*Available online www.jocpr.com*

**Journal of Chemical and Pharmaceutical Research, 2014, 6(1):669-673**

**Research Article**

**ISSN : 0975-7384**
**CODEN(USA) : JCPRC5**

# Proximate, physical and mineral compositions of pigeon meal used as fish bait

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**ABSTRACT**

*Analytical weight, proximate composition and selected mineral contents were determined in male and female pigeons (Columbia livia) found in Tirunelveli, using biochemical methods. It contains high protein (31.23±0.02), lower in ash (8.1±0.02), fat (9.12±0.01) and lowest in fibre (2.34±0.01). The Moisture content is also less. The minor elements were Sodium, Potassium, Calcium, Magnesium and others. The main study of this paper was to investigate the proximate composition of the pigeon meal and to find the nutrients value of them and found that the nutrient value of pigeon is equal or slightly high than fish meal so that the fish meal can be partially substitute with pigeon meal since pigeon meal provides good dietary proteins and dietary minerals.*

**Keywords**: *Columba livia*, Proximate composition, dietary proteins, dietary mineral, pigeon meal

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## INTRODUCTION

Pigeons are selected for the study belongs to phylum: Chordata, class: Aves, super order Neognathae and order Columbiformes. These birds occupy all parts of India. They are fast and powerful in flight. Mostly they feed on paddy, corn, millet, groundnut, fruits and seed and their availability for study is more and hence the pigeon meat is selected as a nutritive food for ornamental fish.

The objective of the study is to select the nutritive food for the fish. In most of the other birds such as Turkey, chicken and in other animals such as poultry, beef and goat so many works have been carried out and the research work on Pigeon meal is meagre. Since the availability and reproducibility of the Pigeon is easy and it's a cheaper source as well as it is having a nutritive value so the meat of the pigeon has been selected as a source meal. The feed of fish and their nutritive value is one of the most important factors depends on production cost and health of fish. In case of ornamental fish, correct formulations of the diet improve the nutrient digestibility, supply the metabolic needs and reduce the maintenance cost and also the water pollution (Yohanna, 2011). The addition of mineral supplements to these diets improved growth and survival (Halver, 2002). Ornamental fish can absorb some water soluble minerals from water (Shim and Ho., 1989) of all the minerals required by fish. Phosphorous is one of the most important for growth and bone mineralisation. Also their contributions towards meat consumption of fish related to its nutritive values were evaluated.

## EXPERIMENTAL SECTION

The proximate composition of pigeon meal was determined according to the AOAC method (1990). The crude protein content was determined by the Kjeldhal method and the crude lipid content was determined by using separating funnel. The ash content was determined by ashing the sample overnight at 550˚C. Moisture content was determined by drying samples overnight at 105˚C. Carbohydrate content was calculated by difference (total mass of moisture, total fat, ash and crude protein substracted from the mass of the food).

Five pigeons were bought from the local market where they rear different kinds of pigeon. The native pigeon (*Columba livia)* was purchased at a cheap rate. The live weight was noted down with the help of a computerised balance. It was then sacrificed, defeathered and eviscerated. The whole weight of the pigeon before and after the sacrifice was observed. And for physical data analysis, each part was removed and weighed. The pigeon meat was separated from their bones. Then the meat was dried in microwave oven at medium heat for 6 minutes and powdered in a mixie. The dry powder was sieved and stored in containers. Pigeon meal was formulated along with fish meal in different concentration such as (PM1 10%, PM2 25%, PM3 50%, PM4 75%, PM5 100%). The control feed was without pigeon meal.

## RESULTS AND DISCUSSION

**Table 1 Physical composition of Pigeon (gm)**

| Sl.No | Parameter | Male | Female |
|---|---|---|---|
| 1 | Live weight | 272.02±13.1 | 246.64±10.09 |
| 2 | Weight after evisceration | 120.07±5.02 | 98.07±4.69 |
| 3 | Bone | 55.81±1.78 | 42.69±1.62 |
| 4 | Flesh | 44.43±0.07 | 40.97±0.05 |
| 5 | Head with blood | 14.87±0.02 | 10.98±0.02 |
| 6 | Liver | 7.95±0.01 | 7.91±0.03 |
| 7 | Heart | 3.01±0.00 | 2.21±0.00 |
| 8 | Kidney | 9.02±0.01 | 7.33±0.02 |
| 9 | Gizzard | 10.04±0.02 | 9.90±0.01 |
| 10 | Pancreas | 0.5±0.01 | 0.1±0.01 |
| 11 | Crop contents | 25.06±2.00 | 23.04±2.30 |

