Carcass characteristics of crossbred Hampshire pig fed on poultry by-products

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Abstract

An experiment was conducted to study the effects of the inclusion of poultry by-product meal in the ration of pig replacing the fish meal at different levels viz. 50% and 100% on the carcass characteristics in Crossbred Hampshire pigs. A total of Eighteen (18) weaned Crossbred Hampshire pigs (9 castrated male and 9 female) with an average age of 8 weeks and average body weight of 11.11±0.02 kg were selected from an institutional pig farm (30-Sow Teaching Unit) under the Department of Livestock Production and Management, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati-22. The trial was conducted for 150 days, from 15th October 2021 to 14th March 2022. The piglets were divided into three treatment groups depending upon the nearness of body weight and age in such a manner that each treatment will consist of six pigs(3 males and 3 females in each group) viz. groups C, T_1, and T_2. The animals under T_1 group were provided with Standard conventional feed with 2.5%, T_2 group with 5% inclusion of poultry by-product meal replacing 50% and 100%of fish meal respectively. However, the control group was provided with standard conventional feed without the inclusion of poultry by-products. The Live weight (kg), Slaughter weight (kg), Hot Carcass weight (kg), chilled Carcass weight (kg), Hot dressing percentage (%), chilled dressing percentage (%), Carcass length (cm), Back fat thickness(cm), and Loin eye area (cm^2) showed nonsignificant difference among different groups. Wholesale cuts (ham, bacon, loin, picnic, Boston butt, and jowl) showed non-significant differences among the groups. The edible and inedible offal also did not differ significantly (P>0.01). Thus it can be concluded that the inclusion of poultry by-products up to 5% level in the pig ration replacing fish meal may be recommended in terms of growth and economic production without any adverse effect on general performance.

Key words: Crossbred, Hampshire Pig, Poultry By-Products**,** Carcass characteristics

Introduction

India is an agrarian country and the livestock sector is an important component of India's economy in terms of income, employment, and foreign exchange earnings. The livestock sector contributes 26% to the total income of small households as against an average of 24% for all the rural households. The livestock sector produces different food items such as Meat, Milk, and Eggs for human consumption. It is producing about 10.25 million tonnes of meat in a year (BAHS, 2023-24). Although India produces 10.25 million tons of meat, even the availability of animal protein is only 15 g/head/day against the minimum requirement of 30 g as per the recommendation of the Indian Council of Medical Research. As per the 20th Livestock census, India's pig population is 9.06 million which amounts to about 1.7 % of the country's entire livestock (Borah et al., 2022). The poultry slaughterhouse by-product is a highly nutritious ingredient that can be an important animal protein source in the diet of swine and chickens. The chicken meal contains 55% proteins, 19% fat, 3% calcium, 0.96% phosphorus, 2.16 % lysine, 0.72 % Methionine, 0.72% cysteine and 3.4 ME Mcal/ kg (Chandrasekaran, 2013). Poultry by-product meal is usually a palatable and high-quality feed ingredient due to its content of fatty acids, different essential amino acids, minerals, and vitamins (Meeker and Hamilton, 2006). In view of the above, if poultry by-products like head, shank, intestine, etc. are effectively used by pigs as protein and energy substitute without reducing the animal's performance, it will reduce the cost of feed and thereby increase the profitability of pig business. However, in Indian conditions there is confined research available on the performance of pigs supplemented with poultry by-product meal. With this background, the present study was carried out to evaluate the effect of the inclusion of poultry by-product meal in weaned pig diets.

Materials and methods

The experiment was conducted in the institutional pig farm (30-Sow Teaching Unit) under the Department of Livestock Production and Management, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati-22 In collaboration with Department of Livestock Products Technology, Department of Veterinary Biochemistry, Department of Animal Nutrition, and AICRP on Post-Harvest Engineering & Technology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati-22. The experiment was carried out for 5 months (150 days) i.e. from 15th October 2021 to 14th March 2022. Eighteen (18) weaned Crossbred Hampshire pigs (9 castrated male and 9 female) with an average age of 8 weeks and average body weight of 11.11±0.02 kg was selected for the study. Thereafter, the piglets were divided into three experimental treatment groups depending upon the nearness of body weight and age in such a manner that each treatment consisted of six pigs (3 male and 3 females in each group) *viz*. groups C, T_1, and T_2. Standard rations were prepared by using different conventional feed ingredients, viz. Maize, Wheat bran, Rice polish, GNC (DO), Fish meal, mineral mixture, Iod. Salt and Poultry by-product meal (PBM).

