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Formulating And Proximate Analysis Of New Poultry Feeds Based On Corn Flour Enriched With Seed Flour And Nere Pulp (*Parkia Biglobosa*), Then Snail And Fish.

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Abstract: *The objective of this work is to study the physico-chemical and nutritional composition of 3 diets formulated on the basis of lower-cost, available local products and that of a commercial food, intended for the feeding of poultry on Ivory Coast. As a first step, the 3 food diets (A1, A2 and A3) were formulated. In front of these 3 foods formulated, there was a food of commerce at which served as a control food. Room these foods (formulated and witnessed) have been analyzed on the physico-chemical and nutritional levels. The results revealed that the formulated foods are real sources of protein, carbohydrates and various other nutrients are not the concentrations are similar (A3) higher than the control (AT). The major foodstuffs that have been taken into account in the formulation of these foods are maize as a carbohydrate source, pulp and nere grains (Parkia biglobosa) as a vegetable protein source and fishmeal (Sardinella maderensis) and snail (Achatina Fulica) have been used as a source of animal protein.*

Key words*: Flour, seed, néré, pulp, fish, snail, corn, food, formulated, trade, physico-chemical, nutritional*

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I. Introduction

One of the major constraints to the development of poultry farming in Ivory Coast as in other African countries is related to food. Food is the main component of poultry farming, taking around 60 to 80%, of production cost **(MRA, 2010)** and limit the profitability of poultry farms. It also limits people's access to poultry products. The food plays a very important role alongside environmental factors in production levels and product quality **(Zaman *and al.*, 2004)**. According to **(Tossou *et al.*, 2014)**, given a good quality ration in sufficient quantity allows to animals them to express all their genetic potential. The problem of supplying food inputs today is all the more crucial because we are seeing the international market increasing the cost of ordinary raw materials such as maize, soybean meal, and Fish flour. In the formulation of food rations, maize is the major ingredient in the fact that it is of high energy value and is devoid of anti-nutritional substances **(Bornstein and Lipstein, 1971)**. Conventional sources of vegetable proteins used in poultry feed are numerous. Soybean meal has the best food characteristics and therefore occupies the first place in the world trade in protein and oilseeds. However, low national soybean production and high meal costs the immediate consequences of this situation are the increase of about 15% on full food prices and massive imports of poultry carcasses judged for our economy and our health **(Njonga, 2004).** In view of this situation, the research and enhancement of alternative food resources whose availability or cost are not limiting factors, could be a solution to improve poultry productivity. It is in this context that the present study proposes to examine the possibility of using unconventional food resources that are substitute or substitute foods for conventional foods **(Dahouda *and al.*, 2009)**. These alternative food resources include Néré (*Parkia biglobosa*) and garden snails (*Achatina fulica*). Indeed, Néré is a plant whose nutritional interest lies in the high protein content of its seeds (35%) but are usually fermented to produce a condiment commonly known as "Soumbala" in Bambara. The pulp of néré is rich in carbohydrates (60%) and also contains vitamin B2 **(Bonkoungou, 1987)**. Garden snails (*Achatina fulica*) are also a real protein, available in the environment and not taken by the population. The objective of this work is to study the physico-chemical and nutritional composition of diets formulated on the basis of lower-cost, available local products and that of a commercial food, intended for the feeding of poultry in Ivory Coast.

II. Material And Methods

1-Samples preparation

1.1-Corn flour

The corn grain were sorted and washed with tap water. Then, they were dried under the sun for three days to reduce the water content at corn dried grain was grinded using Huler grinder (SN200, Henan Institut, Chine). The powder obtained is sieved using two sieves with diameters of 3 mm and 4 mm in function of launching and growth phases of the poultry respectively.

1.2-Flour of nere pulp and grains (*Parkia biglobosa*)

When removing the external cover, the yellow pulp adhered to the néré seeds was removed and dried under the sun for 3 days. After drying, the product is slightly ground with wooden mortar and pestle. Then, the powder is sieved at 200 µm in diameter and the yellow flour of nere pulp is collected. The seeds were also milled in a grinder (SN200, Henan Institut, Chine) because of the hardness of the hull, the starting and growth meshes being taken into account.

1.3-Snail Flour (*Achatina fulica*)

The snails were sorted, washed with tap water and then removed from their shells. Their shells were cleared, their flesh was well washed with distilled water and then dried under the sun for 7 days. After 7 days, the dried flesh was carried to the mill for processing into flour.

1.4-Fish meal (*Sardinella maderensis*)

Fish were purchased at local marked of Adjamé and carried in the lab. They were sorted and dried under the sun for 3 days and carried to the mill to be grinded into flour.

2-Feed formulation

Three (3) kinds of feed have been formulated according to table 1. Feed A1 was made with 100% of fish protein flour (*Sardinella maderensis*) (100%); Feed A2 was made with 100% of fish protein flour snail (*Achatina fulica*) (100%) and feed A3 containing 50/50, p/p of snail and fish protein flour. For each formulation, the carbohydrate component was composed mainly of yellow corn flour to which the same amount of nere powder (grains and pulp) were added.