Table 1 summarizes the anatomical weight compositions of a male and a female pigeon birds (wet wt. in gm). The live weight in male (272.02±13.1) and in female was (246.64±0.09). The heart of the former (3.01±0.00) and that of the latter was (2.21±0.00). The bone weight in male (55.81±1.78) was slightly higher than in female (42.69±1.62). Similarly the weights of liver, kidney and pancreas showed variation in weights (liver in male - 7.95±0.01) and in female (7.91±0.03), kidney in male was (9.02±0.01) and in female it was (7.33±0.02), weights of pancreas in male was (0.5±0.01) and in female bird (0.1±0.01). The gizzard was heavier in male (10.04±0.02) than in female. The head along with blood was weighed separately. Similar weight differences were noticed in male (14.87±0.02), female (10.98±0.02). Weight of the body after evisceration in male was noticed to be (120.07±5.02) and in female was (98.07±4.69) on the whole, but the weight of the flesh alone was much less, in male (44.43±0.07) and in female (40.97±0.05)

**Table 2 List of food items including crop contents in pigeons**

| |
|---|
| Cereals - Paddy |
| Kitchen wastes - Vegetable trimmings, cooked rice |
| Forages - Plant materials |
| Others - Sand, Stone and unidentified ingredients |

The crop content of male pigeon (25.06±2.00) and in female (23.04±2.30).

The AOAC method (1990) of Moisture, Protein, Fat, Ash and Fibre was analysed for the pigeon meat.

**Table 3 Proximate composition of male and female pigeons**

| Parameters (%) | Male | Female |
|---|---|---|
| Fat | 10.07±1.05 | 9.12±0.01 |
| Fibre | 2.34±0.02 | 2.00±0.01 |
| Protein | 34.17±0.02 | 31.23±1.01 |
| Moisture | 7.05±0.07 | 6.46±0.03 |
| Ash | 12.34±0.05 | 8.1±0.2 |

Table 3 summarizes the proximate composition of the samples investigated sexwise. Variations were observed sexwise. The relative fat content varied in both sex; values being in male (10.07±1.05) and fat content in (9.12±0.01). It can be deduced the pigeons belong to medium fat meat category. Moisture content ranges between (7.05±0.07 - 6.16±0.03). Protein content of male (34.17±0.02) and female (31.23±0.01) was also similar in composition with those reported for fishes and crabs (Ekler, 1987) and crabs (Adeyye, 2002). The parameters of fibre (2.34±0.02 - 2.00±0.01) and ash (12.34±0.05 - 8.1±0.02) also showed similar variations. It must be remembered that the proximate compositon of the samples given according to the size and sex of birds. From the analytical results it can be deduced that the spongy mass of the fibre would help to satisfy the apetite of the fish and

also assist in moving the food through the alimentary canal by the muscular action of the intestine thus preventing constipation. The low fat content may not contribute significantly as a source of visible oil in the fish feed. Therefore it is evident that the samples would satisfy nutritional requirements of fish.

**Table 4 Proximate composition of the feed ingredients (%) of fish feed**

| Parameter | Moisture | Protein | Fat | Ash | Fibre |
|---|---|---|---|---|---|
| Control | 8.45±0.17 | 33.81±1.11 | 13.79±1.15 | 6.15±0.03 | 7.14±0.02 |
| Pigeon meal | 6.46±0.01 | 40.08±0.02 | 9.12±0.01 | 8.1±0.02 | 2.34±0.01 |
| Fish meal | 10.02±0 | 55.5±0 | 10.45±0 | 14.56±0 | 5±0 |
| Prawn meal | 9.26±0 | 35.17±0.85 | 0.4±0 | 7.71±0.21 | 5±0 |
| Groundnut Oil Cake | 6.6±0 | 30.77±0.28 | 4.4±0.4 | 7.75±0.10 | 5±0 |
| Rice bran | 8.87±0.14 | 10.38±0.40 | 2.53±0.23 | 20.37±0.05 | 25±0 |
| Tapioca | 10.47±0 | 1.28±0.20 | 0.6±0.28 | 1.60±0.26 | 10±0 |

The rest of the 100% is organic matter and Nitrogen Free Extract

The proximate composition of the feed ingredients (%) are tabulated in Table 4. The range of the moisture content of the control feed varies from 6.46±0.01 in pigeon meat to 10.47±0 in Tapioca hence the highest value in Tapioca was followed by fish meal (10.02±0), prawn meal 9.26±0, rice bran 8.87±0.14, Groundnut oil cake 6.6±0 and pigeon meal 6.46±0.01.