The average cost per kg grower diet was worked out to be Rs. 29.60 for the C group, Rs.29.44 for T_1, and Rs.29.29 for the T_2 group. Similarly, the average cost per kg finisher diet was worked out to be Rs.28.13. for the C group, Rs.27.97 for T_1, and Rs.27.81 for the T_2 group.

Feeding of experimental animals

All experimental pigs were managed intensively under individual feeding with the above feeding regime for 150 days. The animals under the T_1 group were provided with Standard conventional feed with 2.5% inclusion of poultry by-product meal replacing 50% of fish meal. However, the animals of the T_2 group were provided with Standard conventional feed with 5% inclusion of poultry by-product meal replacing 100% fish meal. The control group was provided with standard conventional feed without the inclusion of poultry by-products. The grower rations were provided to the pig from weaning to 5 months of age and thereafter, finisher rations were provided till the end of the experiment. A measured quantity of respective concentrate mixtures was offered to the pigs reared in different groups in the morning at 9 a.m. and in the evening at 3 p.m., and then the leftover was collected the next day and recorded. From these data, the total feed intake was worked out at fortnight intervals. The amount of feed was adjusted at fortnightly intervals along with the change in live weight. Throughout the experimental period, the pigs had free access to clean and fresh drinking water on 24 hours basis

Procedure for preparation of poultry by-products meal

Poultry by-products meal was prepared as described by Ockerman & Hansen (1999). Inedible poultry by-products were collected hygienically from the local poultry slaughterhouse and transported to the laboratory in chilled condition. After the separation of the visible dirt, big feathers etc, the by-products were chopped into small pieces. The chopped by-products were sterilized at 121^{0}C for 15 minutes at 15 lb pressure. After sterilization, the solid cooked by-products were separated from the gravy. Extra pressure was applied to extract moisture/oil from the cooked material. The cooked by-products were minced in a mechanical mincer and thereafter, it was dried using a tray dryer maintained at 55-60^{0}C for 6-8 Hrs. The dried by-products were milled/ pulverized using one mechanical grinder. Thereafter, the ground by-products were packed in air-tight containers/ packages.

Table 1: Percentage composition of experimental ration

Type of ration	Feed Ingredients	Experimental groups		
		C	T_1	T_2
Grower ration	Maize	45.00	45.00	45.00
	Wheat Bran	20.00	20.00	20.00
	Rice Polish	7.00	7.00	7.00
	GNC(DO)	20.00	20.00	20.00
	Fish meal	5.00	2.50	0.00
	Poultry By-product meal (PBM)	0.00	2.50	5.00
	Mineral mixture	2.50	2.50	2.50
	Iod. salt	0.50	0.50	0.50
	Total	100	100	100
	CP (%)*	18.31	18.75	19.19
	ME (Kcal/kg)*	3079.27	3115.81	3152.35
Finisher ration	Maize	42.00	42.00	42.00
	Wheat Bran	28.00	28.00	28.00
	Rice Polish	10.00	10.00	10.00
	GNC(DO)	12.00	12.00	12.00
	Fish meal	5.00	2.50	0.00
	PBM	0.00	2.50	5.00
	Mineral mixture	2.50	2.50	2.50
	Iod. salt	0.50	0.50	0.50
	Total	100.00	100.00	100.00
	CP (%)*	16.27	16.71	17.15
	ME (Kcal/kg)*	3059.27	3095.81	3132.35

*Calculated Value.

Table 2: Chemical composition of the poultry by-product (on dry matter basis)

Components	Percentage (%)
Dry matter	94.18
Organic matter	90.4
Crude Protein	60.55
Ether extract	23.3
Crude fibre	0.30
Total ash	9.6
Ca	3.34
P	1.46

Nutritional composition of poultry by-product meal

The Nutritional composition (on DM basis) of poultry by-products like Dry matter, Organic matter, Crude protein, Ether extract, Crude fibre, and Total ash, were 94.18, 90.4, 60.55, 23.3, 0.30, and 9.6 percent, respectively. The minerals viz. Calcium and Phosphorus were recorded as 3.34 and 1.46 percent respectively.