Table 1: Composition of Formulated Feeds A1, A2 and A3

Quantity (g/100g)						
Ingrédients	Stard-up			Growth		
Corn flour	56	56	56	58	58	58
Néré pulp flour	3	3	3	3	3	3
Néré seed flour	20,8	20,8	20,8	19	19	19
Fish meal	15	00	7,5	14.5	00	7,5
Nail meal	00	15	7,5	00	14,5	7,5
Shell	2	2	2	2.2	2,2	2,2
Red oil	2	2	2	2	2	2
Vitamin Complex	0.5	0.5	0.5	0.7	0,7	0,7
Salt	0.3	0.3	0.3	0.3	0,3	0,3
Lysine	0.25	0.25	0.25	0.2	0,2	0,2
Méthionine	0.15	0.15	0.15	0.1	0,1	0,1

3- Physicochemical and nutritional analysis

3.1- Determination of moisture and dry matter rate

Moisture and dry matter rate were determined according to the method proposed by **AOAC (1990)**. Five (5) grams of feed (P0) were homogeneously spread in a porcelain crucible. The set porcelain crucible and samples were heated in an oven (MEMMERT-GERMANY) at 105 ° C during 24 hours. After cooling to the desiccator, the mass of this set was determined. The dry material content (MD) was determined in g / 100 g of feed with the following formulae:

$$\mathbf{MS\ (\%) = \frac{P2 - P1}{P0} \times 100}$$

MS: Dry matter content (%); P_1: Empty mass of porcelain crucible (g)
P_0: mass of feed taken (g); P_2: Mass of the set (crucible + sample) (g)

The moisture was determined in g / 100 g of feed from the following formulae:

$$H\ (\%) = 100 - MS$$

H: Moisture content (%); MS: Dry matter content (%)

3.2- Ash content

Ash content was determined according to the method proposed by **AOAC (1990)**. Five (5) grams of feed was introduced into a porcelain crucible. The set (crucible + feed) was carried to the muffle furnace (Nabertherm 30-3000 ° C) at 550 ° C for 12 hours. Then the crucible was cooled in a borosilicate glass desiccator and weighed. The ash content is determined according to the following formulae:

$$\mathbf{Ash\ \ (\%) = \frac{(m_2 - m_0) \times 100}{(m_1 - m_0)}}$$

m_o: empty crucible mass (g); m_1: mass of the set (crucible + feed) (g)

3.3- Lipid crude content

The lipid content was determined according to the method proposed by **AFNOR (1986)**. Ten (10) grams of feed were introduced into a cellulose extraction cartridge. The cartridge was plugged with hydrophilic cotton and placed in the Soxhlet extractor. And then an empty glass flask was weighed and 300 mL of hexane was poured into it. All The set connected to the extraction apparatus (Soxtherm Automatic Gerhardt, Germany). The extraction was made by the reflux system for 7h at boiling. Then, the residual hexane of the flask was evaporated by means of a rotary evaporator. The flask containing the fat was heated in an oven at 100 °C. for 20 minutes and then cooled with a desiccator (Metller toledo HX 204) and weighed. The total lipid content was calculated according to the following formulae:

$$\mathbf{Lipid\ \ (\%) = \frac{(m - m_0) \times 100}{m_e}}$$

m: mass of the cooled flask after oven (g); m_o: empty glass flask mass (g)
m_e: mass of the sampled feed (g)

3.4- Protein crude content

Raw (Gross) proteins were measured according to the method proposed by **AOAC (1990)** using Kjeldhal. One gramme of feed is weighed in a mineralization flask. Then, a pinch of catalyst (selenium + potassium sulphate) and 20 ml of concentrated sulfuric acid were added successively. The mineralization was made in 400 °C during 2 hours in a digester (BUCHI). After cooling the tube at room temperature (28 ° C) for 15 minutes, the mineralized material was transferred to a volumetric flask about 100 mL and completed up to the mark with distilled water. Ten mL of sodium hydroxide (40%, p / v) was added to 10 mL of diluted mineralized material and the mixture well homogenized by hand was placed in the distiller tank. The extension of the distiller's refrigerant was then immersed in a beaker containing 20 mL of boric acid (0.05 mol / L) supplemented with a mixed indicator (methyl red + bromocresol green). The distillation was carried out for 10

minutes. After this operation, the distillate nitrogen was measured with sulfuric acid solution (0.1N) until the change from green to orange. A blank was made under the same conditions as the test. The total nitrogen content, expressed in mg / 100 g of dry material, was determined by the following formulae:

$$total\ \text{Nitrogen}\ (\%) = \frac{N\,(V_1 - V_0) \times 14}{m_e}$$

V_0: sulfuric acid solution volume (mL) (0.1 N) poured for the blank test.
V_1: sulfuric acid solution volume (mL) (0.1 N) poured for the test (sample)
N: sulfuric acid solution normality;
m_e: Sampled food mass (g).
Gross protein content (P) expressed in mg / 100 g of dry material calculated by the following formulae:

$$Total\ Protéin\ (\%) = 6,25 \times total\ \text{Nitrogen}\ (\%)$$

6.25: nitrogen conversion factor into protein **(FAO, 2002b)**.

