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RESEARCH TITLE

ESTIMATION OF THE NUTRITIONAL VALUE OF BROILER AND LAYING CHICKEN FEED (STARTER, GROWER AND FINISHER) AT THE UNITED FEED COMPANY LIMITED - YEMEN - ADEN

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Abstract

Approximate analysis was carried out in selected samples of poultry feed used as a starter, sleeper, and broiler finisher, as well as for layer poultry feed as a starter and finisher, which were obtained from the United Feed Company Limited - Yemen - Aden. Nutrient analysis were carried out using a Perten Instrument (Model DA 7250, Perkin-Elmer, Inc., Perten Instruments North America, Springfield, IL, United States).The mean concentration of crude protein, crudefat, crude fiber, ash, moisture and carbohydrates, for broiler feed for sample (A1) was (20.48%), (5.39%), (2.98%), (3.477%), (13.19%), (54.50%) respectively, and for sample (A2) the results were (18.69% crude Protein, 4.81% crude fat, 2.80% crude fiber, 3.237 ash, 14.61% moisture and 58.19%carbohydrates). While the average concentration of the sample (A3) was found (17.86% crude protein, 3.56% crude fat, 2.63% crude fiber, 3.103% ash, 14.60% moisture and 58.89% carbohydrates), it was also found that the average concentration of crude protein, Crude fat, Crude Fiber, Ash, Moisture and Carbohydrates for Layering Poultry Feed Samples (A4 and A) 5) were (26.93% and 25.56%), (2.59% and 2.53%), (2.77% and 2.06%), (7.920% and 7.807%), (16.57% and 15.88%) and (43.22% and 46.16%) , respectively. Statistically significant differences were observed at the confidence level ($P \leq 0.05$) between the average concentrations of crude protein and crude oil for all samples, while in the case of fibers and ash, there were no significant differences between the average concentrations of all samples except only in the case of crude fiber concentration of samples (A4). and A5). There were significant differences at the confidence level ($P \leq 0.05$).

Key Words: nutritional value; protein, fat, Fiber, Ash, Moisture and Carbohydrates; broiler and laying chicken feed.

Introduction

Poultry feeds are known as a complete feed, since it is prepared in such a way to contain all the vitamins, minerals, energy, protein and other nutrients essential for proper health of the birds, egg production and growth **(Bukar and Saeed, 2014).** Feed ingredients and additives in poultry diets contain different sources: Com and soybean meal sources of energy, fish meals and meat meals good sources of protein and amino acids **Bale *et al.* (2015)** reported also that the feed consists of gains such as com, wheat or barley, oil seeds, cake meal (originating mainly from oil producing seeds such as soybeans) sunflower seeds, peanuts, cotton seed and protein products of animal origin such as fish meal, meat and bone meal.

Chicken meat is widely consumed all over the world. Chicken meat and its products are important to the human diet because they provide a significant portion of nutrients, including necessary minerals and trace elements **(Liu *et al.*, 2012).** The production of broiler and laying chickens is considered one of the important pillars for achieving food security, and its price is relatively suitable for members of the community **(Eman *et al.*, 2016).** They are also better than animals in converting food, and poultry is characterized by the abundance of offspring throughout the year and this facilitates selection and mixing, and is also characterized by the rapid turnover of capital **(Salamah, 2019).**

One of the main concerns of livestock owners is to get a good ration of energy, protein, amino acids, minerals and vitamins to ensure a high productivity suitable for their animals **(Abdelnour *et al*., 2018).** Therefore, nutrition is one of the most important factors affecting hatchability. **(Yassin and Abdel Abbas,2010).**The since food costs represent from 70% to 60% of the final product of poultry, whether meat or eggs, it was necessary to pay attention to feeding and adopting modern methods to reduce the cost of feed and setting standards or nutritional needs for each bird without increasing or decreasing production in order to obtain the lowest costs of the highest performance rate Possible food, the nutritionist must create diets that contain all the nutrients that the bird needs, whether to produce meat, table eggs or hatching eggs**(Makky, 2019).**Nutritionists mention that any deficiency in vitamins and mineral salts affects the resulting eggs, the developing fetus, and the rate of hatching before its effects on the mothers herd. to cage system so all the nutrients must be balanced within the feed to fulfill all the requirements of the birds, Feed production ethics and quality control assurance is being implemented strictly in developed countries, there is no defined system of evaluating the quality poultry feeds being sold to poultry farmers by feed manufacturers. Poor quality feeds results in high mortalities, low productivity, and low product quality which lead to losses in poultry industry. so the feed should be selected on the basis of performance **(Singh *et al.*, 2019).**