Carcass traits of slaughtered pigs

At 7 months or approx.70 Kg body weight, the animals were sold to the butcher and the Carcass characteristics and meat quality traits were evaluated after collection of different meat parts from the butcher.

Live weight (kg)

The live weight of the pig was recorded in Kg. The animals to be slaughtered were kept deprived of feed overnight (12 hrs) with free access to water and immediately before slaughter.

Slaughter weight (kg)

The weight of the pig immediately prior to slaughter was recorded in Kg.

Hot Carcass weight (kg)

The Hot carcass weight was taken after complete bleeding for 4-5 minutes having the carcass on rails, dehairing it after scalding in boiled water, eviscerating, and thorough cleaning of the body. The hot carcass weight was recorded without head after 30 minutes of final washing and was recorded in kg .

Chilled Carcass weight (kg)

The weight of the carcass after chilling was recorded in Kg.

Dressing percentage (Hot and Chilled)

It was worked out from the carcass weight and slaughter weight of pigs immediately after slaughter by using the formula given below:

$$\text{Dressing percentage} = \frac{\text{Carcass weight}}{\text{Slaughter weight}} \text{X100}$$

Carcass length (cm)

The carcass length was measured in centimeters as a straight-line distance from the anterior edge of the first rib to the anterior edge of the aitch bone (Symphysis pubis). The measurement was taken on each half carcass separately and the average value was recorded as carcass length

Back fat thickness (cm)

The back fat thickness was measured in centimeters with a Measuring steel tape at three different points on the back region of the carcass. The mean of these three measurements taken opposite to the first rib, last rib, and last lumbar vertebrae was considered to be the average back-fat thickness of the carcass.

Loin eye area (cm^2)

Loin eye is the circumference of the *Longissimus dorsi* muscle in between the 10^{th} and 11^{th} ribs. The circumference was traced on a tracing paper by placing the same against the out surface of the eye muscle. The traced area was then measured with the help of a graph paper by taking into account all the squares fallen within and converting the same into square centimeters.

Weight of various wholesale cuts (kg)

Each half of the carcass was then disjoined at certain specific points to make the various wholesale cuts. The weight of each cut, viz. ham, loin, bacon, picnic, butt, and jowl were recorded by using a Weighbird spring balance (10 kg capacity) and expressed as a percentage of carcass weight.

Weight of the edible and inedible offal (kg)

Edible offals: Weight of edible offals, viz. (a) Heart, (b) Liver, (c) Spleen, and (4) Kidney was recorded immediately after evisceration. Weight of inedible offals and parts, viz. (a) Lungs, (b) GIT with content (including urinary bladder, genitalia, and pancreas), (c) Head, (d) Shank, (e) Tail and (f) Blood were recorded. All the above weights were expressed as percentages to slaughter weight.

Results and discussions

In the present study, the values of the live weight and the slaughter weight of the experimental animal gradually increase with the increasing levels of the poultry by-products meal. As a general rule, the carcass weight increases as live weight increases. A similar trend was also observed in the present study. The Carcass length, back fat thickness, and loin eye area of the experimental animal increase in the T_2 and T_1 groups as compared to C groups which might be due to the higher energy content of the poultry by-product meal in the diet than the fish meal. The findings of the present study are in agreement with those of Tibbetts *et al.* (1987) who found non-significant differences among treatment groups for live weight, slaughter weight, dressing percentage, carcass length, and average back fat for growing and finishing pigs after supplementation with poultry offal ensiled with lactobacillus acidophilus in swine diets. Udedibie *et al*. (1988) found Poultry offal meals at 20% dietary inclusion levels improved the dressing percentage and back fat thickness for grower pigs. They also found live weight at slaughter was also non-significantly different among different treatment and control groups. Lunen *et al.* (1991) found that carcass characteristics were significantly unaffected when the poultry offal hydrolysate was fed to growing-finishing pigs at levels of 0, 5, 10, or 15% DM in feeding trials. Lallo *et al.* (1997) observed no significant differences in slaughter parameters among treatments after the ensiling of poultry offal with sugarcane molasses and Lactobacillus culture for feeding to growing-finishing pigs under tropical conditions.