3.5- Total carbohydrate content

The calculation of total carbohydrate contents in feeds was done according to the relationship given by **FAO (1998)**.

$$\text{Carbohydrate}\ (\%) = 100 - [protein\ (\%) + \text{water}\ (\%) + lipid\ (\%) + \text{ash}\ (\%)]$$

3.6- Calculation of the energy value

The Calculation of the energy values in food was done according to the method proposed by **FAO (2002b)**.

$$\text{Energy value}\ (kcal\ /\ 100\ g) = [(2,44 \times protein) + (8,37 \times lipid) + (3,57 \times \text{carbohydrate})]$$

3.7- Fiber crude content

Raw fibre or insoluble fibre include cellulose, some hemicelluloses, lignin. Raw fibre contents in feeds were determined using the method proposed by **AOAC (1990)**. 2 grammes of feed were dissolved in 50 ml of sulfuric acid (0.25 N) contained in a beaker which was then boiled for 30 min. Fifty (50) ml of sodium hydroxide (0.3N) were then added to this mixture and boiled for 30 minutes. After this thermal treatment followed with filtration on Wathmann paper No. 42, the residue was washed several times with hot distilled water until complete alkalis eradication. The insoluble material obtained was dried at 150 °C. for 8 hours and weighed with a precision scale (Analytica Balance MT 200). This dry residue was incinerated at 550 ° C in the self-regulating muffle furnace (Nabertherm 30-3000 °C), preheated at 550 ° C for 3 h. The ash was weighed with the same precision scale. The crude fibre content (g / 100g) was obtained by the following relationship:

$$Fibres\ brutes\ (\%) = \frac{(M_1 - M_2) \times 100}{M}$$

M: Taken sample Mass (g); M_1: Sample Mass after lasting 8hours in the oven (g)
M_2: Dry residue Mass after incineration at 550 ° C for 3 h (g)

3.8-Total sugar content

Dubois *and al.*, (1956) method allowed the determination of total sugars using phenol and concentrated sulphuric acid. In the presence of these two reagents, the OSes give a yellow-orange color whose intensity is proportional to the concentration of carbohydrates. Absorbance is determined between 450 and 550 nm. The éthanosoluble extract (150 M L) was collected and placed in a test tube. At this volume, 1 ml of phenol (5%, w/V) and 1 ml of concentrated sulphuric acid (97%) were added respectively. The reaction medium was homogenized and left cooled for 5 min. The absorbance reading was made at 490 nm at the spectrophotometer (MS-V5100, China) against a control containing all the products except the éthanosoluble extract. The absorbance was converted into total sugars using a standard curve obtained from a glucose solution (2 mg/ml). This amount of sugars is reduced as a percentage of the dry matter.

3.9-Reducing sugar content

Reducing sugars were determined to the method proposed by **Bernfeld (1955)** using 3.5 dinitrosalycilique acid (DNS). DNS forms quantitatively hot with reducing sugars an orange-red derivative whose absorbance is measured at 540 nm. The éthanosoluble extract (150 M L) was collected and placed in a

test tube. At this volume, have been added 300 M L of the DNS solution. The mixture was brought to the boiling Mary Bath for 5 min. After cooling on the bench for 5 min, 2 ML of distilled water was added to the reaction medium. The optical density was read at 540 nm at the Spectrophotometer (MS-V5100, China) against a control containing all the products, except for the éthanosoluble extract. The optical density was converted into a quantity of reducing sugars by a standard curve obtained from a glucose solution (2 mg/ML). This amount of reducing sugars is converted as a percentage to the dry matter.

3.10-Starch content

Knowing the levels of total carbohydrates and total sugars in foods, it is possible to determine the starch content according to the **FAO (1947)** method using the following expression:

Starch content (%) = 0,9 [% Total carbohydrates -% Total sugars]

4- Statistical analysis

Statistical analyses of the data were performed using the software Statisticala 7.1 (Statsolft Inc, Tulsa-USA headquartes) and XLSTAT-Pro 7.5.2 (Addinsoft SARL, Paris-France). The comparisons between the dependent variables were determined using two-factor Anova and the Duncan test. Statistical significance was defined at the 5% threshold.

III. Results And Discussion

1-Results

1.1-Moisture rate

Moisture rates in formulated feeds (A1, A2, and A3) and commercial feed (control feed) vary from 9.93 ± 0.06 to 11.88 ± 0.02%. Formulated feed have statistically ($P \geq 0.05$) the same moisture rates. These levels are strongly higher than the commercial feed ($P \leq 0.05$). For starter feeds, formulated A2 and A3 foods and (AT) commercial one have statistically ($P \geq 0.05$) the same levels which are strongly lower than A1 feed. In all cases, moisture levels do not reach the 12% threshold (Figure 1).