It is difficult to use a high proportion of good ingredients for the manufacture of animal feed, so the remaining unconventional feed ingredients are used mainly in animal formulations. To compete in the market, most of the feed industries are trying to lower the cost, by using non-traditional feed ingredients and not very specific to the nutrients in the feed which is the reason for the present study. Poultry farmers get less value for their money while buying commercial feed. Most of the poultry farmers in Aden depend on commercial feed. The purpose of this study is evaluating the types of commercial-grade feed (broiler and laying feed) in the United Feed Company Limited - Yemen - Aden.

Materials and Methods

Sampling

Specific samples for the study were taken directly from the study area (National Feed Company - Aden - Yemen) by taking one kilogram from each sample (concentrated poultry feed), which are: three types of broiler chicken feed (starter, grower, and finisher) as well as two types oflayer chicken feed (starter and finisher) samples were collected in August 2020. Then they were encoded with (A, B, C, D and E), respectively, in airtight plastic containers, and kept in a dry place, at a temperature of 25 to 30 degrees Celsius, until chemical analyzes are done.

Machines used

- Sensitive Scale.
- DA 7250, Perkin-Elmer.
- Muffle Furnace (Buhler).
- Oven(Heraeus® Series 6000).

Determination of Chemical Composition

Total Crude Protein,Crude fiber and Crude fat:

The dried sample (300g) was weighed and the content of the sample was transferred to a specific container for the analysis process, where it was placed in the place designated for analysis, the analysis was done by near-infrared (NIR) spectroscopy with Perten Instrument (Model DA 7250, Perkin-Elmer, Inc., Perten Instruments North America, Springfield, IL, United States).To analyze each of: protein, fat and fiber using infrared (NIR) as it gives percentage values (%) directly on the device display screen.

Near-infrared technologyOF DA 7250

Near-infrared (NIR) Rays, electromagnetic energy with a wavelength range between 750 and 2500 nm, is widely used for the quantitative analysis of foods **(Nielsen, 2010; Agelet & Hurburgh, 2010).** When samples are explosed to light of specific wavelengths, the light energy is absorbed for vibrations of molecular and bonds, including C-H (methyl, aromatic, carbonyl, etc.), N-H (amides and amine salt), O-H (alcohols and water), S-H, C=O groups, etc. Transmission and diffuse reflectance are two modes of the NIR system. Diffuse reflectance mode allows the instrument to measure thicker and denser samples but is also greatly affected by density or packing, particle size, and absorption of samples **Shi, D. (2021).** NIR technology is a rapid and non-destructive method for measuring chemical components and nutrients in food materials with little sample preparation **(Cen & He, 2007; Mihaljev*et al.*, 2015).** The automatic reading and recording functions make it simple to operate, and it allows measurement for multiple constituents of samples at the same time**(Osborne, 2006).** the NIR instrument has no need for hazardous chemicals, which is safe and environmentally friendly **(Wu *et al.*, 2002).**

Sanitary design NIR for food analysis

The DA 7250 NIR is designed for use in food production. Its stainless steel IP65 certified casing allows it to be placed anywhere, and the open analysis area and smooth corners make it very easy to clean. Advanced diode array NIR technology provides accurate analysis of moisture, protein, fat and more in only six seconds. All types of food products are analysed with little or no sample preparation – meats,feeds, butter, cream, powders and baked

products are a few examples. As the sample is analyzed in an open dish, the problems associated with sample cups are avoided and operator influence on results is minimal. Disposable petri dishes can be used, eliminating the need for cleaning between samples. The stainless steel sanitary design of the instrument makes it hygienic and easy to clean **(Sundara *et al.*, 2014).**

Total Ashcontent:

A crucible was dried in an oven for 24hrs, cooled and weighed (W1). The dried sample weighed 20g (W2) was placed in a crucible and subjected to ashing in a muffle furnace (BUHLER)' at constant temperature of 900 °C until a constant final weight for the ash was obtained. After ashing, the ash was covered with a lid and placed in desiccators prior to weighing. This was then measured as (W3) **AOAC, (1990).**

