

# Meat Yield and Quality of Broiler Chickens Feed with *Xanthosoma sagittifolium* Corm Meal

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## Abstract

The utilization of relatively less expensive roots and tubers as substitute feeds was given attention due to the high cost of feed ingredients nowadays. Sundried cocoyam (*Xanthosoma sagittifolium*) corm meal (SCCM) was fed to broiler chicken to evaluate the carcass yield and meat quality after 34 and 42 days. The study followed the complete randomized design with four treatments: (T<sub>1</sub>) 0% SCCM, (T<sub>2</sub>) 5% SCCM, (T<sub>3</sub>) 10% SCCM, and (T<sub>4</sub>) 15% SCCM. The remaining percentages composed the commercial feeds mixed in SCCM in the feed ration. Representative samples, fed with varied SCCM percentages, were dressed for carcass yield and meat quality evaluation. Results of the study revealed no significant difference in the carcass yield of the birds such as the weight of thigh, breast, drumstick, back and wings. The quality of broiler meat such as flavor, juiciness, smell, texture and tenderness were all not affected by the incorporation of SCCM in the feed ration of chicken up to 15%. The study demonstrated that the cocoyam corm meal is a good ingredient that can be incorporated in the formulation of broiler feeds.

**Keywords:** *Xanthosoma sagittifolium* corm; Broiler feeds; Cocoyam; Broiler meat quality, Alternative feeds.

## 1. Introduction

The escalating cost of feed ingredients nowadays like those used in the formulation of poultry feeds is becoming a serious consideration that limits the production of meat particularly in developing countries [1]. Maize is the commonly used main ingredient in the feed formulation. However, there is an impending social impact considering the competition as food for humans and feed for animals.

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This resulted in high cost of feeds and low profit of farmers because of high demand and a limited supply of maize. This is much felt by smallholder producers who, sometimes, cannot reach breakeven in their production cost [2]. This havoc calls for an exploration of finding an alternative source of feed ingredients, especially that the demand for poultry products (meat and eggs) are increasing in the market. A cheap, locally available and of low human preference would surely hit as an immediate answer to this problem [2–4].

Non-conventional feedstuffs are among the target sources considering that these are usually cheap and less competitive alternatives. One of this feedstuff that is locally available in the Philippines is wild cocoyam, a herbaceous underground root crop with corm rich of starch. The use of cocoyam parts like corm has been tried to poultry [5], leaves and foliage as a source of protein for pigs [6] and as a soup ingredient for humans [2,7]. High quantity of biomass and corm can be derived from a single plant of wild cocoyam [8], a drought hardy and water-logged tolerant plant [9,10].

Identified drawbacks of the utilization of non-conventional feedstuffs like wild cocoyam in animal production include digestibility, bulkiness, palatability and more importantly the presence of anti-nutritional factors. It has been thought that too much intake of wild cocoyam resulted to serious health implications [2]. Among the undesirable components of wild cocoyam are tannins, hydrocyanic acids, oxalates, antitrypsin inhibitors, phylate, and hydrocyanide [2,10,11]. With these contrasting reports that the cocoyam was positively used as feed/food and that there are anti-nutritional components in it, there is a need to explore if incorporating this abundant cocoyam, up to some percentage in feed formulation, would affect chicken broiler meat yield and quality.

Thus, this study was conducted to evaluate the potential of *Xanthosoma sagittifolium* corms as a feed ingredient to broiler rations. The aim of the study was to evaluate the carcass yield and meat quality of broiler chickens fed with varying levels of cocoyam corm meal in the ration at 34 and 42 days. Specifically, the study aimed at determining the broiler chickens' live weight, dressed weight, dressing percentage, and choice cuts weight. Further, this work evaluated the characteristics of the raw meat of the broiler chickens in terms of color, water holding capacity, and acceptability; and the sensory attributes of the cooked meat in terms of texture, smell, flavor, juiciness, and tenderness.