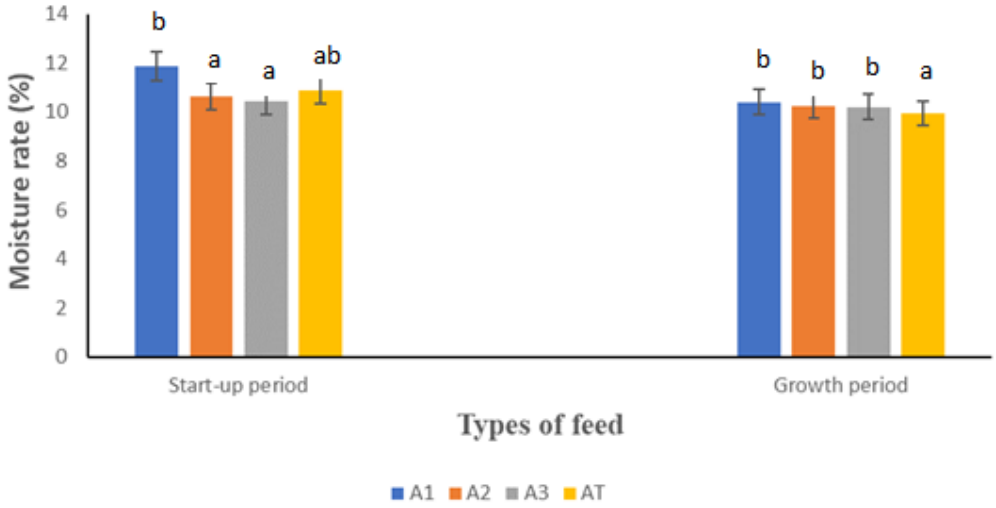

Figure 1: Moisture rate in starter and growth formulated and trade feeds.

The same letters assigned to averages mean that they are not different at the 5% threshold.

1.2-Ash content

The ash content of formulated (A1, A2 and A3) and AT trade feeds are respectively 7.59 ± 0.07; 4.67 ± 0.06; of 6.86 ± 0.07 and 8.1 ± 0.03. Those of the formulated (A1, A2 and A3) and AT trade growth feeds are 8.51 ± 0.08; 5.93 ± 0.25; of 7.95 ± 0.06 and 5.89 ± 0.01%. Ash levels of start-up feeds are different ($P \leq 0.05$). Those of growth feeds A2 and AT trade are identical ($P \geq 0.05$). However, they are lower than A1 and A3 growth feeds ($P \leq 0.05$). Growth feed A1 has the highest ash rate among all growth feeds ($P \leq 0.05$). In the term of start-up level, the AT feed has the highest ash content ($P \leq 0.05$). The lowest rate is obtained with the launch feed A2 (Figure 2).

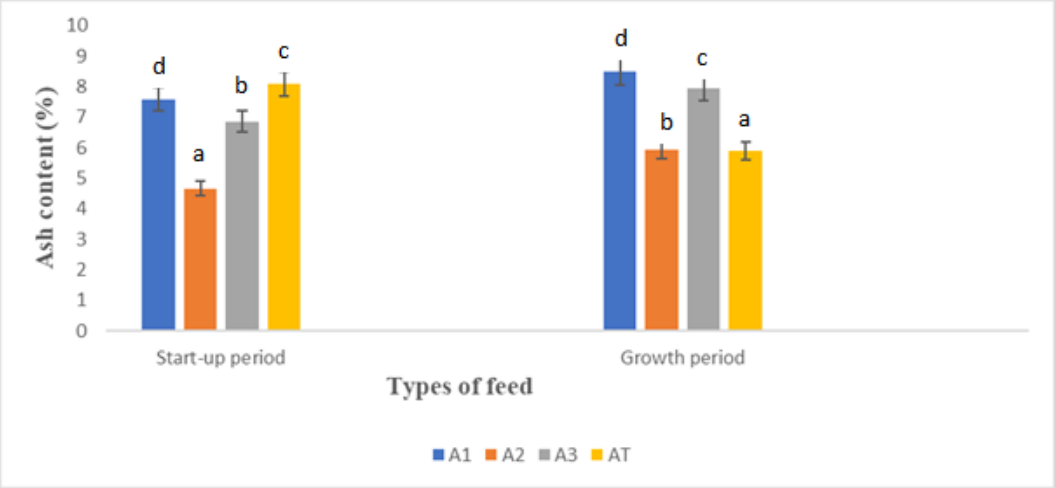

Figure 2: sh content of launch and growth formulated and trade feeds.

The same letters assigned to averages mean that they are not different at the 5% threshold.