Present findings were in agreement with Tibbetts *et al.* (1987); Udedibie *et al*. (1988); Lunen *et al.* (1991); and Lallo *et al*. (1997). However, Urlings *et al*. (1993) found a significantly higher carcass weight, a lower meat percentage, and an increased back fat thickness after the incorporation of broiler by-products (heads, feet, and viscera) in the fattening ration.

Weight (kg) of various wholesale cuts

The average weight (kg) of ham of crossbred Hampshire pigs of Group C, T_1, and T_2 were 13.44 ± 0.60, 13.81 ± 0.46, and 14.23 ± 0.97 respectively. The average weight (kg) of loin of crossbred Hampshire pigs of Group C, T_1, and T_2 were 11.47± 0.64, 11.69 ± 0.68, and 11.91 ± 0.55, respectively. The average weight (kg) of Boston Butt of crossbred Hampshire pigs of Group C, T_1, and T_2 were 6.08 ± 0.27,6.53 ± 0.28, and 6.46 ± 0.25, respectively. The average weight (kg) of Picnic shoulder of crossbred Hampshire pigs of Group C, T_1, and T_2 were 6.56 ± 0.47, 6.59 ± 0.09, and 6.74 ± 0.14, respectively. The average weight (kg) of Bacon of crossbred Hampshire pigs of Group C, T_1, and T_2 were 8.98 ± 0.33, 9.22 ± 0.34, and 8.96 ± 0.70, respectively. The average weight (kg) of Jowl of crossbred Hampshire pigs of Group C, T_1, and T_2 were 1.73 ± 0.05, 1.71 ± 0.04, and 1.70 ± 0.09 respectively.

Table 3: Mean(±se) weights (kg) of carcass traits of slaughtered pigs under different experimental groups

Carcass traits	Experimental groups			P Value
	C	T_1	T_2	
Live weight (kg)	70.76 ± 0.82	70.81 ± 0.34	70.97 ± 0.57	0.970
Slaughter weight (kg)	70.01 ± 0.82	70.19 ± 0.34	70.31 ± 0.57	0.944
Hot Carcass weight (kg)	48.26 ± 0.96	49.55 ± 0.85	50.01 ± 1.59	0.584
Chilled Carcass weight (kg)	47.28±0.97	48.49±0.86	48.98±1.55	0.599
HDP (%)	68.96 ± 1.74	70.59 ± 1.13	71.15 ± 2.50	0.706
CDP (%)	66.84 ± 1.72	68.47 ± 1.13	69.04 ± 2.49	0.702
Carcass length (cm)	87.73 ± 1.27	87.77 ± 1.20	89.07± 1.29	0.575
Back fat thickness (cm)	2.83 ± 0.03	2.87 ± 0.07	2.94 ± 0.10	0.630
Loin eye area (cm^2)	22.07 ± 0.58	22.27 ± 0.43	23.30 ± 0.98	0.462

$C_=$ Standard conventional feed without poultry by-product, $T_{1=}$ Standard conventional feed with 2.5% inclusion of poultry by-product meal
$T_{2=}$ Standard conventional feed with 5% inclusion of poultry by-product meal

Table 4: Mean weight (kg) and percentage of various wholesale cuts in carcasses of pigs under different experimental groups

Particulars	Experimental groups			P Value
	C	T_1	T_2	
Hot Carcass weight (kg)	48.26 ± 0.96	49.55 ± 0.85	50.01 ± 1.59	0.584
Ham	13.44 ± 0.60 (27.85± 0.69)	13.81 ± 0.46 (27.87 ± 1.03)	14.23 ± 0.97 (28.46 ± 1.62)	0.746
Loin	11.47± 0.64 (23.76± 1.15)	11.69 ± 0.68 (23.60± 0.96)	11.91 ± 0.55 (23.82 ± 0.99)	0.882
Boston Butt	6.08 ± 0.27 (12.60 ± 0.75)	6.53 ± 0.28 (13.18 ± 0.37)	6.46 ± 0.25 (12.92 ± 0.39)	0.484
Picnic Shoulder	6.56 ± 0.47 (13.60 ± 0.97)	6.59 ± 0.09 (13.30 ± 0.41)	6.74 ± 0.14 (13.48 ± 0.19)	0.897
Bacon	8.98 ± 0.33 (18.61 ± 0.63)	9.22 ± 0.34 (18.61 ± 0.78)	8.96 ± 0.70 (17.92 ± 1.20)	0.916
Jowl	1.73 ± 0.05 (3.58± 0.18)	1.71 ± 0.04 (3.44 ± 0.03)	1.70 ± 0.09 (3.39 ± 0.08)	0.941