Moisture Content:

This was done based on the difference between the net weight and the weight after drying to a constant weight. A clean dried petri-dish was weighed (W1) and 10g of the sample were placed on it, and then weighed (W2). This was then placed in an oven (Heraeus® Series 6000), at 130 °C for 1.5hrs. The dish was removed and cooled in desiccators for 30 mins and finally weighed (W3) **AOAC, (1990).**

Total Carbohydrate:

Total carbohydrate was calculated by difference [100-(protein + crude fibre + crude fat + moisture + ash)] as reported by **Akubor *et al*,. (2000).**

Results and Discussion

Protein concentration

Through Table No. (1), it was found that the highest protein concentration was 27.37% in the Starter layer feed, while it was found that the lowest protein concentration was 17.74% in broiler feed samples, a finisher type, compared to the other samples.

it was found that the average protein concentration in broiler chicken feed for samples (A1, A2, and A3) were (20.48%), (18.69%) and (17.86%), respectively. While it was found that the average concentrations of protein in the laying chicken feed for samples (A4 and A5) were (26.93%) and (25.56%). Through the analysis of protein for all samples of broiler chicken feed samples, it was found that all the averages matched the European standard specifications, the World Food Organization (FAO), and the Gulf specifications, while the average protein concentrations of the laying chicken feed samples differed from these specifications, giving higher values, perhaps Because of the use of a larger amount of corn to the feed mixture to produce concentrated feed.

It was also found that the average protein concentrations for all broiler feed samples agreed with **Ofori *et al.*, (2006),** while it differed with laying hens feed samples, and the results of this study agreed with **Uchegbu*et al.* (2009),** and **Bukar and Saeed, 2014),** as well as **Rahman *et al.*, (2014).** The results of **Vakili *et al.*, (2015),** agreed with the results of the studied analysis of broiler feed samples of the two types of (Starter and grower), and differed from them in the concentration values of broiler chicken feed for the finisher type, and there was a difference in the results of this study for species (A1 and A2) with **Olajide *et al.*, (2020),** while it agreed with the type (A3), and it was also noted that the results of this study gave better results than those given by **Alum *et al.*, (2020)** and **Yan *et al.*, (2021).** There are statistically significant differences between the averages of all samples of broiler and laying

chicken feed samples at the confidence level ($p \leq 0.05$), except for samples (A2 and A3), which have no differences between them.

Table 1: Mean concentration of Protein (%) in all the brands of feed

Feed type	A1	A2	A3	A4	A5
Standard	23%	23%	18%	20%	20%
R1	22.67	18.82	17.74	26.42	25.72
R2	19.32	18.54	17.92	26.99	26.22
R3	19.45	18.70	17.91	27.37	24.73
Mean	20.48	18.69	17.86	26.93	25.56
LSD	1.713				

Starter Broiler(A1) grower broiler(A2) finisher broiler(A3) starter layer(A4) finisher layer(A5)

Fat concentration

Through Table No. (2) it was found that the highest concentration of crude fat was 6.35% in the sample of broiler chicken feed sample, Starter type, while the lowest concentration of crude fat was 1.99% in the laying chicken feed sample, finisher type, compared to other samples of feed. From the table, it was found that the average concentration of crude fat in broiler chicken feed at the confidence level ($p \leq 0.05$), for samples (A1, A2 and A3) were (5.39), (4.81) and (3.56), respectively, while it was found that the average concentration of The crude fat in the laying chicken feed for samples (A1 and A2) was (2.59) and (2.53), respectively, among all other samples.

It is noted that the results of the analysis of the average crude fat concentration for all broiler and laying chicken feeds were almost in accordance with the European standards and the World Food Organization (FAO) as well as the Gulf standards.

It is also noted that the mean values of crude fat concentration for all broiler feed samples of species (A1, A2 and A3) were in agreement with the results of **Ofori *et al.*, (2006),** and also was consistent with the study of **Rahman *et al.*, (2014),** while The averages of crude fat for laying chicken feed samples differed from this study. It was found through the average values of crude fat that there are no statistically significant differences between all concentrations of broiler chicken feed concentrations, as well as between concentrations of laying chicken feed for all samples, at the confidence level ($P \leq 0.05$).

