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Theme: Substitution of Fish Meal by Pigeon Pea (*Cajanus cajn*) Flour and *Moringa Oleifera* Leaves (*Moringa oleifera*) in Quail Feed: Effects on Zootechnical and Sanitary Performances

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Abstract : ***In order to develop a diet adapted to the success of quail breeding in the tropical areas, a study for the substitution of fish meal by vegetable protein sources (Moringa oleifera and Cajanus cajn) was conducted. The objective of this study is to improve zootechnical and sanitary performance of quail breed in captivity. Five hundred and forty coturnix japonica (one-day-old), were used in this study during 42 days. Birds were divided into three groups of 180 young quail. The first group was feed with a diet contain fish flour (Alt), the second feed diet including cajanus cajan flour (Alc) and the last group feed diet with moringa flour (Alm). Each group was reparted into three randomized batches of 60 birds; three (3) repetitions per diet was used. Live weights at 42 days were 155.505 ± 11.31 g for control animals (Alt), 151.72 ± 13.53 g for those feed the diet Alc and 165.544 ± 10.58 g for subjects feed with the Alm diet. The feed intake (FI) of the quail diet ranged from 10.62 ± 0.32 to 22.44 ± 0.37 g / day / quail, compared to 8.61 ± 0.29 to 19.3 ± 0.32 g / day / quail for quails feed at the Alc diet and 12.11 ± 0.27 at 21.46 ± 0.34 g / day / quail for those feed the moringa diet. Alt animals showed a mean daily gain of 3.88 ± 1.186 g / day, compared with 3.27 ± 1.035 g / day for the Alc diet and 4.569 ± 1.594 g / day for the Alm diet. During this experiment Alt-feed quail recorded the highest consumption indices (CI). These indices range from 2.5 ± 0.08 to 5.8 ± 0.08, from start (1 to 14 days) to finish (42 days of age). The quail of the cajanus group ranged from 2.5 ± 0.41 to 5.9 ± 0.12. The moringa quail CI were predominantly significantly ($p < 0.05$) lower than other two groups and ranged from 2.2 ± 0.2 to 4.7 ± 0.2. The health risk index of the animals feed with control diet was 27 while those of the Alc and Alm diets were respectively 24 and 38. This study showed that moringa and pigeon pea can substitute validly the fish meal in the quail ration. However, pigeon pea must be treated to eliminate antinutrients and make it more edible for quail. This could lead to greater production of these protein-quality plants in Côte d'Ivoire.***

Keywords: flour, moringa oléifera, cajanus cajan, fish, quail, performance, Côte d'Ivoire

1. Introduction

During these two last five years the breeding of quail "coturniculture" long, has been the object of a real interest in the African countries like Algeria, Morocco and Cameroon ... etc, thus contributing to the diversity of their poultry products [10]. Like these countries, cotton farming in Côte d'Ivoire is motivated by the production of meat, eggs (alicament) and its precocity [3]; [12]. It has many potentialities and is characterized by simplicity in its practice, a need for limited space and financial resources [27]. Due to its short production cycle and early slaughter age, quail offers fast cash flow and good financial returns. In addition, improved breeding performance of quail meat in recent years through genetic selection makes it an asset for livestock production [28] Similarly to the egg, the quail meat seen its organoleptic quality and its balanced composition in nutrients is more and more requested. It is a lean meat, digestible, very rich in proteins and minerals. With low cholesterol, quail meat has a higher nutritional flavor than many poultry [14]. The growth of the quail is a reflection of what she eats. In intensive farming, the fleshed quail must weigh about 175g to 200g live weight when its maintenance and production needs are well covered by a suitable and balanced diet [27]. This should also be accompanied by good hygienic practices and good prophylactic follow-up [16]. To obtain animals with good performances (weight and health), it is important to respect in quail food as much as possible its nutritional needs. However, in most farms in Côte d'Ivoire, quails are fed with broiler and / or layer feed without actually taking into account the real needs of the animal. That is why this study has the general objective of developing a diet based on local products, adapted for the development of coturnidiculture in Côte d'Ivoire. This would be a real contribution to biosecurity in that country.