Figures in the parenthesis indicate percent weight, $C_=$ Standard conventional feed without poultry by-product, $T_{1=}$ Standard conventional feed with 2.5% inclusion of poultry by-product meal, $T_{2=}$ Standard conventional feed with 5% inclusion of poultry by-product meal

Table 5: Mean(±SE) weights (kg) and percentage of the edible offals of slaughtered pigs under different experimental groups

Particulars	Experimental groups			P Value
	C	T_1	T_2	
Hot Carcass weight (kg)	48.26 ± 0.96	49.55 ± 0.85	50.01 ± 1.59	0.584
Liver	1.35 ± 0.03 (1.93 ± 0.03)	1.38 ± 0.03 (1.96 ± 0.04)	1.42 ± 0.02 (2.02 ± 0.02)	0.306
kidney	0.28 ± 0.01 (0.40 ± 0.01)	0.27 ± 0.01(0.38 ± 0.02)	0.29 ± 0.02 (0.42 ± 0.03)	0.529
Heart	0.30 ± 0.01 (0.42 ± 0.01)	0.29 ± 0.01 (0.42 ± 0.01)	0.32 ± 0.01 (0.45 ± 0.01)	0.095
Spleen	0.14 ± 0.01 (0.20 ± 0.01)	0.16 ± 0.01 (0.23 ± 0.01)	0.17 ± 0.01(0.24 ± 0.01)	0.223
Total	2.07 ± 0.05 (2.95 ± 0.05)	2.10 ± 0.04 (2.99 ± 0.05)	2.20 ± 0.02 (3.12 ± 0.02)	0.148
Total edible parts	50.33± 0.02 (71.91± 0.02)	51.65±0.02 (73.58± 0.03)	52.21±0.02 (74.27± 0.02)	0.342

Figures in the parenthesis indicate percent weight, $C_=$ Standard conventional feed without poultry by-product, $T_{1=}$ Standard conventional feed with 2.5% inclusion of poultry by-product meal, $T_{2=}$ Standard conventional feed with 5% inclusion of poultry by-product meal

Table 6: Mean(±se) weights (kg) and percentage of the inedible offals of slaughtered pigs of under different experimental groups

Particulars	Experimental groups			P Value
	C	T_1	T_2	
Lungs	0.73 ± 0.09 (1.04 ± 0.12)	0.75 ± 0.10 (1.06 ± 0.13)	0.71 ± 0.06 (1.01 ± 0.08)	0.953
GIT	10.66 ± 0.36 (15.22 ± 0.34)	10.60 ± 0.32 (15.10 ± 0.39)	10.63 ± 0.35 (15.12 ± 0.37)	0.992
Head	3.76 ± 0.24 (5.36 ± 0.28)	3.95 ± 0.30 (5.62 ± 0.40)	4.11 ± 0.31 (5.84 ± 0.40)	0.698
Blood	2.32 ± 0.11 (3.32 ± 0.11)	2.32 ± 0.18 (3.30 ± 0.24)	2.36 ± 0.14 (3.36 ± 0.18)	0.971
Shank	1.60 ± 0.20 (2.29 ± 0.26)	1.63 ± 0.09 (2.33 ± 0.12)	1.76 ± 0.21 (2.51 ± 0.30)	0.800
Tail	0.12 ± 0.01 (0.17 ± 0.01)	0.13 ± 0.01 (0.18 ± 0.01)	0.13 ± 0.01 (0.18 ± 0.00)	0.353

Figures in the parenthesis indicate percent weight $C_=$ Standard conventional feed without poultry by-product, $T_{1=}$ Standard conventional feed with 2.5% inclusion of poultry by-product meal, $T_{2=}$ Standard conventional feed with 5% inclusion of poultry by-product meal