One of the limitations of the study is the use of sensory evaluation by Hedonic Scale. Also, selected evaluators of the meat quality were all coming from the University community of the University of Science and Technology of Southern Philippines

## **2. Materials and method**

### ***2.1. Preparation of experimental animals***

The study used 48 heads of broiler chickens distributed to four (4) experimental treatments. Four (4) square feet per experimental unit was used in the study. The chickens were slaughtered after 34 and 42 days of feeding with sundried cocoyam corm meal (SCCM) in the feed ration for meat yield and quality evaluation. One bird per replication from each treatment was taken as a sample. The representative sample of the meat from each bird

slaughtered was subjected to cooking through the steaming process for 1 h. When the meat was cooked, it was placed in coded plates for sensory evaluation by selected testing panel.

### **2.2. Experimental design and feeding schedule**

The study was established following the completely randomized design (CRD). The treatments which replicated thrice are: Treatment 1 (0% SCCM), Treatment 2 (5% SCCM), Treatment 3 (10% SCCM), Treatment 4 (15% SCCM) in the feed ration. Each replication had four (4) chickens that were randomly assigned to each treatment.

The experimental diets commenced after brooding the chicks for 14 days. The experimental ration was fed to the chickens according to their assigned level of SCCM supplementation. Probiotics were added to every SCCM supplementation at the same rate. The feeding schedules were the following: Chick booster mash during the brooding stage (1-14 days), Chick Starter Crumble mix with SCCM (15-24 days), Chick Grower Crumble mix with SCCM (25-31 days), and Chick Finisher Crumble mix with SCCM (32-42 days).

### **2.3. Slaughtering and dressing management**

After 34 days of feeding the broilers with varying levels of cocoyam corm meal incorporated in the commercial feeds, the birds were fasted for about 24 h. One bird per replication was taken, slaughtered and evaluated for meat yield and quality. The birds were dressed, cleaned and eviscerated and the shanks, neck, and head parts were separated. The same procedure was followed in slaughtering the chickens at 42 days of feeding.

### **2.4. Determination of dressing percentage and choice cuts weight**

The dressed chicken was weighed to determine its weight. The dressed chicken meat was cut into portions known as choice cuts. The cut parts were sorted and weighed separately to determine whether there is difference in the weight due to SCCM feed supplementation.

### **2.5. Determination of the raw meat color and water holding capacity**

The breast portion of the chickens in every replicate sample was placed in the coded plates for evaluation of testing panel. Table 1 shows the Hedonic scale used in grading the raw meat of the chicken.

**Table 1:** Raw meat Hedonic scale

Meat Color		Meat Water Holding Capacity	
Description	Scale	Description	Scale
Extremely red	5	Extremely watery	5
Moderately red	4	Moderately watery	4
Just normal pink	3	Just normal watery	3
Slightly pale	2	Moderately not watery	2
Extremely pale	1	Extremely not watery	1

**2.6. Meat sensory evaluation**

**Table 2:** Cooked meat Hedonic scale

Description	Scale	Description	Scale
<b>Meat Texture</b>		<b>Meat Smell</b>	
Extremely desirable texture	5	Extremely desirable smell	5
Moderately desirable texture	4	Moderately desirable smell	4
Just normal texture	3	Just normal smell	3
Slightly undesirable texture	2	Slightly undesirable smell	2
Extremely undesirable texture	1	Extremely undesirable smell	1
<b>Meat Flavor</b>		<b>Meat Juiciness</b>	
Extremely desirable flavor	5	Extremely desirable juiciness	5
Moderately desirable flavor	4	Moderately desirable juiciness	4
Just normal flavor	3	Just normal juiciness	3
Slightly undesirable flavor	2	Slightly undesirable juiciness	2
Extremely undesirable flavor	1	Extremely undesirable juiciness	1
<b>Meat Tenderness</b>		<b>Overall Acceptability</b>	
Extremely desirable tenderness	5	Extremely acceptable	5
Moderately desirable tenderness	4	Moderately acceptable	4
Just normal tenderness	3	Just normally acceptable	3
Slightly undesirable tenderness	2	Slightly unacceptable	2
Extremely undesirable tenderness	1	Extremely unacceptable	1

After dressing, the breast parts of the chickens per replication were used for determining the quality of the meat. The chicken meats were wrapped with foil paper and were subjected to steaming process for about 1 h or until cooked.