2. Material and Method

Situation of the experimental site:
The study was carried out on the ISMOREL farm located in the commune of Adiaké; these geographic coordinates are 5 ° 17'06'North and 3 ° 18'07 " West. The average annual temperature was 28 ° C, with an average annual rainfall of 1784 mm of rain. Said farm is located about 2 km from the city, and 100 m from the crossroads that lead to the villages of Assomanan and Aboutou. It covers an area of three (3) hectares and has nine livestock buildings, including six (6) large buildings (60m / 10m) and three (3) small (20m / 8m).

Experimental device and experiment management
Three groups of 180 quails (coturnix japonica) from F1 generation were obtained after egg hatching. These groups were formed after sorting and weighing the quail. The mean live weights of the clams used at the start of the experiment were 7.46 ± 0.72 g (lot cajanus), 7.37 ± 0.62 g (lot moringa) and 7.34 ± 0.55 g (lot witness). After constitution of the different batches, the animals were transferred to chicks previously heated using gas radiant. During the first 14 days, the temperature was maintained between 38° and 40° C and then decreased to 34°-35° C by reducing the gas flow. After

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21 days of heating with continuous illumination, sexing was performed based on the external characteristics of the plumage and staining of the sternum. This separation made it possible to avoid early mating. After sexing, 120 quails of very close living weight were then selected from each group and divided into 4 groups of 30 individuals, including 3 groups of females and 1 group of males. These lots were made randomly and put in collective cages of size: 50 cm x 40 cm x 40 cm. They were raised in these until sexual maturity. During the test, each group of animals was dieted according to their physiological stage (Table 1).

At start, the quails were fed ad libitum for two (2) weeks. Nevertheless, the daily quantity of food served and the refusals were weighed. From the 15th day of age, the amount of food served was a function of the age and number of live animals in the cage. Thus, for each group, 15 g of food were served per day and per quail. This diet was supplemented with 5g of food every 3 days if we noticed almost empty feeders the next day. The addition was made until reaching a ration of 30 g per quail maximum.

The distribution of the food ration was done in several departments in order to reduce food wastage (6 times / day during start-up) and (3 times / day in growth phase). In order to prevent the appearance of any pathologies, strict measures of sanitary biosecurity (daily cleaning of the building, water troughs and feeders, weekly dedusting of the fence of the building and the cages) have been respected. The weight parameters such as the quantities of food served, the refusals and the mass of the animals were determined using an electronic balance of 5 kg range and accuracy (0.01 g).

Food rations and refusals were weighed on a daily basis, which made it possible to calculate feed intake (FI) and consumption index (CI). As for the animals, they were weighed every three days up to 42 days of age. The weighing involved a sample of 30 randomly selected animals per diet. After sexing, weighing was done following a draw of 5 females per batch (5 x 3 lots) and 15 males per diet. The values recorded for each group were set in semiforms without distinction of sex. They were used to calculate the mean live weight (MP), the average total earnings (GMT) and the average daily earnings (GMQ) of the animals of the different diets. The animals were observed daily and examined to detect and remove the sick and the dead in each batch. The number of dead and sick animals recorded per batch was used to calculate the health risk index (HRI) for each diet.

The formulas of the calculations performed are as follows:
Pm = Σ (live weight) / nA
GMQ (g / d) = Σ (Pf-Pi) / nA x ΔT
GMT = Pi-Pf
FI (g / d) = (quantity of food distributed - refusal) / nA
CI = quantity of food consumed per day / GMQ
HRI = number of morbid animals + number of dead animals, with:
GMQ = average daily gain
Pi = initial weight of animals
Pf = final weight of animals
nA = Total number of animals
ΔT = Breeding time

Chemical analyzes
The approximate composition of the test inputs (moringa oleifera leaf meal, raw pigeon pea seeds, maize, soybean and wheat bran) and experimental diet samples were determined using the methods of the Analytical Chemist Association. (AOAC, 1990) at the National Laboratory for Agricultural Development Support (LANADA).

Statistical analyzes:
The nuances between the three diets were evaluated using the student's T test. The diet was the fixed effect, with 5% as the threshold of significance. The STATISTICA version 7.1 software was used to perform these tests. The impact of the food on the morbidity rate, mortality and the health risk index, was analyzed and compared using the software R version 2.10.1 G test.