1.3- Crude Lipid content

The crude lipid contents in start-up feeds concerning the formulated (A1, A2 and A3) (AT) trade are respectively 3.09 ± 0.11, 3.43 ± 0.45; of 4.50 ± 0.07 and 4.63 ± 0.51%. Those of formulated (A1, A2 and A3) and AT trade growth feeds are 5.79 ± 0.48; 4.00 ± 0.46; 5.59 ± 0.15 and 5.32 ± 0.31%. Start-up feeds A1 and A2 had statistically the same lipid levels ($P \geq 0.05$). It's the same for A3 and AT trade feeds. However, the lipid levels in the first group of feed (A1 and A2) are statistically lower than the one of the second group (A3 and AT trade feeds) ($P \leq 0.05$). Concerning growth feed, A3 and AT trade had statistically the same lipid levels ($P \geq 0.05$). A1 growth feed has the highest lipid level ($P \leq 0.05$) while A2 feed has the lowest. The lipid levels in start-up feeds are higher than those of growth feeds ($P \leq 0.05$) (Figure 3).

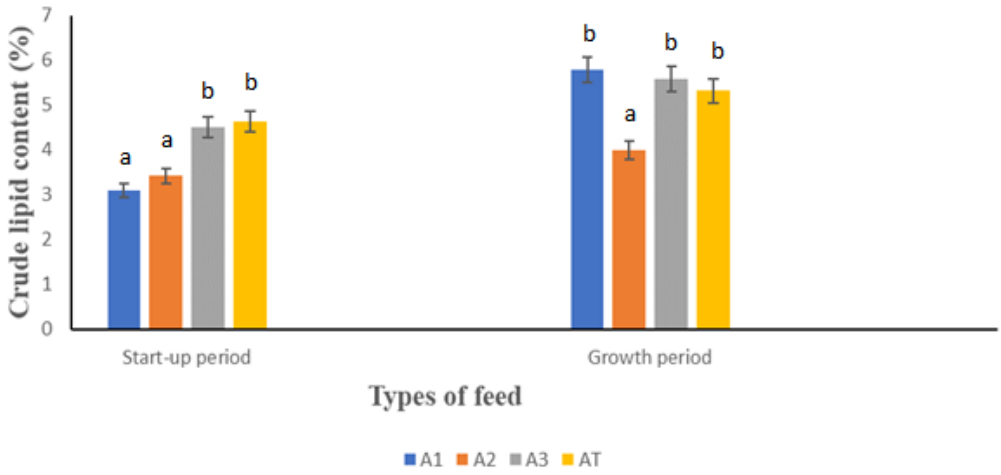

Figure 3: Crude Lipid contents in Start-up, Growth Formulated and Trade feeds

The same letters assigned to averages mean that they are not different at the 5% threshold.

1.4- Crude Protein content

Protein levels in start-up feeds concerning Formulated (A1, A2 and A3) and (AT) trade were as follows 16.58 ± 0.49; 18.04 ± 0.37; of 19.72 ± 0.28 and 20.31 ± 0.51%. The growth feeds (A1, A2 and A3) produced and AT trade feeds are successively 15.33 ± 0.78; 16.71 ± 0.66; of 18.36 ± 0.21 and 18.09 ± 0.24%. The start-up feeds A3 and AT trade have) the same protein levels ($P \geq 0.05$).These rates are different from those of start-up feeds A1 and A2 . Among the start-up feeds, A3 and AT trade have the highest protein levels ($P \leq 0.05$), while the protein level in A1 is the lowest. In term of the growth feed, the same observations were obtained. In all cases, the protein levels of the start-up feeds are higher than those of the growth feeds ($P \leq 0.05$) (Figure 4).

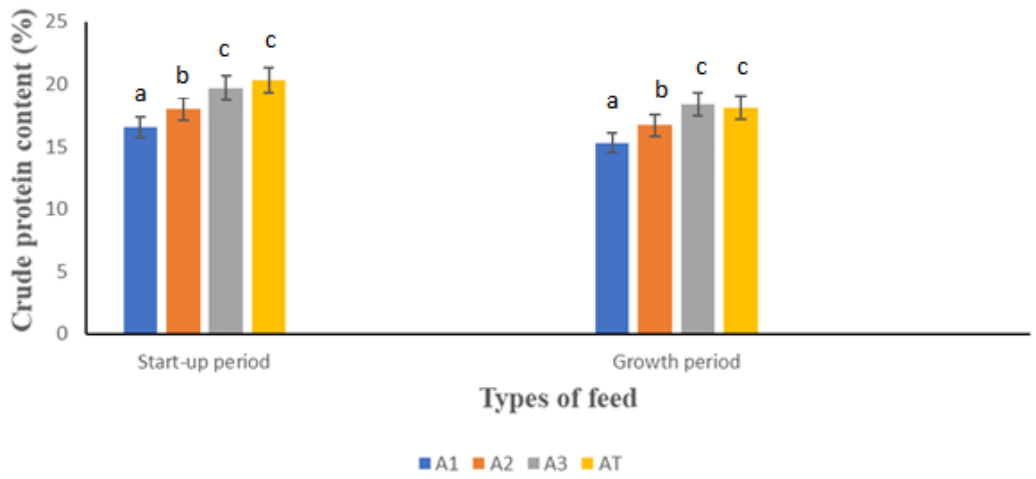

Figure 4: Crude Protein content in start-up and growth feeds concerning formulated and trade feeds. The same letters assigned to averages mean that they are not different at the 5% threshold.