After cooking, they were placed in coded plates for evaluation in terms of texture, smell, flavor, juiciness and tenderness. Ten (10) members of the sensory panel evaluated the steamed meat samples using the Hedonic rating scales presented in Table 2.

**2.7. Data gathering and statistical analysis**

In this work, the data that were gathered included dressing percentage, weight before and after fasting, dressed weight, choice cuts weight, and meat quality was evaluated based on a Hedonic scale for texture, smell, flavor, juiciness, and tenderness.

All the data were analyzed through analysis of variance in CRD to test the significant differences among treatments. The Tukey Studentized Range Test was used to determine the significance of treatment means.

### 3. Results and discussion

#### 3.1. Carcass yield

The average live weight of broilers fed with varying levels of sundried cocoyam corm meals (SCCM) and dressed on the 34<sup>th</sup> day is shown in Table 3. Results revealed that chicken fed with 10% SCCM gave the highest weight of 1480 g while those fed with 5% SCCM had the lowest live weight of 1066.67 g. Based on statistics, the difference was found significant which implies that the live weight of the broilers was affected by the incorporation of cocoyam in the ration.

**Table 3:** Mean live weight of broilers fed with varying levels of SCCM before and after fasting at 34 and 42 days

Treatment (% corm meal)	Before Fasting Live Weight (g)		After Fasting Live Weight (g)	
	34 days	42 days	34 days	42 days
T1 (0%)	1290.00 <sup>ab</sup>	2086.66	1240.00	1980.00
T2 (5%)	1066.67 <sup>b</sup>	2013.33	986.67	1820.00
T3 (10%)	1480.00 <sup>a</sup>	2080.00	1400.00	1920.00
T4 (15%)	1266.67 <sup>ab</sup>	2273.33	1200.00	2100.00
Level of significance	*	ns	ns	ns
CV%	11.00	13.80	12.22	12.29

At 42 days, chicken fed with 15% SCCM gained the highest live weight of 2273.33 g, while those fed with 5% SCCM got the lowest with 2013.33 g. Based on statistics, no significant difference was observed among the treatments which imply that the live weight of the broilers at 42 days was not affected by cocoyam incorporation in the diet. After fasting, the live weight of the chicken reduced both those harvested at 34 and 42 days. No significant difference of the live weight after fasting has been found in all the treatments both in 34 and 42 days old chicken.

#### 3.2. Dressed weight and dressing percentage

Dressed weight of broilers fed with different levels of SCCM and probiotics is shown in Table 4. At 34 days, birds fed with 15% SCCM gained high dressed weight of 902 g followed by those fed with 5% SCCM having 864 g and the 0% SCCM with 854 g. Birds fed with 10% SCCM got the lowest weight of 820 g. No significant difference among the treatments implying that the dressed weight was not affected by the incorporation of cocoyam in the ration.

At 42 days, chickens fed with 15% SCCM consistently had the highest dressed weight of 1484.00 g, and the lowest dressed weight was obtained by those flock fed with 10% SCCM which weighed 1191.33 g. Statistically, the amount of SCCM was found not significantly affecting the dress weight.

**Table 4:** Mean dressed weight and dressing percentage of broilers fed with varying levels of SCCM at 34 and 42 days.

Treatment (% corm meal)	Dressed Weight (g)		Dressing Percentage (%)	
	34 days	42 days	34 days	42 days
T1 (0%)	854	1374.66	69.56	69.58 <sup>ab</sup>
T2 (5%)	864	1269.00	86.92	69.61 <sup>ab</sup>
T3 (10%)	820	1191.33	59.04	62.05 <sup>b</sup>
T4 (15%)	902	1484.00	76.59	70.47 <sup>a</sup>
Level of significance	ns	ns	ns	*
CV%	18.32	13.59	20.81	4.36