3. Results

Impact of food on change in body weight
The effect of diets on the evolution of live weight of animals is presented in Figure 1. This figure shows similar weight changes for all lots of quail subjected to different diets. However, birds fed the moringa diet had live weights of 16.04 ± 0.76g; and 165.54 ± 0.81g, respectively from the 6th to the 42nd day of age, higher than those subjected to the control diets and cajanus. During the entire test period, the animals of the Cajanus diet recorded the lowest live weight, these weights ranged from 9.03 ± 0.62g to 151.72 ± 0.64g between the 6th and 42nd days of life. Age. The statistical test indicates that the mean live weight of moringa quail is significantly higher ($P < 0.05$) than that of the control and cajanus diets, regardless of the age of the animals. On the other hand, it does not indicate any significant difference ($P > 0.05$) between the weights of the animals of the cajanus group and those of the control group (12.69 ± 0.63g to 155.51 ± 0.64g).

Impact of diet on feed intake
Quail food consumption by physiological stage is shown in Table 2. The data in this table show that feed intake of quail increases with age.

During the start-up phase (1 to 14 days) quails fed with the moringa diet (12.11 ± 0.27 g / day) had a significantly higher daily consumption ($p < 0.05$) than quail in the control groups (10.62 ± 0.32 g / day) and cajanus (8.61 ± 0.29 g / day). The consumption of quail diets containing Cajanus cajan seed meal was significantly lower ($p < 0.05$).

During the growth phase (15 to 28 days) there was no significant difference ($P < 0.05$) between consumption of quails fed with the moringa diet (14.53 ± 0.36g / day) those fed with the diet Cajanus (12.23 ± 0.22g / day). However, quail consumption in the control group (16.58 ± 0.35g / day) was significantly ($p < 0.05$) higher than moringa and cajanus diets.

During the finishing period (29 to 42 days of age) the quail food consumption of the control group (22.44 ± 0.37 g / day) was significantly ($p <0.05$) higher than that of the Cajanus batches. (19.3 ± 0.32g / day) and moringa (21.46 ± 0.34g / day), which presented statistically identical feed intakes ($p >$

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0.05). Cajanus-fed quail recorded the lowest intake ($p < 0.05$) at 13.28 ± 0.34 g / day, compared with 16.3 ± 0.41 g / day for the whole period of the test. Controls and 16.03 ± 0.35 g / day for moringa group animals.

Impact of diets on animal weight gain

Throughout the experiment, the average daily gains (GMQ) of the animals evolved similarly regardless of the diet. However, the GMQs of the quail of the Cajanus diet remained below those of the quail of the control and Moringa groups. In the 6 to 12 day age range quails from the control and The animals of the moringa group presented very close average daily gains (GMQ). During the experiment quails fed the moringa diet gave higher average daily gains (GMQ) (Figure 2)

The (GMQ) and the mean total gains (GMT) of the animals fed the different diets are shown in Table 3 and Figure 2. Moringa diet-fed quail had a statistically higher GMQ (4.569 ± 1.584 g / day) than control diet (3.27 ± 1.035 g / day) and cajanus (3.27 ± 1.035 g / day) ($P < 0.05$). Quail with the incorporated Cajanus cajan seed diet and those fed the control diet had the lowest GMT (143.611g for the Cajanus diet and 148.159g for the control). The statistical test does not mention any significant difference ($P > 0.5$) between these two diets with regard to the GMT of the animals. The GMT of the moringa-containing diet was significantly better ($P < 0.05$) than the quail of the control diets and cajanus.

Impact of diet on the consumption index (CI*)*

Data on quail consumption indices by diet and physiological stage are summarized in Table 4. The statistical test applied to these data shows that during the start-up phase (1 to 14 days) quail fed with the ration containing moringa had a consumption index (2.2 ± 0.2) significantly ($p < 0.05$) better than those of the control and cajanus groups (2.7 ± 0.08 and 2.5 ± 0.41). However, no significant difference was found between the consumption index of quail subjected to the Cajanus diet compared to that fed to the control diet during this same phase.