1.5-Total carbohydrate content

The total carbohydrate content in formulated (A1, A2 and A3) and (AT) trade start-up feeds are 60.86 ± 0.64; 63.22 ± 0.98; 58.49 ± 0.45 and 56.07 ± 1.93%. Those of the formulated (A1, A2 and A3) and trade AT growth feeds are the followings: 59.98 ± 1.36; 63.77 ± 0.91; 60.01 ± 0.30 and 60.76 ± 0.36%. The total carbohydrate levels in formulated A1, A2, A3 and AT trade launch feeds were highly different ($P \leq 0.05$). The start-up feed AT trade has the lowest total carbohydrate rate ($P \leq 0.05$) while the highest rate is obtained with the start-up feed A2. A1, A3, and AT trade feeds had statistically ($P \geq 0.05$) the same total carbohydrate totals. These rates are statistically ($P \leq 0.05$) lower than that of the A2 growth food. The total carbohydrate levels of the growth foods are statistically ($P \geq 0.05$) identical to those of the starter foods (Figure 5).

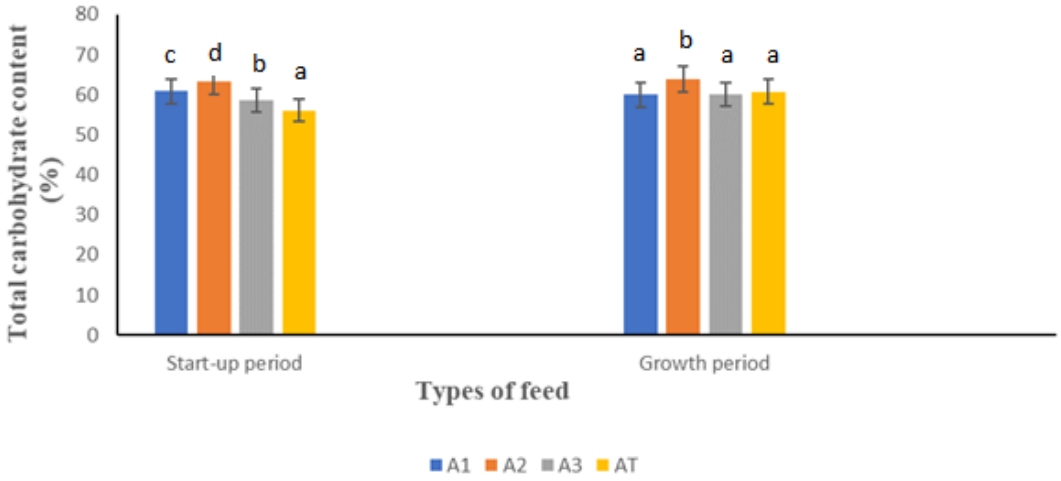

Figure 5: Total carbohydrate content in start-up and growth formulated and trade feeds

The same letters assigned to averages mean that they are not different at the 5% threshold.

1.6-Energy value

Reducing sugar content in formulated (A1, A2 and A3) and (AT) trade growth feeds are 300.01 ± 2.78; 301.96 ± 3.61; 305.85 ± 1.94 and 305.60 ± 2.08. Those of formulated (A1, A2 and A3) and trade AT launch feeds are respectively 283.61 ± 0.66; 298.37 ± 2.50; of 294.62 ± 0.94 and 288.49 ± 2.54 (Kcal / 100g). The energy values in launch feeds are different ($P \leq 0.05$). Among launch feeds, feed A2 has the highest energy value ($P \leq 0.05$) while the lowest value is obtained with start-up food A1. There is no significant difference between the energy values in the formulated A1, A2, A3 growth feeds ($P \leq 0.05$). However, these energy values are statistically higher than the trade growth feed ($P \leq 0.05$**)** (Figure 6).

