



Volume 6(1), pages 14-19, February 2020 Article Number: 89791CEE3

ISSN: 2536-7099

https://doi.org/10.31248/JASVM2020.196 https://integrityresjournals.org/journal/JASVM

Full Length Research

# Fish entrails meal as feed for broilers (Gallus gallus domesticus): Its potential as dietary supplements on the carcass quality and meat organoleptic evaluation

Janine I. Berdos<sup>1\*</sup>, Angel Ann A. Aquino<sup>2</sup>, Lloyd B. Garcia<sup>1</sup> and Allan Rey S. Angeles<sup>1</sup>

<sup>1</sup>Department of Animal Science, Tarlac Agricultural University, Camiling, Tarlac 2306, Philippines. <sup>2</sup>New Hope Liuhe, Gerona, Tarlac, Philippines.

\*Corresponding author. Email: janine.berdos@yahoo.com; Tel: +639462284305.

Copyright © 2020 Berdos et al. This article remains permanently open access under the terms of the <u>Creative Commons Attribution License 4.0</u>, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received 17th March, 2020; Accepted 14th April, 2020

ABSTRACT: The main objectives of the study were to examine the nutritional value, carcass quality and meat organoleptic evaluation of broilers supplemented with fish entrails meal. Proximate analysis of fish entrails meal was analysed. Its effects on carcass weight, dressed weight and cuts-up weight were evaluated when used as supplement in the ration of broilers. For the organoleptic evaluation, hedonic scale scorecard was used. A total of 60 respondents evaluated the poultry meat fed with fish entrails meal and each sample were randomly assigned in Completely Randomized Design (CRD) following the four treatments. The treatments were: without fish entrails meal, with 3, 5 and 7% fish entrails meal. Fish entrails meal contained 33.0±0.9% crude protein and 38.4±0.9% crude fat. Carcass quality evaluation revealed that supplementing fish entrails meal significantly influenced the dressed yield (p<0.05), carcass yield (p=0.01), leg weight (p<0.01), and breast weight (p<0.05). Furthermore, hedonic scale scorecard revealed that the colour of carcass were paled but statistically (p<0.05), 7% inclusion rate of fish entrails meal influenced the carcass colour. In terms of economics, broilers fed with 5% fish entrails meal had the highest income over feed cost (43.36 PhP) since it attained highest marketable weight (1,511.11 g/bird). Generally, fish entrails meal contained high crude protein, high crude fat and organoleptic quality of cobb broilers. Moreover, feeding fish entrails meal up to 5% increased income over feed cost.

**Keywords:** Fish entrails meal, meat organoleptic.

# INTRODUCTION

Poultry industry has been noted by the Philippine Statistics Authority as a growing venture in the country especially today wherein many Filipino farmers switched from pork to chicken production due to African Swine Fever (ASF) disease outbreak (Galang, 2019) which has been a significant contributor to the country's agriculture sector. As of 2018, a broiler population in first quarter of the year was estimated about 184.34 million wherein Central Luzon had the highest broiler inventory with a total share of 79.89% in the country's total broiler production, followed by Calabarzon and Northern Mindanao. The top three (3) chicken producers in the country accounted for 63.70% of the total chicken production (PSA, 2018).

As the broiler production is growing, the needs in terms of vitamins and minerals for optimum growth of broiler are also considered. However, the cost of synthetic vitamins and minerals which are being used is also increasing. With this, the use of an alternative readily sources such as fish entrails could substitute the vitamins (A, D and B complex) and minerals source as well as boost production (Batal and Dale, 2011 and Fanimo et al., 1996).

Fish entrails through the help of the aquaculture industry could be availed anytime since it is a major source of animal protein and income for smallholders in the Philippines. In 2012, the Philippines ranked among the major fish producing countries in the world with a total

production of 3.1 million tonnes of fish, crustaceans, mollusks and other aquatic animals (FAO, 2020). Meanwhile, in the first quarter of 2019, it posted an increase of 0.9% from its previous year's level of 1.00 million metric tons (PSA, 2019). The utilization of fish wastes in the country is known for processing of fish sauce, human consumption, production of commercial fish meal and direct feed to aquaculture species (Cruz, 2014) but not common for the production of locally fish entrails meal for small hold poultry raisers. Hence, to lessen the expenses and to minimize the use of synthetic sources in poultry feeds, this study was conducted to evaluate the proximate values of fish entrails meal as dietary supplement for broilers and to determine the carcass quality of broilers as influenced by fish entrails meal.