During the growth phase (15 to 28 days) the animal consumption indices of the Cajanus and Moringa diets were significantly different ($p < 0.05$) from that of the control diet. However, the quail consumption index of the control group (4.2 ± 0.22) was higher than the index of the animals of the Cajanus diet (3.7 ± 0.27) and the consumption index of the quail with rations containing moringa (3.6 ± 0.23).

The substitution of fishmeal for pigeon pea showed no effect on the quail consumption index during the finishing phase (29 to 42). Indeed, animals subject to The diet containing cajanus showed a CI statistically identical to that of quail fed the control diet (5.9 ± 0.12).

Over the entire period of the experiment, quails fed moringa diets had the best consumption index (3.5 ± 0.25). In contrast, the control animals had the highest consumption index ($p < 0.05$) (4.2 ± 03).

Impact of food on the health of quail

Data on mortality, morbidity and the health risk index (HRI) are summarized in Table 5. This table indicates that a total of 89 out of 540 animals had health problems between start-up and follow-up. the age of 42 days. Fifty (50) of these 89 sick animals died. The symptoms on clinical examination were: weight loss, sneezing, depression and / or bloating. Autopsy revealed swelling of the caecums, especially in the dead quails of the diet group containing Cajanus cajan flour. The morbidity and mean mortality rates calculated from all animals at the end of the study are 39 quail (21.7%) and 50 quail (27.8%) respectively. The sanitary risk index (HRI) of the batch subjected to the incorporated Cajanus cajanus seed meal diet is higher with a rate of 38% compared to 27% for the control group and 24% for the group subjected to the diet containing the flour. Moringa oleifera ($p < 0.05$). In the 1 to 14 day old period, morbidity in the moringa group (3.9%) was significantly lower than that in the cajanus group ($p < 0.05$). On the other hand, morbidity (8.3%), mortality (7.7%) and HRI (16.1%) of animals fed the Cajanus diet were significantly higher during these first two weeks. However, in the control and moringa groups, morbidity and mortality were very similar. In the age ranges of 15 to 28 days and 29 to 42 days, no significant differences were found between diets with respect to these parameters ($p > .0,05$)

4. Discussion

Impact of food on change in body weight

The incorporation of *Cajanus cajan* grain flour as well as *Moringa Oleifera* leaf meal resulted in good weight growth in quail throughout the experiment period. Moringa oléifera leaf meal induced the best growth with a total weight gain of 4.569 ± 1.594g / day. This would be related to the richness of this element in protein (23.93 ± 0.03%), vitamin C (1.68 ± 0.26%) and reducing sugars (39.16 ± 0.01%). Moreover, [18], found that this plant has a high pepsin content (soluble protein) than most plants, making it a good source of protein for monogastrics. The incorporated Moringa oleifera leaf meal diets showed energy amounts of 2905.61 Kcal / Kg (for the starter feed) and 2916.2 Kcal / Kg (for the growing food), followed by levels of crude protein of 27.45% (for the starter feed) and 22.15% (for the growth food), which meets the quail nutrients requirements. Indeed, according to [27], a quail food must contain 25 to 28% of protein at startup and 22% in fattening. Also, these foods will have to provide them, 2695 to 3000 Kcal / Kg for a good growth. Such results have been obtained by (Tendokeng *et al*. 2008) who reported an improvement in chickens' weight gain with the incorporation of Moringa oleifera leaves into their meal diet. These results also corroborate those of [21], who found that leaves of *Moringa oléifera* were a good source of protein in the diet of monogastrics. Also, [8], showed that the inclusion of 8 to 16% *Moringa Oleifera* leaf meal in the local chicken diet significantly improves their GMQ.

Impact of diet on feed intake

During our work the dietary intake of quail varied according to the diet and the age of the animals. This state of affairs can be explained on the one hand by the chemical composition of the ration (protein value, energetic value, calcium value, antinutritional factors, etc.) which has an influence on the consumption of a food. Thus, the low ingestion values recorded in quail fed Cajanus diets are believed to be the cause of tannins and other antinutritional factors in raw Cajanus seeds that give them a bitter [13] and

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make them less palatable. Comparable ingestions were observed by [5] and [15]. The high intake values recorded with the control diet would be the cause of low protein levels in these diets. Indeed, the protein levels (20.5% at startup and 18.2% for growth) of the control rations are lower than the standards required to meet the needs of quail reared in the tropics (24 to 28% at start-up, and 22% for growth). To seek to satisfy their protein needs, quails tend to consume more food.