The dressing percentage was computed by taking the dressed weight divided by the live weight of the broiler chickens. Birds dressed at 34 days had comparable results regardless of the amount of SCCM fed to them. The flock fed with 5% SCCM got the highest average dressing percentage of 86.92%. At 45 days, results showed that those nourished with 15% SCCM achieved the highest dressing percentage of 70.47% and closely followed by those fed with 15% SCCM having 69.61%. Those fed with 10% SCCM recorded the lowest dressing percentage of 62.05%. Based on these observations, it was noted that the dressing percentage of birds fed with SCCM meal at 15% had higher dressing percentage which could be attributed to the nutrient content of SCCM. It could be inferred that the increasing levels of the anti-nutritional factors resulting from increasing inclusion levels of SCCM were not high enough at 15% cocoyam as to adversely affect the performance negatively on the feed intake.

### 3.3. Choice cut weight

Results on the mean weight of the choice cuts of the experimental birds fed with SCCM in 34 and 42 days are shown in Tables 5 and 6, respectively.

**Table 5:** Mean weights of the meat cuts of broilers fed with varying levels of SCCM at 34 days

Treatment (% corm meal)	Weight of Meat Cuts (g)				
	Wing	Back	Breast	Thigh	Drumstick
T1 (0%)	126.67	170.67	247.33	118.67	102.67
T2 (5%)	145.33	210.67	302.00	132.67	114.67
T3 (10%)	138.00	185.33	265.33	122.00	109.33
T4 (15%)	174.00	186.00	290.67	144.00	107.33
Level of significance	ns	ns	ns	ns	ns
CV%	20.27	12.80	33.44	29.03	18.42

**Table 6:** Mean weights of the meat cuts of broilers fed with varying levels of SCCM at 42 days

Treatment (% corm meal)	Weight of Meat Cuts (g)				
	Wing	Back	Breast	Thigh	Drumstick
T1 (0%)	258.66	232.66	494.66	221.33	177.33
T2 (5%)	262.66	241.33	403.33	199.00	161.33
T3 (10%)	227.33	199.33	415.33	254.00	161.33
T4 (15%)	268.00	266.00	524.00	242.00	194.00
Level of significance	ns	ns	ns	ns	ns
CV%	20.79	20.79	18.47	12.42	14.33

At 34 days, the result showed that those chicken fed with 15% SCCM got the highest weight of wings (174 g). Those fed with 100% commercial feeds without SCCM exhibited the lowest weight (126.67 g). The chicken at 42 days showed that those fed with 15% SCCM got the heaviest weight of 268 g while those with 10% SCCM recorded the lowest weight of 227.33 g. Statistically, it was found out that the weight of birds was not significantly affected by the variation of percent SCCM incorporated in the feed ration. It can be postulated that the SCCM is a good feed substitute for a commercial feed at the percentage up to 15% by weight.

In terms of back cuts, the results revealed that the incorporation of SCCM in the feed ration of broiler chicken did not affect the weight of the back cuts at 34 and 42 days. The highest weights were 210.67 g and 266 g with 5% SCCM (34 days) and 15% SCCM (42 days), respectively.

The result of breast weight showed no statistical difference in weight of the group of birds fed at different SCCM percentage both at 34 and 42 days. Highest breast weight was 302 g at 34 days (5% SCCM) and 524 g at 42 days (15% SCCM).

The variation of SCCM percentage in the feed ration did not significantly affect the weight of the thigh of chicken both at 34 and 42 days. The result showed that at 34 days the highest thigh weight was 144 g (15% SCCM) and 254 g (10% SCCM) at 42 days.

Statistical analysis revealed no statistical difference in the mean weight of thigh of the birds fed at different percentage of SCCM. Although at 34 days, the birds fed with 5% cocoyam corm meal had the heaviest weight of 114.67 g, it was statistically comparable with those fed with 10% SCCM (109.33 g), 15% SCCM (107.33 g), and 0% SCCM (102.67 g). At 42 days, chicken with 15% SCCM got the heaviest weight of 194 g, and the lowest was those with 5% and 10% SCCM (161.33 g). The inclusion of cocoyam corm meal in the ration of broilers did not affect the weight of the drumstick of the birds.