Table 2: Mean concentration of Fat (%) in all the brands of feed

Feed type	A1	A2	A3	A4	A5
Standard	3 - 4.5%	4%	4%	4%	4%
R1	5.33	3.85	3.21	2.62	2.28
R2	4.49	5.78	3.18	2.02	1.99
R3	6.35	4.80	4.28	3.14	3.33
Mean	5.39	4.81	3.56	2.59	2.53
LSD	1.41				

Fiber concentration

Through Table No. (3), it was found that the highest concentration of crude fiber was (3.96) in broiler chicken feed, a growing species, among all other samples. and The lowest crude fiber concentration was (1.39) in broiler feed, finisher type, among all other samples.

The previous table shows that the average concentration of crude fibers for broiler feed for types (A1, A2 and A3) were (2.98, 2.80 and 2.63), respectively. While the average values of fiber concentration for the feed of laying chicken (A1 and A2) were (2.77 and 2.06) respectively, It is noted that the results of the analysis of the average crude fiber concentration for all broiler and laying chicken feeds were close of accordance with the European standards and the World Food Organization (FAO) as well as the Gulf standards.

It is noticeable in the results of the analysis of the crude fibers of broiler chicken feed samples (A1, A2 and A3) that were greater than the results conducted by **MZ et al., (2019),** while the results of the analyzes for the current study of all broiler feed samples were lower than the study conducted by **Uchegbu et al,. (2009),** and **Oyedeji et al., (2013),** while the results of the study for broiler feed agreed with the results conducted by **Bukar and Saeed, (2014),**and the results of the study conducted by **Vakili et al., (2015).** Analysis of laying chicken feed with the results of the study conducted by **San Andres et al., (2011),** while it was less than the results of the study of **Nasaka et al., (2018),** and a study conducted by **Olajide et al., (2020).**

It was found through the average concentration of crude fibers that there were no statistically significant differences at the confidence level ($P \leq 0.05$) between samples (A1, A2, and A3), while there were statistically significant differences between samples (A5 and A4).

Table 3: Mean concentration of Fiber (%) in all the brands of feed

Feed type	A1	A2	A3	A4	A5
Standard	4.5%	4%	4%	4%	4%
R1	3.4	2.34	3.74	2.38	2.03
R2	2.23	2.10	2.75	3.14	2.07
R3	3.3	3.96	1.39	2.79	2.07
Mean	2.98	2.80	2.63	2.77	2.06
LSD	1.405				

Ash concentration

Through Table No. (4), we noticed that the highest concentration of crude ash was (8.01%) for the laying poultry feed (Starter), while the lowest concentration of crude ash was (3.00%) for broiler poultry feed (finisher), among other samples.

Using the analysis of the average concentration of crudeash, we found that the average concentration of raw ash for broiler feed samples (A1, A2 and A3) crude (3.477%, 3.237% and 3.103%), while the average concentration of crudeash for laying chicken feed samples (A4 and A5) was (7.920% and 7.807%).

When comparing the results of the analysis of this study with the previous studies, it was found that the values of crudeash concentration for broiler feed (Starter) are identical with the study of **Oyedeji *et al.*, (2013),** while for broiler feed (grown and laying) it gave lower values, and in the study that Conducted by **Vakili *et al.*, (2015),** it was found that all values of broiler feed concentrations were close to this study, while the averages of laying chicken feed concentrations (Starter, finisher) gave higher values. It was also found that the average concentrations of crudeash for broiler and laying feed collection were less than the values of the average concentration of crudeash in the study conducted by **Ofori *et al.*, (2006),** and the average concentration of crudeash for laying chicken feed was less than the values in the study conducted by **San Andres *et al.*, (2011),** but it is compatible with European Standard Specifications, (FAO), and Gulf Specifications.

It was found through the averages of ash content that there were statistically significant differences at the confidence level ($P \leq 0.05$) between all samples (A1, A2, A3, A4 and A5).

Table 4: Mean concentration of Ash (%) in all the brands of feed

Feed type	A1	A2	A3	A4	A5
Standard	6.5%	6.5%	6.5%	6.5%	6.5%
R1	3.61	3.25	3.16	7.8	7.72
R2	3.41	3.19	3.15	8.01	7.83
R3	3.41	3.27	3.00	7.95	7.87
Mean	3.477	3.237	3.103	7.920	7.807
LSD	0.164				

Moisture concentration

Through Table No. (5), we found that the maximum moisture content concentration was (16.65%) for sample (A4) laying chicken feed (Starter type), while the minimum moisture content concentration was (11.33%) for sample (A1) broiler feed. (Starter type).