The results of consumption of quail in the control group during the finishing period corroborate those of [26] and [29] who found ingestion levels between 15.01 and 19 g / day. On the other hand, other authors have reported lower ingestions [11] (12.08 and 10.77g / day).

Impact of diets on animal weight gain

Quail diets containing cajanus grain meal (Altc) had mean live weights very close to those in the control diet. And yet, both diets had different crude protein levels. In fact, the raw protein contents of the diets containing cajanus grain meal (Alt c) are 25.25% (starter feed) and 21.32% (food growth) compared to 20.5% (starter feed). And 18.1% (growth food) for the control diets (Alt). The poor growth performance presented by animals fed diets containing cajanus could, according to [2] to be justified by the fact that the raw Cajanus cajan grains contain tannins, and antinutritional factors influencing the palatability of the food. These elements would have prevented a good digestibility of the nutrients of the food; which resulted in low growth weight of the animals. [2]also showed that pigeon pea treated by soaking between 24 and 72 hours or roasted in 30 minutes gave a good protein level and at the same time a better weight growth rate of quail fed with feed incorporated by 30% flour of Cajanus cajan seed flour. This is in agreement with the results of [31] who showed better GMQ in quail fed with a feed containing 10% roasted pea pea flour[25] found during their work that the incorporation of 20% raw pea pea flour combined with 200 ml / 100 kg of vegetable oil in the broiler diet increases their growth performance. According to these authors, vegetable oil inhibited the action of the antinutritional factors of pigeon peas, which thus favored the digestion of nutrients and indirectly contributed to the improvement of growth. The results obtained by [4], [25] and [25] on the use of pigeon pea in animal feed proved conclusive in improving the GMQ of experimental animals.

Impact of diet on the consumption index (CI)

The consumption index (CI) of the quail of the control groups (4.2 ± 03) studied is comparable to that found by [6] and [20] in their control group (from 3.7 to 10.2). This high IC found in the quail of the control group during our work would be the cause of the increase in consumption observed in this group. This increase, which was intended to meet the nutritional and protein requirements of quail, led to an increase in IC. This finding was made by [9] in quails in the growth phase fed on a diet containing faba beans treated.

Also the reduction in the CI of animals fed rations containing pigeon pea flour would have been caused by reduced ingestion in these animals. In addition, the presence of antinutrients and tannin makes the food less palatable thus reducing feed efficiency and ingestion, hence the decrease in consumption. Similar discoveries were made by [17] in the experiments and corroborated by those of [13] During the work, quails fed Moringa oleifera leaf meal diets did not exhibit better ICs compared with the CI of control and cajanus animals. This performance can be attributed to the composition of the leaves of Moringa oléifera which is a good source of protein but also contains very little tannin, phytate saponins and oxalate which are antinutritional factors [22]. Similarly, [24] have argued that the absence of heavy metals in Moringa Oleifera leaves makes them very transformable for incorporations into monogastric foods. According to these previous studies we can deduce that the leaves of Moringa oléifera improve the performance of quail. Our results are in agreement with those of [7]. These authors have shown in their experiments that *Moringa Oleifera* leaf-based diets significantly improve animal performance but do not have adverse effects on the daily consumption of these animals.

Impact of food on the health of quail

From 0 to 14 days of age, animals fed the *Cajanus cajan* seed diet had a higher health risk index (HRI), mortality and morbidity. On the other hand, those fed moringa had the lowest values of the same parameters, ie about two (2) times less than those of cajanus.

These observed differences could be caused by the antinutritional factors contained in raw pigeon peas. [25] proved it during these works. Pigeon pea is a good source of protein and minerals for animal feed. However, it contains many antinutritional and toxic factors that do not promote good nutrient uptake and cause abdominal bloating due to flatulence [24]. The work of [19] on the inclusion of unprocessed protein weights in diet also showed high mortality rates in laying hens. These authors also put this high mortality rate on account of the presence of antinutritional factors and tannins in the cortex of legume seeds.