## **MATERIALS AND METHODS**

## **Animals and treatments**

A total of 120 fourteen-day-old Cobb broiler chickens with an average weight of 261.13 g were used as part of feeding trial. The Cobb broiler chickens were randomly distributed to four experimental treatments following Completely Randomized Design (CRD). Each treatment had three replicates with 10 mixed-sex chickens for each replicate. The experimental treatments were: (1) Commercial Ration (CR) only, (2) CR+ 3% fish entrails meal, (3) CR + 5% fish entrails meal, and (4) CR + 7% fish entrails meal.

Fresh mixed-fish entrails from *Chanos chanos*, *Oreochromis niloticus*, *Decapterus macarellus* were purchased in the public market, boiled at 100°C, and it was heated, roasted and well-cooked in a pan. The dried fish entrails were manually ground using mortar and pestle until homogenous texture was obtained. The fish entrails meals were weighed using a digital weighing scale and mixed with the commercial ration (Table 1) based on the inclusion rate needed.

## **Data collection**

A 200 g sample of dried fish entrails were placed in separate zip lock plastic bags marked and sealed and personally sent to the Department of Agriculture, Regional Field Office III (DA-RFO III)-Regional Feed Chemical Analysis Laboratory, City of San Fernando, Pampanga, Philippines for proximate analysis.

To evaluate the carcass and cut yields, Cobb broiler chickens were weighed individually at day 36 (end of the experiment) following the Animal Welfare Act in the Philippines (Republic Act No. 8485, Section 6, No.6). Three (3) chicken per replication were fasted for six (6) hours and they are only allowed to drink water *ad libitum* prior to slaughtering. Chicken were also weighed before subjected to slaughter (stunning, bleeding, plucking,

chilling, and dripping) following the slaughtering procedures implemented by Department of Agriculture (DA)-Administrative Order No.18, Series of 2008. The carcass and cut-ups yields were recorded.

To evaluate organoleptic quality of chicken meat, meat samples with an equal average weight was randomly selected from the cut-ups yield. The raw meat samples were steamed at 80°C for 15 to 30 minutes until desired texture were obtained and additional of any spices, seasonings or condiments were not necessary. The meat samples were cut to approximately 2.5 inches cubes and were served once from each experimental-group, and the serving order was randomized according to sample, replicate and assessor. Intensities of tenderness, juiciness, flavour, aroma and desirability were evaluated with the use of hedonic scale scorecard. The hedonic scale scorecard (Table 5) used for evaluation of sensory attributes ranging from the lowest intensity of each attributes (score 1) to the highest intensity (score 5). Water were served for cleansing the palate between samples. Sixty panelists composed of 20 faculty members, 20 nonfaculty members, 10 male students and 10 female students participated in the organoleptic evaluation which is within the required range.

# Statistical analysis

The five-point hedonic scale scorecard were used to determine the organoleptic quality of poultry meat fed with fish entrails meal and data were analyzed using ANOVA of STAR (Statistical Tool for Agricultural Research). For carcass quality, data were analyzed using ANOVA of STAR (Statistical Tool for Agricultural Research). The least-significant differences (LSD) test was used to determine significant differences between treatment means at p=0.05.

# **RESULTS AND DISCUSSION**

## **Nutritional value**

The proximate analysis generally typified the chemical composition of fish entrails meal (Table 2). Results indicated that the crude protein was the main interest of study where it was expected to influence carcass of broilers.

The amount of crude protein (Table 2) was high and consistent to study conducted by Gibson and Hotz (2001) in which fish entrails was an excellent source of animal protein and minerals for poultry. However, crude protein values in recent study was much lower than the chemical composition found by Arvanitoyannis and Kassaveti (2008) due to differences of fish species and processing techniques adapted. This was also supported by Rosenfeld et al. (1997) where they observed that the

Phosphorus (%NLT)

Bassimata analysis	Feed Type				
Proximate analysis	Chick booster	<b>Broiler starter</b>	Broiler finisher		
Crude Protein (%NLT)	21.50	19.50	18.00		
Crude Fat (%NLT)	4.00	5.00	6.00		
Crude Fiber (%NMT)	3.50	4.50	5.50		
Moisture (%NMT)	12.00	12.00	12.00		
Calcium (%)	0.85-1.15	0.80-1.10	0.80-1.10		

0.70

0.70

**Table 1.** Nutrient Standards for poultry feeds as basis of commercial producers.

Source: PhilSAN (Philippine Society of Animal Nutritionists), 2010.