Using one-way analysis of variance (ANOVA) at the confidence level ($P \leq 0.05$), it was found that the average moisture concentration of broiler feed samples (A1, A2 and A3) was (13.19%, 14.61% and 14.60%), respectively, while the average moisturecontent concentration For laying chicken feed samples (A4 and A5), they were (16.57 and 15.88), respectively.We know that all average moisturecontent concentrations for all broiler and laying chicken feed samples exceeded the maximum limits of European Standards, Food and Agriculture Organization (FAO) and Gulf Standards.

When comparing the results of this study with the previous studies, it was found that the average moisture content of broiler feed samples (A1 and A3) was close to the results of the study conducted by **Ofori *et al*., (2006),** while the concentration of (A2) differed from this study as it was Less. As for the studies conducted by **Rahman *et al*., (2014)**, **Bukar and Saeed, (2014)** and **Vakili *et al*., (2015),** it was found that all the values of the average moisture content of these studies are less than the values in the current study, and this affects the Feed in general, and the reason for this may be due to the use of an excessive amount of water in the feed mixture. We note that the moisture content values in this study were in agreement with the results of **Oyedeji *et al*., (2013),** for broiler feed samples (A1, A2), while the sample (A3) differed, giving higher values.

It was found through the average moisture content that there are statistically significant differences at the confidence level ($P \leq 0.05$) between samples (A1 and A2) as well as between (A3, A4 and A5), while there are no statistically significant differences between samples (A2 and A3).

Table 5: Mean concentration of Moisture (%) in all the brands of feed

Feed type	A1	A2	A3	A4	A5
Standard	12%	12%	12%	14%	14%
R1	11.33	14.49	14.62	16.65	16.17
R2	13.9	14.75	14.73	16.54	15.92
R3	14.33	14.49	14.46	16.52	15.56
Mean	13.19	14.61	14.60	16.57	15.88
LSD	1.353				

Carbohydrate's concentration

From table No. (6), it was found that the highest carbohydrate concentration was (60.29%) in broiler feed, a finisher type, while the lowest carbohydrate concentration was (42.23%) in laying chicken feed, Starter type, among all concentrations of other samples.

The averages of the results were analyzed using the genstat analysis program, at a confidence level ($P \leq 0.05$), where it was found that the average concentration of broiler chicken feed samples for species (A1, A2 and A3) were (54.50, 58.19 and 58.89), respectively, while the average concentration of carbohydrates for samples The laying chickenfeed for types (A4 and A5) were (43.22 and 46.16), respectively, as it was found that the average values of carbohydrate concentration for broiler and laying feed samples for all species were higher than the European standard specifications (FAO), while all carbohydrate concentrations were consistent with the values of **(Ofori *et al*., 2006)**, for all types of feed, and it also agreed with the values of **Bukar and Saeed, (2014)**, for all types of broiler and laying chicken feed, except for the value of broiler chicken feed (grower) which gave a concentration lower than the analytical value. These results were subjected to a one-way analysis of variance (ANOVA) ($p < 0.05$). There were significant differences in the carbohydrate content of all broiler and laying chicken feed samples at the confidence level ($p \leq 0.05$).

Table 6: Mean concentration of Carbohydrate's (%) in all the brands of feed

Feed type	A1	A2	A3	A4	A5
Standard	≥ 32%	32%≥	32%≥	≥ 32%	≥ 32%
R1	53.69	59.25	57.41	44.13	46.08
R2	56.65	57.64	60.29	43.30	45.97
R3	53.16	57.68	58.96	42.23	46.44
Mean	54.50	58.19	58.89	43.22	46.16
LSD	2.217				

Conclusion

In conclusion, the data obtained in the proximate analysis represents a large discrepancy between the quality of poultry feed from the selected manufacturer, finally, this study may help poultry feed manufacturers and poultry farmers to provide nutritious, healthy, safe and cost-effective broiler meat, which is still A major source of protein for consumers, as well as helping farmers to improve performance and productivity by paying attention to raising laying hens and producing eggs with high specifications, by providing such feeds that contains the required supplements.

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