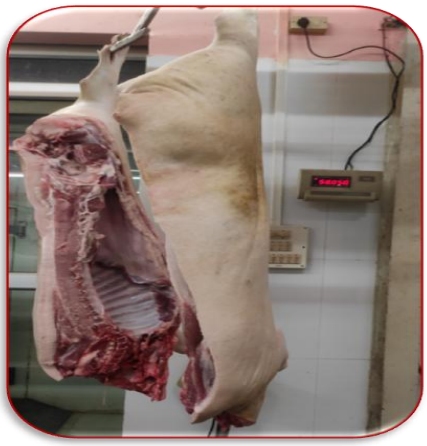

Fig 1: Carcass weight

Fig 2: Carcass length

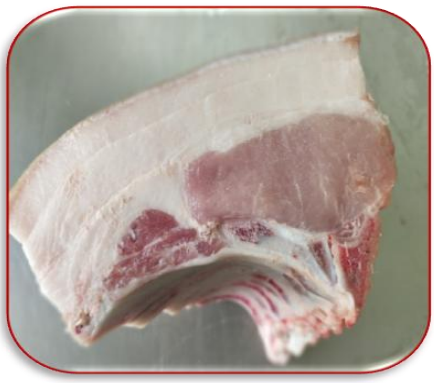

Fig 3: Loin eye area

Fig 4: Back fat thickness

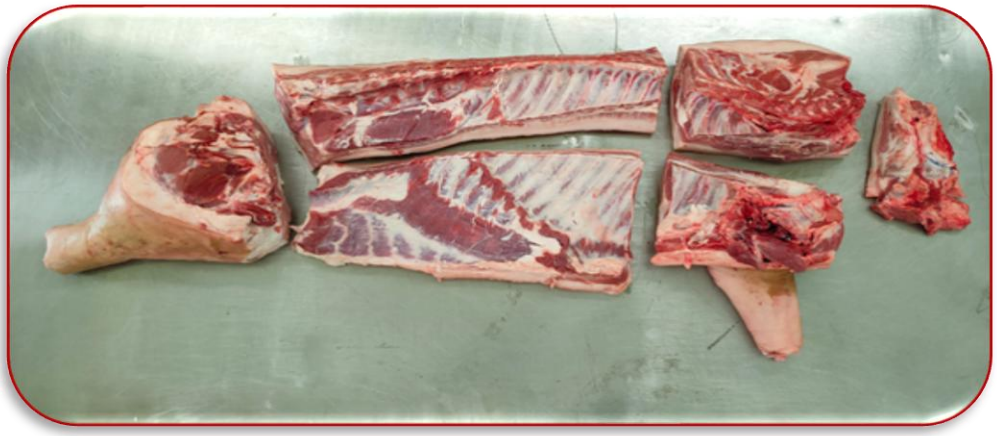

Fig 5: Wholesale cuts of pork

Analysis of variance of the data on different wholesale cuts revealed that the various wholesale cuts (ham, loin, boston butt, picnic shoulder, bacon, and jowl) of crossbred Hampshire pigs don't differ significantly between different treatment and control groups. Tibbetts *et al.* (1987) found non-significant differences among treatment groups for the percentage of ham, loin, shoulder, lean cuts, and primal cuts for growing and finishing pigs after supplementation with poultry offal. Udedibie *et al.* (1988) recorded that the weight of different wholesale cuts increased with increasing levels of Poultry offal meal in the diet of grower pig. In the present study, the values of the different wholesale cuts (Ham, loin, Boston butt, and picnic shoulder) of the experimental animal gradually increase with the increasing levels of the poultry byproducts meal. The present finding were in agreement with Tibbetts *et al*. (1987); Udedibie *et al.* (1988). However, Apple *et al*. (2003) reported that ham weight decreased linearly with increasing levels of feather meal in the diet of the pig.