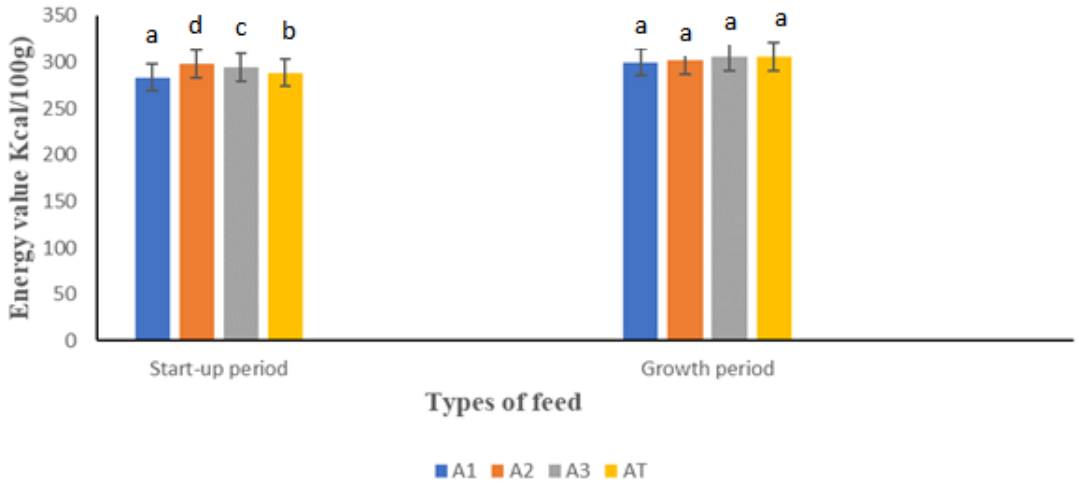

Figure 6: Energy value in launch and growth formulated and trade feeds.

The same letters assigned to averages mean that they are not different at the 5% threshold.

7-Other biochemical parameters

7.1- Crude Fibre content

The crude fibre content in start-up feeds for formulated (A1, A2 and A3) and (AT) trade feeds are 7.42 ± 0.13, 8.36 ± 0.14; 9.32 ± 0.06 and 9.51 ± 0.23%. Concerning growth feeds in formulated (A1, A2 and A3) and trade, the crude fibre levels are respectively 8.27 ± 0.19; 8.44 ± 0.07; 8.51 ± 0.18 and 8.61 ± 0.26%. A raw fibre level in formulated A3 and AT trade feeds similar ($P \geq 0.05$). These rates are statistically higher than the startup feed A2 ($P \leq 0.05$) which then is higher than crude fiber level in start-up feed A1. The A3 and trade feeds have similar statistical rates too ($P \geq 0.05$). These levels are significantly different from those of A1 and A2 growth feeds ($P \leq 0.05$). The A3 and AT trade feeds have the highest crude fiber levels ($P \leq 0.05$) while A1 growth feed has the lowest crude fiber content ($P \leq 0.05$) (Table 2 and 3).

7.2- Total sugar content

The total sugars content in start-up feeds concerning the formulated (A1, A2 and A3) and (AT) trade feeds are the followings: 2.78 ± 0.02, 3.64 ± 0.14; 3.76 ± 0.19 and 7.53 ± 0.4 g / 100g. Those of the formulated (A1, A2 and A3) and AT trade growth feeds are respectively 4.53 ± 0.16; 3.63 ± 0.20; 4.87 ± 0.39 and 7.82 ± 0.17 g / 100g. Start-up feeds A2 and A3 have the same total sugar levels ($P \geq 0.05$). These levels are significantly higher than the start-up feed A1 ($P \leq 0.05$) and lower than the AT trade food. The growth feeds A1 and A3 have the same total sugar levels ($P \geq 0.05$). These levels are significantly higher than the growth feed A2 ($P \leq 0.05$) and lower than the total sugars levels in trade feed (Table 2 and 3).

7.3-Reducing sugar

Reducing sugar content in formulated (A1, A2 and A3) and trade (AT) growth feeds are respectively 0.24 ± 0.04, 0.24 ± 0.02; 0.24 ± 0.01 and 0.24 ± 0.05 (g/100g). Those of the formulated (A1, A2 and A3) and trade AT start-up feeds are as follows: 0.17 ± 0.03; 0.16 ± 0.02; 0.15 ± 0.04 and 0.14 ± 0.06 (g / 100g). The reducing sugars levels in growth feeds are statistically similar ($P \geq 0.05$). This same observation was made for all start-up feeds. But reducing sugars levels in growth feeds are higher than those of start-up feeds ($P \leq 0.05$) (Table 2 and 3)**.**

7.4-Starch content

Starch content in formulated (A1, A2 and A3) and trade (AT) growth feeds are 49.91 ± 1.09, 54.13 ± 0.99; 49.62 ± 0.45 and 47.65 ± 0.39%. Those of the formulated start-up feeds (A1, A2 and A3) and trade AT are respectively 52.27 ± 0.56; of 53.61 ± 0.99; of 49.25 ± 0.58 and 43.68 ± 1.39%. Start-up feeds A1 and A2 have the same starch levels ($P \geq 0.05$). These rates are higher than start-up feeds A3and AT trade ($P \leq 0.05$). AT trade start-up feed has the lowest starch level among all start-up feeds ($P \leq 0.05$). Growth feeds A1 and A2 have the same starch levels ($P \geq 0.05$). Among growth feeds, food A2 had the highest starch level ($P \leq 0.05$) and trade feed the lowest starch level ($P \leq 0.05$) (Table 2 and 3).

Table 2: Crude Fiber, total sugar**,** reducing sugar and starch contents in start-up feeds concerning formulated and trade products.