**Table 2.** Proximate composition (%) of FEM.

0.70

Parameter	Results		
Dry matter	95.2		
Crude protein	$33.0 \pm 0.9$		
Ash content	$19.0 \pm 0.5$		
Crude fat	$38.4 \pm 0.9$		
Crude fiber	$1.5 \pm 0.5$		
Nitrogen-free extract	8.1		

**Table 3.** Carcass quality of broiler in terms of slaughter weight (g), dressed and carcass yields (%) as influenced by FEM on their rations.

Treatment	Slaughter weight (g)	Dressed yield (%)	Carcass yield (%)
T1 – Commercial Ration (CR)	1,288.88	89.05 <sup>b</sup>	63.97 <sup>c</sup>
T2- 3% FEM + CR	1,388.88	89.60 <sup>ab</sup>	64.32 <sup>bc</sup>
T3 - 5% FEM+ CR	1,511.11	91.54 <sup>a</sup>	68.60 <sup>ab</sup>
T4 - 7% FEM + CR	1,432.22	96.99 <sup>a</sup>	74.63 <sup>a</sup>
p-value	0.5122	0.0389	0.0136

In each column, means followed by different superscript letters are significantly different (p<0.05).

processing method used can directly affect the nutritional value of the meal and proved that in general, amino acid content and protein quality of animal protein sources tend to be superior than those of vegetable sources.

# **Carcass quality**

The carcass quality in terms of slaughter weight was not affected (p>0.05) by the inclusion of fish entrails meal (FEM) (Table 3). However, statistics revealed significant effect on supplementing 7% FEM in their ration as compared to non-FEM ration. Thus, numerically, broilers given 7% FEM in the ration were the highest among its counterparts with 96.99% dressed yield (p<0.05) and 74.63% carcass yield (p=0.01).

The weights of leg and breast in terms of percent yield were affected when FEM was included in their diet (Table 4). The highest percentage (p<0.01) of leg yield (37.19%)

was seen in broilers supplemented with 5% FEM in their ration while breast yield (33.05%) was consistently observed (p<0.05) in broilers supplemented with 7% FEM in their ration.

FEM significantly increased in dressed and carcass yields was associated with the study conducted by Ponce and Gernat (2002) where tilapia by-products could partially replace the use of soybean meal in broiler diets without negatively affecting performance or carcass quality. On the other hand, Salih (2009) claimed that broilers fed fish meal at levels 0, 1.5, 3.5 and 5% improved carcass meat quality. This finding indicated that 7% FEM in the ration of poultry is regarded as satisfactory.

# Organoleptic quality

The results of organoleptic quality through sensory evaluation (colour, odor, texture, taste, general acceptability)

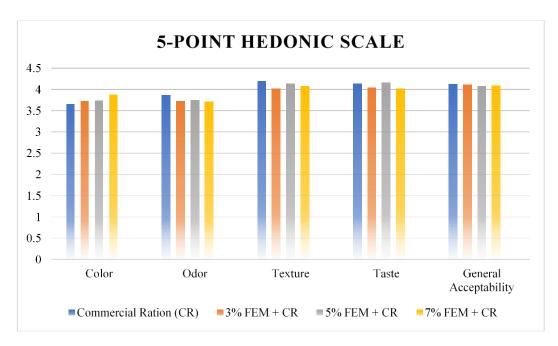
**Table 4.** Cut-ups yield (%) as influenced by FEM on their rations.

Treatments	Leg yield (%)	Breast yield (%)
T1 – Commercial Ration (CR)	34.50 <sup>b</sup>	31.54°
T2- 3% FEM + CR	30.97 <sup>b</sup>	32.34 <sup>bc</sup>
T3 - 5% FEM+ CR	37.19 <sup>a</sup>	32.05 <sup>ab</sup>
T4 - 7% FEM + CR	30.35 <sup>b</sup>	33.58a
p-value	0.0030	0.0165

In each column, means followed by different superscript letters are significantly different (p<0.05).