The average weight (kg) of the Liver of crossbred Hampshire pigs of Group C, T_1, and T_2 were 1.35 ± 0.03, 1.38 ± 0.03, and 1.42 ± 0.02 respectively. The average weight (kg) of kidneys of crossbred Hampshire pigs

of Group C, T_1, and T_2 were 0.28 ± 0.01, 0.27 ± 0.01, and 0.29 ± 0.02 respectively. The average weight (kg) of heart of crossbred Hampshire pigs of Group C, T_1, and T_2 were 0.30 ± 0.01, 0.29 ± 0.01, and 0.32 ± 0.01 respectively. The average weight (kg) of spleen of crossbred Hampshire pigs of Group C, T_1, and T_2 were 0.14 ± 0.01, 0.16 ± 0.01, and 0.17 ± 0.01 respectively. Analysis of variance of the data on different edible cuts revealed that the various edible offals (liver, kidney, heart, and spleen) of crossbred Hampshire pigs don't differ significantly between different treatment and control groups.

In the present study, the values of the different edible offals and the weight of the total edible offals of the experimental animal increased in the T_2 and T_1 groups than in the C group with the increasing levels of the poultry by-product meal. The higher weight in the T_2 and T_1 groups might be due to the higher energy and protein content of the poultry by-product meal than the fish meal. Present findings were in agreement with Udedibie *et al*. (1988) who found that the weight of the heart, liver, spleen, and kidney increased with increasing levels of poultry offal meal in the diet of grower pigs. Similar findings were also reported by Isika *et al*. (2006) who recorded supplementation of processed broiler offal meal (BOM) and feather meal (FM) results in non-significant effect on the mass of liver, spleen, kidney, heart, and gizzard.

Weights (kg) of the inedible offals

The average weight (kg) of Lungs of crossbred Hampshire pigs of Group C, T_1, and T_2 were 0.73 ± 0.09, 0.75 ± 0.10, and 0.71 ± 0.06 respectively. The average weight (kg) of GIT of crossbred Hampshire pigs of Group C, T_1, and T_2 were 10.66 ± 0.36, 10.60 ± 0.32, and 10.63 ± 0.35 respectively. The average weight (kg) of the Head of crossbred Hampshire pig of Group C, T_1, and T_2 were 3.76 ± 0.24, 3.95 ± 0.30, and 4.11 ± 0.31 respectively. The average weight (kg) of Blood of crossbred Hampshire pigs of Group C, T_1, and T_2 were 2.32 ± 0.11, 2.32 ± 0.18, and 2.36 ± 0.14 respectively. The average weight (kg) of Shank of crossbred Hampshire pigs of Group C, T_1, and T_2 were 1.60 ± 0.20, 1.63 ± 0.09, and 1.76 ± 0.21 respectively. The average weight (kg) of the Tail of crossbred Hampshire pigs of Group C, T_1, and T_2 were 0.12 ± 0.01, 0.13 ± 0.01, and 0.13 ± 0.01 respectively. Analysis of variance (Table 10) of the data on different inedible cuts revealed that the various inedible offals (Lungs, GIT, Head, Blood, Shank, and Tail) of crossbred Hampshire pigs don't differ significantly between different treatment and control groups.

Udedibie *et al*. (1988) found that the weight of different inedible cuts (Lungs, GIT, Head, Blood, Shank, and Tail) increased with increasing levels of Poultry offal meal in the diet of grower pigs. Hassanabadi *et al*. (2008) reported weight of eviscerated carcass (carcass without head, neck, feet, and gut), intestine, gizzard, and pro-ventriculus of the chicks was not significantly different after substitutions of soybean meal with poultry by-product meal on broiler chick performance. In the present study, the values of the different inedible cuts of the experimental animal increased in the T_2 and T_1 groups than in the C group with the increasing levels of the poultry by-product meal. Similar findings were also reported by Udedibie *et al*. (1988) and Hassanabadi *et al*. (2008).

Conclusion

Inclusion of poultry by-products meal at 2.5% and 5% dietary levels improved the carcass characteristics. Thus it can be concluded that the inclusion of poultry by-products up to 5% level in the pig ration as a replacer of the fish meal may be useful for better growth and economic pig production without any adverse effect on general performance. However, further studies are needed for a complete evaluation of the effect of the inclusion of poultry by-products in pig rations to support its usefulness.

Conflict of Interest

There is no conflict of interest. All authors read and approved the final manuscript. The research was conducted following the guidelines of the Institutional Animal Ethics Committee of Assam Agricultural University, Khanapara, Guwahati-781022, Assam, India vide memo no m770/GO/Re/S/03/CPCSEA/FVSC/AAU/IAEC/20-21/819/ dtd 31.07.2021.

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