The low mortality recorded in moringa animals is justified, on the one hand, by the low level of antinutritional factors in these leaves, [18] and on the other hand by these therapeutic virtues [8].

No significant differences were revealed between the different regimes with respect to the IRS during the growth phase. Similar results were found by [9]. According to this author, quails are more sensitive to the antinutritional factors of protein peas during the start-up phase. This is responsible for a high mortality rate in quails fed rations containing raw *Cajanus cajan* seed meal. In addition, he noted during this work that the inclusion of unprocessed faba bean and field pea in quail rations during the growing season did not have a negative effect on their health.

5. Conclusion

The results obtained in this study show that *Cajanus cajan* seeds and *Moringa oleifera* leaves can be used as a source of protein in poultry feed as well as commonly used soybean meal, cotton peanut ... etc.). Indeed, these inputs in this study have led to very good growth in quail. The flour Cajanus cajan seeds can validly substitute fish meal in the diet of quail because these two inputs have induced the same

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growth performance in these animals. However, it would be more appropriate to treat the seeds of *Cajanus cajan* by roasting or soaking to eliminate its antinutritional substances for the purpose of make it more digestible by animals. As for moringa leaf flour, it has been the best source of protein for quail feed formulation.

References

[1] **Angela U., 2017:** The Effect of Moringa Oleifera on the Growth Performance, Packed Cell Volume (PCV) and Laying Capacity Of Young Growing Quails American Journal of Zoological Research, *Science and Education Publishing* 5 **(2)**: 33-37

[2] **Akintunde A R., Omage J J., Bawa, G S., Onimisi P A & Afolayan M., 2017:** Growth performance and nutrients digestibility of japanese quail chicks (coturnix coturnix japonica) fed diets containing raw and processed pigeon pea seed meal based diets. *Journal of Animal. Productions.* 29 **(10)**: 257-267

[3] **Alkan S., Karabag K., Galiç A., Karsli T., Balcioglu M S., 2010:** Determination of Body Weight and Some Carcass Traits in Japanese Quails (*Coturnix coturnix japonica*) of Different Lines. *Kafkas University of Vetenary FakDerg* 16 **(3)**: 277-280.

[4] **Amaefule KU., Obioha F C., 2007:** Pigeon pea (Cajanus cajan (L.) Mill sp.) Seed meal in layer diets: 2. Laying performance and egg quality characteristics of pullets fed rawor processed pigeon pea seed meal diets during grower and layer stages of life. *International Journal of Poultry Sciences*; 6 **(6)**: 445-451

[5] **Aminzade B., Karami B & Lotfi E., 2012:** Growth response and carcass characteristics of Japanese quail to *Mentha piperita* plant Supplementation. *Animal Biology & Animal Husbandry International Journal of the Bioflux Society* 4 **(2)**: 24-26

[6] **Attia Y A., Abd El-H., Ellakany H F., Bovera F., Al-Harthi M A., & Ghazaly S A., 2013:** Growing and laying performance of Japanese quail fed diet supplemented with different concentrations of acetic acid. *Italian Journal of Animal Sciences* 12 **(e37)** 222-229

[7] **Banjo O S., 2012:** Growth and performance as affected by inclusion of Moringa oleifera leaf meal in broiler chicks diet. *Journal of Biology, Agriculture and Healthcare* **(9)** 35-38

[8] **Bello H., 2010:** Essai d'incorporation de la farine de feuilles de *Moringa oleifera* dans l'alimentation chez les poulets indigènes du Sénégal : Effets sur les performances de croissance, les caractéristiques de la carcasse et le résultat économique. Thèse, Université Cheik Anta Diop de Dakar (Sénégal) 119 p.

[9] **Bensalah A., 2016:** Effets de quelques formules alimentaires sur les performances zootechniques et le profil biochimique de la caille japonaise. Thèse université des frères Mentouri Constatine, 231p

[10] **Berrama Z., Mefti H., Kaidi R & Souames., 2011:** caractérisation Zootechnique et paramètres génétiques des performations de croissance de la caille japonaise coturnix japonica élevée en Algérie. *Livestock recherche for Rural Developement* 23 **(11)** 1-14

[11] **Chantiratikul A., Chantiratikul P., Sangdee A., Maneechote U., Bunchasak C & Chinrasri O., 2010:** Performance and carcass characteristics of Japanese quails fed diets containing wolffia meal [*Wolffia globosa (L). Wimm*.] As a protein replacement for soybean meal. *International Journal of Poultry Sciences* 9 **(6)**: 562-566.