The protein content was the highest in fish meal (55.5±0) followed by pigeon meal (40.08±0.02) and in control feed (33.81±1.11), prawn meal (35.17±0.85), Groundnut oil cake (30.77±0.28), rice bran (10.38±0.40) and in tapioca (1.28±0.20) respectively.

The maximum amount of fat content was observed to be (13.79±1.15) in control feed which was followed by fish meal (10.45±0), pigeon meal (9.12±0.01), Groundnut oil cake (4.4±0.4), rice bran (2.53±0.23), Tapioca (0.6±0.28) and prawn meal (0.4±0).

The proximate composition of ash value was the highest as per the record in rice bran (20.37±0.05) followed by (14.56±0), pigeon meal (8.1±0.02), Groundnut oil cake (7.75±0), prawn meal (7.71±0.21), control feed (6.15±0.03) and tapioca (1.60±0.26) respectively.

The estimation of fibre content indicated that the rice bran (25±0) held the highest value followed by tapioca (10±0) and in control feed (7.14±0.02), prawn meal and groundnut oil cake showing the same amount of value (5±0), whereas pigeon meal (2.34±0.01).

**Table 5 Proximate composition of the six types of feed using different concentration of Pigeon meal incorporated along with other feed ingredients**

| Sl.No | Moisture | Protein | Fat | Ash | Fibre |
|---|---|---|---|---|---|
| Control feed | 9.03±0.03 | 41.56±0.26 | 11.27±1.69 | 8.53±1.30 | 7.5±0.10 |
| PM 1 | 6.8±1.53 | 50.91±0.76 | 9.33±0.05 | 8.11±0.23 | 2.31±0.02 |
| PM 2 | 6.53±0.74 | 53.44±0.90 | 9.35±0.11 | 8.24±0.12 | 2.44±0.11 |
| PM 3 | 6.77±0.62 | 55.14±1.10 | 9.41±1.09 | 8.32±0.20 | 2.52±0.21 |
| PM 4 | 6.85±0.8 | 57.0±0.11 | 9.44±0.12 | 8.45±0.23 | 2.01±0.32 |
| PM 5 | 6.90±0.55 | 58.1±0.14 | 9.45±0.5 | 8.48±0.2 | 2.66±0 |

*PM - Pigeon Meal*

The percentage of moisture, protein, fat, ash and fibre for the five formulated feeds are used for ornamental fish *Etroplus maculatus* reported in Table 5, The maximum moisture content among the five formulated feeds was found to be in control feeds (9.03±0.03) and the maximum protein content among the five formulated feeds was observed in P5 (58.1±0.14). The proximate composition of fat was observed to be higher in control feed (11.27±1.69) and the ash content was more in the control feed which contain (8.53±1.30) and the fibre was more in control feed (7.5±0.5) respectively.

Fish feeds were catagorized into 5 types of feed minimizing or maximizing the proportion of the pigeon meal as 10% for the first feed, 25% of pigeon meal for the second feed, 50% of it for the third feed, 75% of it for the fourth feed and 100% of fish meal for the last feed. The remaining percentage of the feed was that of fish meal, excluding the other feed ingredients - prawn meal, groundnut oil cake, rice bran, tapioca, oil, vitamin and mineral mix, colour and binder.

**Table 6 Mineral content in the Pigeon meal (%)**

| Sl.No | Minerals | Pigeon meal |
|---|---|---|
| 1 | Calcium | 56.38 |
| 2 | Magnesium | 22.47 |
| 3 | Zinc | 4.85 |
| 4 | Iron | 23.6 |
| 5 | Copper | 0.544 |
| 6 | Sodium | 190.8 |
| 7 | Potassium | 243.3 |

The micro element contents of the flesh of the pigeon are listed in Table 6. Ca, Mg, Zn, Fe, Cu, Na, K were determined by atomic absorption spectrophotometer in the tissues of fish. The Fe levels are 23.6%. Na and K level were at their peak levels - 190.8% and 243.3% respectively. The rest of the microelements Ca, Mg, Zn and Cu were 56.38%, 22.47%, 4.85% present below toxic levels (WHO, 1992). Thus it can be deduced that the micro mineral elements present in the meat, prove beyond doubt that the meat of pigeons are good sources of sodium, potassium, calcium, magnesium, zinc and iron that are easily palatable to and ingested by fishes as studied and reported by (Adeyeye, 1996), Abulude, (2004b) and Abulude (2004C). Calcium, playing a vital role in blood clotting, muscle contractions and metabolic processes in certain enzymes, when in conjunction with magnesium, Vitamins A, C and D and protein, helps in bone formation.