**Table 5.** Five-point hedonic scale of sensory evaluation.

Score	Organoleptic quality				
	Color	Odor	Texture	Taste	General acceptability
1	Dark	Dislike	Very poor	Very poor	Dislike
2	Slightly dark	Neither like	Poor	Poor	Neither like
3	Moderate	Like slightly	Fair	Fair	Like slightly
4	Pale	Like moderately	Good	Good	Like moderately
5	Very pale	Like very much	Very good	Very good	Like very much



**Figure 1.** Organoleptic evaluation result of poultry meat as influenced with FEM by their ration based on 5-point scale score card.

was obtained from steamed poultry meat supplemented with (FEM) in their ration. Figure 1 shows the average values obtained based on hedonic scales by respondents (tasters). Although inclusion of FEM in their ration had no significant effect with the colour of steamed meat, which remarked pale, statistically, 7% FEM in their ration has little influenced (p>0.05) on its meat colour. Furthermore, taste and texture of the meat were not influenced as panelists

classified it as good. Likewise, odor and general acceptability of meat were described as like moderately by panelists (Table 5).

The process of cooking meat is an utmost considered factor in changes of colour that affects the concentration and chemical form of myoglobin, morphology of muscle structure and the ability of the muscle to absorb or scatter incident light which might resulted to pale or dark colour of

Table 6. Income over feed cost of broilers supplemented with and without FEM in their rations.

Item	Commercial ration	3% FEM+CR	5% FEM+CR	7% FEM+CR
Fish entrails <sup>1</sup> , Php	-	3.68	6.35	9.27
Marketable weight <sup>2</sup> , g	1,288.88	1, 388.88	1,511.11	1,432.22
Income over feed cost <sup>3</sup> , PhP	6.63	22.75	43.36	40.00

<sup>&</sup>lt;sup>1</sup>Price of fish entrails is Php 5.00/kg but may vary depending on place. 2Average marketable weight per broiler for 5 weeks.3Income over feed cost per broiler.

the meat (Walters, 1975 as cited in Seideman et al., 1984). In contrary, Al-Marzooqi et al. (2010) considered the type of a housing as a factor for having yellowish colour of meat for birds raised in open-sided house compared from birds raised in close house while diet can affect its juiciness and flavour. The present study was not influenced by odor, however, 75% inclusion rate of local fish meal in their ration would result to fishy flavour and odor in carcasses (Jassim, 2010). Likewise, birds fed diet of 30% fish silage would give an off-flavour or fishy odor to meat. The present data indicate that 3 to 7% FEM inclusion in their ration does not deteriorate the quality of meat.

#### Income over feed cost

Overall, the highest income over feed cost (PhP) was obtained in broilers supplemented with 5% FEM in their ration with a value of PhP 43.36/bird and a marketable weight of 1,511.11 g/bird compared with other treatments (Table 6).

The broiler supplemented with and without FEM differed in marketable weight produced. In line with this, supplementation of 3 to 7% FEM is acceptable in terms of their marketable weight and economics of production (Okah and Onwujiariri, 2012; Awoniyi et al., 2003). Aside from that, replacement of costly fish meal with conventional dietary fish meal would increase profitability and meat yield (Hossain et al., 2003). Therefore, inclusion of FEM in their ration is tolerable due to certain areas or countries where large amounts of fish meal are produced that may be economically feasible to use fish meal as the major protein supplement in the diet of broiler chicks (Ponce and Gernat, 2002).

# Conclusion

In conclusion, fish entrails meal contained high crude protein, high crude fat and moderately low in crude fiber. Fish entrails meal as part of the ration supported satisfactorily the carcass quality and organoleptic quality of cobb broilers. Moreover, feeding fish entrails meal increased income over feed cost.

# **CONFLICT OF INTEREST**

The authors declare that they have no conflict of interest.

## **ACKNOWLEDGEMENT**

We acknowledge the College of Agriculture and Forestry of Tarlac Agricultural University for partly supporting the work in terms of Animal Processing Laboratory.

#### REFERENCES

Al-Marzooqi, W., Al-Farsi, M. A., Kadim, I. T., Mahgoub, O., & Goddard, J. S. (2010). The effect of feeding different levels of sardine fish silage on broiler performance, meat quality and sensory characteristics under closed and open-sided housing systems. *Asian-Australasian Journal of Animal Sciences*, 23(12), 1614-1625.

