (Jiajun et al., 2011)

CONCLUSIONS

Chromium tripicolinate supplementation in swill feed fed pigs has a positive influence on producing lean meat in growing pigs. Chromium has lowering effect on backfat thickness and fat percentage in pigs. However, chromium influences positively in increasing loin eye area and muscle percentage.

REFERENCES

Bereskin B, Steele NC (1988). Estimate of genetics parameters for carcass measures of body composition and growth in swine. Journal of Animal Science, 60:2498-2507.

Boleman SL, Boleman SJ, Bidner TD, Southern LL, Ward TL, Pontif JE, Pike MM (1995). Effect of chromium picolinate on growth, body composition, and tissue accretion in pigs. Journal of Animal Science, 73:2033-2042.

Duncan DE (1955). Multiple range and multiple F test. Biometrics. pp 11:1-12.

Fakler TM, Pettigrew JE, Rapp CJ (2000). Nutrition and sow prolificacy. In proceeding of the fifth international seminar on Suinocultura, September 27–28, USA.

FAO (2009). The state of food and agriculture 2009: Livestock in balance. Rome, FAO.

FAO STAT (2010). Total Indian meat and pork production. Accessed on 18 June 2012. http://faostat.fao.org/site/569/default.aspx#ancor.

Jackson AR, Powell S, Johnston SL, Matthews JO, Bidner TD, Valdez FR, Southern LL (2009). The effect of chromium as chromium propionate on growth performance, carcass traits, meat quality, and the fatty acid profile of fat from pigs fed no supplemented dietary fat, choice white grease, or tallow. Journal of Animal Science, 87**:** 4032–4041.

Jiajun Y, Aiyun H, Shanshan Z, Minhong Z (2011). Regulation of organic nucleic acids and serum biochemistry parameters by dietary chromium picolinate supplementation in swine model. Journal of Trace Element Medical Biology, 25: 91–96.

Kornegay ET, Wang Z, Wood CM, Lindemann MD (1997). Supplemental chromium picolinate influences nitrogen balance, dry matter digestibility, and carcass traits in growing-finishing pigs. Journal of Animal Science, 75:1319–1323.

Lefaucheur L, Dividich JL, Mouurot J, Mourin G, Ecolan P, Krauss M (1991). Influence of environmental temperature on growth, muscle and adipose tissue metabolism and meat quality in swine. Journal of Animal Science, 69**:**2811-2854.

Lindemann MD, Wood CM, Harper AF, Kornegay ET, Anderson RA (1995). Dietary chromium picolinate additions improve gain:feed and carcass characteristics in growing-finishing pigs and increase litter size in reproducing sows. Journal of Animal Science, 73:457-465.

Min JK, Chung IB, Chae BJ, Shin IS, Kim WY, Choi YJ, Han, IK (1997). Effects of chromium picolinate on growth performance, carcass characteristics and serum traits in growing-finishing pigs. Asian-Australasian Journal of Animal Sciences, 10**:** 8-14.

Neely JD, Johnson RK, Valters LE (1979). Efficiency of gain and carcass characteristics of swine of two degree of fatness slaughtered in three weights. Journal of Animal Science, 48: 1049-1056.

Page TG, Southern LL, Ward TL, Thompson, DL (1993). Effect of chromium picolinate on growth and serum and carcass traits of growing-finishing pigs. Journal of Animal Science, 71:656-662.

Shelton JL, Payne RL, Johnston SL, Bidner TD, Southern LL, Odgaard RL, Page TG (2003). Effect of chromium propionate on growth, carcass traits, pork quality, and plasma metabolites in growing-finishing pigs. Journal of Animal Science, 81:2515–2524.

Singh AK, Nath DR, Sarkar AB (1983). Certain economically important carcass traits of castrated and uncastrated Hampshire pigs. Cheiron, 12:231-236.

Van de Ligt CP, Lindemann MD, Cromwell GL (2002). Assessment of chromium tripicolinate supplementation and dietary energy level and source on growth, carcass, and blood criteria in growing pigs. Journal of Animal Science, 80:483–493.

Wang MQ, He1 YD, Lindemann MD, Jiang ZG (2009). Efficacy of chromium (III) supplementation on growth, carcass composition, blood metabolites, and endocrine parameters in finishing pigs. Asian-Australasian Journal of Animal Sciences, 22:1414-1419.

Ziegler TP (1968). The meat we eat. 9th Edn., The interstate printers and Publishers Inc. Danville, Illinois, USA.