The food items including crop contents in pigeon varies depending on the dwelling of the pigeon. Protein content is more in pigeon meat 34.17±0.02 in male and 31.23±1.01 in female pigeon and this result is contradictory to the result of Young quail meat has protein content 20.13±0.15 (*Boni Ikhlas et al*., 2010) comparing this quail meat with that of *Columbia guinea G* the protein content is high in male 60.63% and in female 66.92% (*Olawale Abulude et al*., 2006). In case of pigeon meat the ash content was 12.34±0.05 in male and 8.1±0.2 in female pigeon whereas the ash content of the turkey liver was found to be 1.5% and the percentage of ash content in quail meat indicate that it is in meagre quantity 1.35±0.11. In male pigeon meat moisture content 7.05±0.07 in male and 6.46±0.03 in female pigeon meat and the moisture content varies in *Columbia guinea G* indicating (4.65 - 7.05%).

The proximate composition varied based on location of catch, size and sex. The pigeon meat fat were found to be 10.07±1.05 in male and 9.12±0.01 in female pigeon whereas the Turkey meat has low fat content (1.3 - 2.9%) (*Favier et al*., 1995), In buffalo liver the fat is (5.6±0.3%) as found by the scientist *Devatkal et al*., 2004 which is also less compared to pigeon meat fat.

The pigeon meat becomes darker and redder with increasing age, which is mainly due to increasing in concentration of myoglobin pigment 1 and 2. The fiber content of the pigeon meat was 2.34±0.02 in male and 2.00±0.01 in female. The spongy mass of the crude fibre would help to satisfy the appetite and it assists in moving food through the alimentary canal by aiding the muscular action of the intestine thus preventing constipation.

Moisture content ranges from 6.53±0.74 - 9.03±0.03% in control feed in Pigeon meal whereas the moisture content in feather meal (B grade) is comparatively less 10% (*Saima et al*., 2008), the protein content ranges from (41.56±0.26 in control feed - 58.1±0.14% in PM5 feed) and the protein content of the blood meal (A grade) which has contradictory result and estimated as 82.03%, the crude lipid content ranges from (9.33±0.05 in PM 1 - 11.27±1.69% in control feed) when compared to poultry by-product meal which is slightly high i.e 18.99% (*Yang et al*., 2004), the ash content ranges from (8.11±0.23 in PM 1 feed - 8.53±1.30 in control feed) when compared with the standard fish meal (A and B grade) is 24.5%. The fibre content is 11.5% in pigeon *Columba guniea G* and in the findings the fibre content ranges from (2.01±0.32 in PM 4 feed - 7.5±0.10 in control feed) respectively.

The amount of calcium in pigeon meat was calculated as 56.38% whereas in case of Turkey liver the calcium level (31.4±0.3%) which is comparatively low as reported by *Nacim Zouari et al*., 2011. Growing animals require liberal amounts of calcium and phosphorous. The amount of magnesium in pigeon meat is 22.47% magnesium (23±0.41) in turkey liver more or less corroborates with pigeon meat. The amount of Zinc present is 4.85% and in case of Turkey liver the Zinc content was high (40±2) respectively. Iron present in pigeon meal was 23.6mg and the iron content in turkey liver Iron (161±5) is comparatively high with that of pigeon meal and high on beef liver (60 – 120mg/kg) (Shelf, 1975, Sales and Hayes, 1996).

In the pigeon meal the amount of copper present was 0.544% when compared to the Copper level in *Columba guinea G* between 2.9mg 100g-1 (male) and 5.67mg 100g-1 found by *Olawale Abulude et al*., 2006. Liver function is adversely affected in copper poisoning. The amount of sodium content in pigeon meat was 190.8% which is high in case of Sodium in *Columba guinea G* (611.3 in male - 628mg 100g-1 in female). Sodium regulates in the absorptive processes of monosaccharides, amino acids and bile salts (Hays and Swerson, 1985). The amount of

potassium content in *Columba livia* was 243.3% and the Potassium level was calculated in *Columba guinea G* as 594.5 in male - 625.4mg 100g-1 in female is extremely high.

## CONCLUSION

Thus it is evident that pigeon meal is the animal protein source and this can be used as a partial substitution for fish meal and can be a good sources of healthy food for the fresh water ornamental fish (*Etroplus maculatus*). This pigeon meal is advantageous over the vegetable protein. The proximate composition such as the fiber content is very less so the fish can easily digest the food and the fat content is meagre and the protein content of the pigeon meal is comparatively high so that it is beneficial than other meal. The mineral composition such as Sodium, Potassium, Calcium and Magnesium level was more in pigeon meal. The current mineral constitution of pigeon meal are much better than the other partial substituted meal. This pigeon meal has fiber - low protein and this work has the practical application for the carnivorous ornamental fish feed over the other protein meal.

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