Arvanitoyannis, I. S., & Kassaveti, A. (2008). Fish industry waste: treatments, environmental impacts, current and potential uses. *International Journal of Food Science and Technology*, *43*(4), 726-745.

Awoniyi, T. A. M., Aletor, V. A., & Aina, J. M. (2003). Performance of broiler-chickens fed on maggot meal in place of fishmeal. *International Journal of Poultry Science*, 2(4), 271-274.

Batal, A., & Dale, N. (2011). Feedstuffs ingredient analysis table (2011 Edition). University of Georgia, United States. Pp.16-19.

Cruz, W., Villanueva, J., & Janeo, E. (2015). Status development and use of alternative dietary ingredients in aquaculture feed formulation in the Philippines. In: Catacutan, M. R., Coloso, R. M., & Acosta, B. O. (eds.). Development and use of alternative dietary ingredients or fish meal substitutes in aquaculture feed formulation: Proceedings of the ASEAN regional technical consultation on development and use of alternative dietary ingredients or fish meal substitutes in aquaculture feed formulation, 9-11 December 2014, Nay Pyi Taw, Myanmar (pp. 23-29). Tigbauan, Iloilo, Philippines: Aquaculture Department, Southeast Asian Fisheries Development Center.

Department of Agriculture (DA)-Administrative Order No.18 (2008). Rules and regulations on humane handling in the slaughter of animals for food. Republic of the Philippines, Department of Agriculture Administrative Order No. 18, Series of 2008.

Fanimo, A. O., Mudama, E., Umukoro, T. O., & Oduguwa, O. O. (1996). Substitution of shrimp waste meal for fish meal in broiler chicken rations. *Tropical Agriculture*, 73(3), 201-205.

FAO (2020). Food and agriculture organization, fisheries and aquaculture department, fishery and aquaculture country profiles, the republic of the Philippines. Available: Retrieved 31th March 2020 from http://www.fao.org/fishery/facp/PHL/en.

Galang, V. (2019). Business world. Retrieved 2nd April 2020 from https://www.bworldonline.com/poultry-industry-maintains-2019-growth-target/.

Gibson, R. S., & Hotz, C. (2001). Dietary diversification/modifica-

- tion strategies to enhance micronutrient content and bioavailability of diets in developing countries. *British Journal of Nutrition*, 85(S2), S159-S166.
- Hossain, M. H., Ahammad, M. U., & Howlider, M. A. R. (2003). Replacement of fish meal by broiler offal in broiler diet. *International Journal of Poultry Science*, 2(2), 159-163.
- Jassim, J. M. (2010). Effect of using local fish meal (Liza abu) as protein concentration in broiler diets. *International Journal of Poultry Science*, 9(12), 1097-1099.
- Okah, U., & Onwujiariri, E. B. (2012). Performance of finisher broiler chickens fed maggot meal as a replacement for fish meal. *Journal of Agricultural Technology*, 8(2), 471-477.
- PhilSAn (2010). Feed Reference Standards (4th edition). Philippine Society of Animal Nutritionists, Philippines. p.271.
- Ponce, L. E., & Gernat, A. G. (2002). The effect of using different levels of tilapia by-product meal in broiler diets. *Poultry Science*, 81(7), 1045-1049.
- PSA (2018). Philippine statistics authority, chicken situation report: January to March 2018. Retrieved 18th May, 2019 from https://psa.gov.ph/content/chicken-situation-report-january-march-2018.

- PSA (2019). Philippine statistics authority, fish situation report: January to March 2019. Retrieved 18th March, 2019. https://psa.gov.ph/content/fisheries-situation-report-january-march-2019.
- Republic Act 8485 (1998). An act to promote animal welfare in the Philippines, otherwise known as "The Animal Welfare Act of 1998". Republic Act No. 8485, February 11, 1998.
- Salih, G. E. (2009). Effects of inclusion of local disposed roasted fish meal on the performance and carcass characteristics of broilers. *Egyptian Poultry Science Journal*, 29(3), 735-745.
- Seideman, S. C., Cross, H. R., Smith, G. C., & Durland, P. R. (1984). Factors associated with fresh meat color: a review. *Journal of Food Quality*, 6(3), 211-237.