[12] **Duymus M., Demiraslan Y., Akbulut Y., Orman G., Aslan K. & Ozcan S., 2013:** The Statistical Analysis of Some Volumetric Measurements in the Japanese Quails' Head with Different Feather Color: A Computed Tomography Study. *International Journal of Poultry Sciences* 12 **(2)**: 121-125

[13] **Gemede HF & Ratta N., 2014:** Antinutritional factors in plant foods: Potential health benefits and adverse effects. *International Journal of Nutrition and Food Sciences* 3 **(4)**: 284-289.

[14] **Genchev A., 2012:** Quality and composition of Japanese quail eggs (*Coturnix japonica*). *Trakia Journal of Sciences*, **(10)**: 91-101.

[15] **Hajkhodadadi I., Moravej H., Shivazad M., Ghasemi H & Zareh-Shahneh A., 2014:** Lysine requirements of female Japanese quails base on performance and carcass variables from twenty-One to Forty-Two days of age. *Iranian Journal of Applied Animal Sciences* 4 **(6)**: 629-635.

[16] **Hrncar C., Hanusova E., Hanus A., Bujko J., 2014:** Effect of genotype on egg quality characteristics of japanese quail (*coturnix japonica*), *Slovak Journal of Animal. Sciences*, 47 **(5)**: 6-11

[17] **Jacob J., 2012:** Antinutritional factors in feed ingredients, university of Kentucky In extension.org.Disponible sur: http://articles.extension.org/pages/66921/antinutritional-factors-in-feed-ingredients. Consulter le : 23/02/2016.

[18] **Kakengi., A.M.V., Shen., M.N., Sarwart S.V. & Fujihara, T., 2003.** Can Moringa oleifera be used as protein supplement to ruminant diet? *Asian-Australian Journal of Animal Sciences*, 18 **(4)**: 42-47

[19] **Koivunen E., Tuunainen P., Valkonen E., Rossow L & Valaja J. 2014:** Use of faba beans (*Vicia faba L.*) in diets of laying hens. *Agricultural and Food Sciences* **(23)**: 165–172.

[20] **Makinde OJ., Sekoni AA., Babajide S., Samuel I & Ibe E., 2013:** Comparative response of Japanese quails (*Coturnix coturnix japonica*) fed palm kernel meal and brewer's dried grain based diets. *International Journal of Agriculture and Biosciences* 2 **(3)**: 217-220.

[21] **Mahmoud H M., Haggag A M H & El-Gebaly H S., 2012:** Toxicological studies of malathion on Japanese quail (*coutrnix Japonica*). *Life Sciences Journal*, 3 **(9)**: 1725-1732

[22] **Moussa M M., Riry., Shata F H., Elklou K., Moustafa M EL., Youssef S F &** [20]**Alghonimy A H., 2016:** Effet of using germinated *Moringa oleifera* seeds on Japanese quail growth performance. *Animal Production Research Institue* 36 **(5)**: 561-567

[23] **Mukhtar A., Mukhtar Atif E & Amal O., 2013:** Réponse of broiler chicks fed on diets containing graded levels of pigeon pea (*cajanus cajan*) seeds supplemented with essential caraway oil. *Journal Of Current Research In Sciences*, 2 **(3)**:109-112

[24] **Oludoyi I A & Toye A A., 2015:** The effet of early feeding of Moringa oléifera leaf meal on the

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performance of broiler and pullet chick. *International Journal of Poultry Sciences*, 1 **(6)** 456-474

[25] **Oyarekua M A., 2013:** Biochemical and Microbiological changes during the production of fermented pigeon pea (Cajanus cajan) *African Journal of Food Science and Technology*. 2 **(10)** 223-231.