Types of feed / Biochemical Parameters	A1	A2	A3	AT
Crude Fibre content (%)	7.42±0.13[a]	8.36±0.14[b]	9.32±0.06[c]	9.51±0.23[c]
Total sugar content (g/100g)	2.78±0.02[a]	3.64±0.14[b]	3.76±0.19[b]	7.53±0.4[c]
Reducing sugar (g/100g)	0.17±0.03[a]	0.16±0.02[a]	0.15±0.04[a]	0.14±0.06[a]
Starch content (%)	52.27±0.56[c]	53.61±0.99[d]	49.25±0.58[b]	43.68±1.39[a]

The same letters assigned to averages mean that they are not different at the 5% threshold.

Table 3: Crude Fiber, total sugar**,** reducing sugar and starch contents in growth feeds concerning formulated and trade products.

Types of feed / Biochemical Parameters	A1	A2	A3	AT
Crude Fibre content (%)	8.27±0.19[a]	8.44±0.07[b]	8.51±0.18[b]	8.61±0.26[b]
Total sugar content (g/100g)	4.53±0.16[b]	3.63±0.20[a]	4.87±0.39[b]	7.82±0.17[c]
Reducing sugar (g/100g)	0.24±0.04[a]	0.24±0.02[a]	0.24±0.01[a]	0.24±0.05[a]
Starch content (%)	49.91±1.09[b]	54.13±0.99[c]	49.62±0.45[b]	47.65±0.39[a]

The same letters assigned to averages mean that they are not different at the 5% threshold.

IV. Discussion

The formulated and trade start-up and growth feeds moisture levels are lower at 12 per cent. They constitute a potential advantage. In fact, during their conservation, micro-organism could not easily spread their potential as revealed **(Fellows, 1997).** This shows that those variants are well dry. This result is accordance with those obtained by **Gongnet et Vias Franck (1996)** et **Sakandé (1993)** who made chicken feed whose moisture levels are 89,87% and 91,70%. The lipid level in formulated A3 and AT trade start-up and growth feeds are the same. This situation is hopeful because it is congruent to the control feed. The highest lipid level in growth feed compare with the start-up feeds is very good because during the growth stage of quails we need a considerable energy quantity. The protein levels in start-up feeds are higher than those in growth feeds ($P \leq 0,05$). This formulation is congruent to poultry feed one. Indeed, during start-up period, animals need enough protein quantities to insure endogenous protein synthesis which contribute to new cells elaboration **(Cesard,1993)**. This result is obtained by **Larbier *et al.* (1991)** and **Gongnet and Vias-Franck (1996)** who made broiler feeds whose start-up protein levels are 22% et 23,74% and less in growth. Protein levels similarity between A3 formulated and trade feeds shows that trade feeds have hopeful diet dispositions. Carbohydrate levels in formulated start-up feeds are statistically higher than those in AT trade feeds (AT, Control) ($P \leq 0,05$). This situation can react on energy values in different formulated and trade feeds. Indeed, carbohydrates are essential energy feeds in animal metabolism. Those in studied feeds are very rich in starch, homopolysaccharide glucose energy. Starch presents in these feeds result from maize, a starch rich cereal. During technologic treatments, starch can be degraded to provide reducer and total sugar which are present in formulated and trade feeds. Fibre content in start-up feed range from 7.42 ± 0.13 to 9.51 ± 0.23% and that in growth feed from 8.27 ± 0.19 to 8.61 ± 0.26%. For these content, our feeds can be considered as rich in fibre. In fact, feeds that have 6% fibre contents are considered high fibre feeds. Fibre help slow down the absorption of sugars and fats that cause obesity. The high fibre content, combined with the absence of cholesterol and the low saturated fat content in vegetables, make it the best source of protein that protects against cardiovascular risks. Then a fiber-containing diet helps to prevent constipation, appendicitis and colon cancer **(Okon, 1983)**. Diets containing a high quantity of fibre have low energy values **(komal and kaur, 1992)**. In addition, the dietary fibre have a high hydrophilic capacity meaning they can swell up to 20 times their weight in water. This great ability to swell and retain water along their way in the stomach and intestine facilitates the reduction of the amount of feed intake and increases the volume of stool. This speeds up the intestinal transit. In addition, they form a viscous gel that lines the intestine side, which slows the intestinal absorption of carbohydrates and cholesterol **(Ifon *and al.*, 2009).** For a better formulation, energy values in start-up feeds should be lower than those in growth feeds. This provision was found in the term of formulated and trade feeds except A2 feed. In the growth phase, animals need large amounts of energy to ensure their cellular metabolism **(Jaovelo (2007)**.

V. Conclusion

In sum, the determination of the physico-chemical and nutritional parameters of the food allowed to determine the chemical nature of the constituents of the food, their interactions and influences on the health of the consumer, or at least, allowed evaluate the nutritional value of food. It emerges from our study through statistical analysis that all foods are nutritionally equivalent talking at the threshold of 5%. However, the food formulated A3 proves to be the one capable of generating higher zootechnical performances and identical to that of the control food at, given the composition. This study is therefore a real contribution to the productivity of local poultry by improving its diet with alternatives to the usual protein sources by the valorization of non-conventional food resources in Poultry.

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