### 3.4. Meat quality

In terms of physical characteristics of the raw meat, color and water holding capacity in both 34 and 42 days

were comparable (Table 7). This means that the color of meat did not change even varying the amount of SCCM in the feed ration. It implied that the meat color was not affected by substitution of SCCM in the feeds thereby making the SCCM a good ingredient in the broiler feeds. Similar results were also found in the water holding capacity of the meat. The meat of chicken fed with purely commercial feeds is comparable to the meat of those fed with SCCM. This is a manifestation that the SCCM can be a good component of feed formulation for broiler chicken. In terms of acceptability, the result showed that meat produced with 5% SCCM, at 34 days, is better accepted by the consumers with the highest rating of 3.83. However, acceptability is not affected by the amount of SCCM in the feeds at 42 days. It was found that the meat with SCCM is comparable to the meat fed with purely commercial feed implying that the cocoyam is a good ingredient in the broiler feed ration.

**Table 7:** Characteristics of the raw meat of broilers fed with varying levels of SCCM at 34 and 42 days

Treatment (% corm meal)	Dressed at 34 days			Dressed at 42 days		
	Meat color	Water holding capacity	Acceptability	Meat color	Water holding capacity	Acceptability
T1 (0%)	2.87	3.40	2.80 <sup>b</sup>	3.33	3.36	3.50
T2 (5%)	3.93	3.73	3.83 <sup>a</sup>	3.56	3.40	3.76
T3 (10%)	3.47	2.93	2.67 <sup>b</sup>	3.43	3.40	3.80
T4 (15%)	3.00	3.37	2.77 <sup>b</sup>	3.83	3.56	3.93
Level of significance	ns	ns	*	ns	ns	ns
CV%	15.81	17.87	11.72	12.41	9.84	9.86

**Table 8:** The meat quality of the broilers fed with different levels of SCCM and slaughtered on the 34<sup>th</sup> day.

Treatment (% corm meal)	Meat Quality Criteria				
	Flavor	Juiciness	Texture	Aroma	Tenderness
T1 (0%)	3.87 <i>Just normal</i>	3.57 <i>Just normal</i>	3.50 <i>Just normal</i>	3.77 <i>Just normal</i>	3.47 <i>Just normal</i>
T2 (5%)	3.37 <i>Just normal</i>	3.83 <i>Just normal</i>	3.70 <i>Just normal</i>	3.30 <i>Just normal</i>	3.53 <i>Just normal</i>
T3 (10%)	3.33 <i>Just normal</i>	3.67 <i>Just normal</i>	3.73 <i>Just normal</i>	3.60 <i>Just normal</i>	2.97 <i>Just normal</i>
T4 (15%)	2.90 <i>Slightly undesirable</i>	3.63 <i>Just normal</i>	3.77 <i>Just normal</i>	3.60 <i>Just normal</i>	3.23 <i>Just normal</i>
Level of Significance	ns	ns	ns	ns	ns
CV%	11.21	11.57	5.21	7.06	13.41



The quality of meat of broiler fed with SCCM at 34 and 42 days are presented in Tables 8 and 9, respectively. These include flavor, juiciness, texture, aroma, and tenderness. The study found that the use of SCCM in the feed ration of broiler chicken did not significantly affect the flavor of the meat both those harvested in 34 and 42 days. This result means that the incorporation of SCCM did not change the flavor of the meat. The study have known that the flavor of the meat is normal to moderately desirable.

**Table 9:** The meat quality of the broilers fed with different levels of SCCM and slaughtered on the 42<sup>nd</sup> day

Treatment (% corm meal)	Meat Quality Criteria				
	Flavor	Juiciness	Texture	Aroma	Tenderness
T1 (0%)	3.93 <i>Just normal</i>	3.90 <i>Just normal</i>	4.10 <i>Moderately desirable</i>	3.90 <i>Just normal</i>	3.56 <i>Just normal</i>
T2 (5%)	3.80 <i>Just normal</i>	3.63 <i>Just normal</i>	4.00 <i>Moderately desirable</i>	3.76 <i>Just normal</i>	3.43 <i>Just normal</i>
T3 (10%)	4.06 <i>Moderately desirable</i>	3.93 <i>Just normal</i>	4.03 <i>Just normal</i>	3.96 <i>Just normal</i>	3.56 <i>Just normal</i>
T4 (15%)	4.00 <i>Moderately desirable</i>	4.00 <i>Moderately desirable</i>	4.06 <i>Moderately desirable</i>	3.90 <i>Just normal</i>	3.63 <i>Just normal</i>
Level of Significance	ns	ns	ns	ns	ns
CV%	11.21	11.57	5.21	7.06	13.41

In terms of juiciness, statistics proved that there is no significant effect of SCCM ingredient to the meat. Although, the meat of chicken at 34 days fed with 5% SCCM had the highest result (3.83), and the lowest mean was obtained in the meat with 0% SCCM (3.57), the numerical difference is not statistically significant. At 45 days, meat fed with 15% SCCM gave the highest rating (4.0) while those fed with 5% SCCM came out lowest with a rating of 3.63. Based on the results, SCCM in the feed ration did not lower the quality of broiler juiciness which adds its potential as a feed ingredient.

The study revealed that, at day 34, the texture of the meat of the birds fed with 15% SCCM got the highest rating of 3.77. However, the result could not prove that the quality of meat of the four treatments varies implying that the texture of the meat was not affected by the incorporation of SCCM in the diet of broilers. At 45 days, the meat of broiler fed with 15% SCCM got the highest average of 4.06, while the lowest rating was those fed with 5% SCCM with a rating of 4.00. Results showed that the texture of the meat in all treatments was comparable.

In terms of aroma, the results showed comparable ratings in birds fed with and without SCCM both in 34 and 42 days. At 34 days, those meat produced without SCCM got the highest rating of 3.77; while those with 5%

SCCM had the lowest rating of 3.30. At 42 days, the meat of chicken fed with 10% SCCM marked the highest rating of 3.96; while those with 5% SCCM received the lowest of 3.76. The statistical result showed that the incorporation of SCCM in the feed ration did not affect the aroma of the meat implying the viability of SCCM as a good feed ingredient in broiler production.

Tenderness quality test showed no significant difference in the meat of all the treatments in both 34 and 42 days chicken. These results mean that the addition of SCCM did not affect the tenderness of the chicken meat. The tenderness of the meat was found all normal. It implies that SCCM incorporation in the ration had not affected the tenderness of the broiler meat under study.

#### **4. Conclusions and recommendation**

The study on incorporating different levels of sundried *Xanthosoma sagittifolium* corm meal in feed ration of broiler chicken was conducted to determine if there is an effect on meat yield and quality. The broilers were feed with sundried cocoyam corm meals (SCCM) and slaughtered at 34 and 42 days. The hedonic scale was used in testing meat quality. Carcass yield, dressing percentage, choice cuts weights were determined. The result of the study showed that the incorporation of SCCM in the feed ration of broiler chicken up to 15% did not significantly affect the meat quality in terms of flavor, juiciness, texture, aroma and tenderness. The weight of the choice meat cuts; i.e. thigh, wing, drumstick, breast and back; of those chicken fed with SCCM is generally equal to those chicken fed with commercial feed. Raw meat quality like meat color, water holding capacity, and acceptability did not differ between those fed with SCCM up to 15% and those fed with commercial feeds. The study demonstrated that the cocoyam (*Xanthosoma sagittifolium*) corm meal can be a good feed ingredient in broiler chicken production up to 15% level, with huge implication in the animal production and food security.

It is highly recommended to do further study to investigate if the *Xanthosoma sagittifolium* corm meal contains undesirable components like tannins, hydrocyanic acids, oxalates, antitrypsin inhibitors, phylate, and hydrocyanide.

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