[26] **Peyman F., Yahya E., Habib A S., Naser MS & Alireza A., 2014:** Effects of organic acids supplement on performance and gut parameters in male Japanese quail (*Coturnix Coturnix*).*Biological Forum – An International Journal* 6 **(5):** 127-134.

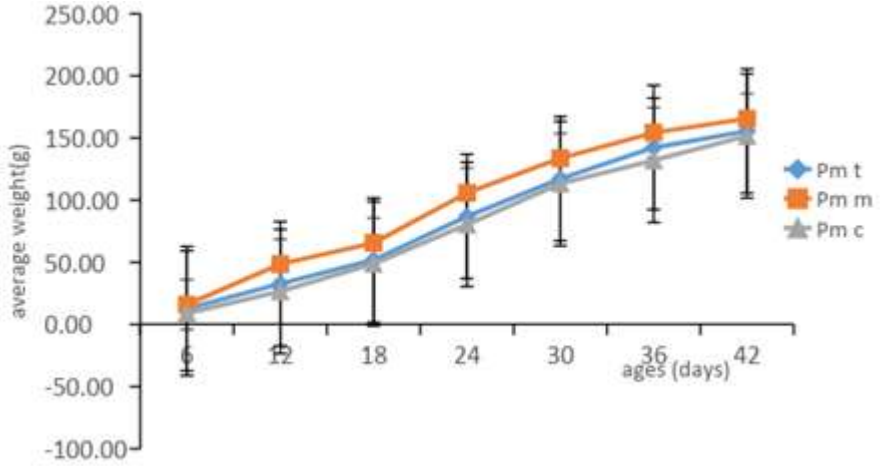
[27] **Ricarda Mondry., 2016:** Élevage des cailles en milieux tropical, Collection *Pro-Agro* 32p

[28] **Sarabmeet K & Mandal A B., 2015:** The performance of Japanese quail (White Breasted Line) to dietary energy and amino les performences de la caille japonaise (*coturnix japonica*) *Egypte Poultry sciences*, 35 (12): 1095-1108

Table1: Centesimal and chemical composition of food

	Alt		Alt m		Al c	
Ingredients (%)	start-up	Growth	start-up	Growth	start-up	Growth
Corn	56	58,9	37	44	34	45
Bran	14.5	14	7	7,8	8	8
Soybean meal	22	22	42	34	42	34.8
Fishmeal	3,5	1	00	00	00	00
Cajanus grain flour	00	00	00	00	12	8
Marine seashell	00	0.1	00	0.2	00	0.2
Moringa dry leaf flour	00	00	9.5	10	00	00
CMV *	4	4	4	4	4	4
Bromatological composition						
Metabolizable energy (Kcal / kg)	2930.9	2921.52	2905.61	2916.28	2846.56	2896.18
Crude protein (%)	20.5	18.2	27.45	22.15	25.25	21.32
Fat (%)	2.75	2.82	2.25	2.34	4.16	1.92
Mineral matter (%)	12.83	10.71	8.65	7.06	8.29	6.42
Raw fiber	3.5	3.43	3.72	3.83	5.57	7.35
Calcium (%)	1.25	1.5	1.23	1.16	1.4	1.2
Phosphorus (%)	0.34	0.82	0.65	0.78	0.70	0.79
Lysine (%)	0.83	1.42	1.45	1.14	1.3	1.17
Methionine (%)	0.33	0.56	0.58	0.52	0.45	0.51
Vitamin A	1000 UI	1000 UI	1000 UI	1000 UI	1000 UI	1000 UI

* *Mineral supplement and vitamins*



Pm c (average weight of the cajanus group), *Pm m* (average weight of the moringa group), *Pm t* (average weight of the control group

Table 2: Impact of diet of feed intake

Ingested (g / day / quail)			
Age (day)	control	cajanus	moringa
1 à 14	10,62 ± 0,32[a]	8,61 ± 0,29[b]	12,11 ± 0,27 c
15 à 28	16,58 ± 0,35[a]	12,23 ± 0,22 [b]	14,53 ± 0,36 b
29 à 42	22,44± 0,37 [a]	19,3 ± 0,32 [b]	21,46 ± 0,34 b
1 à 42	16,35 ± 0,41[a]	13,28 ± 0,34[b]	16,03 ±0,35 b

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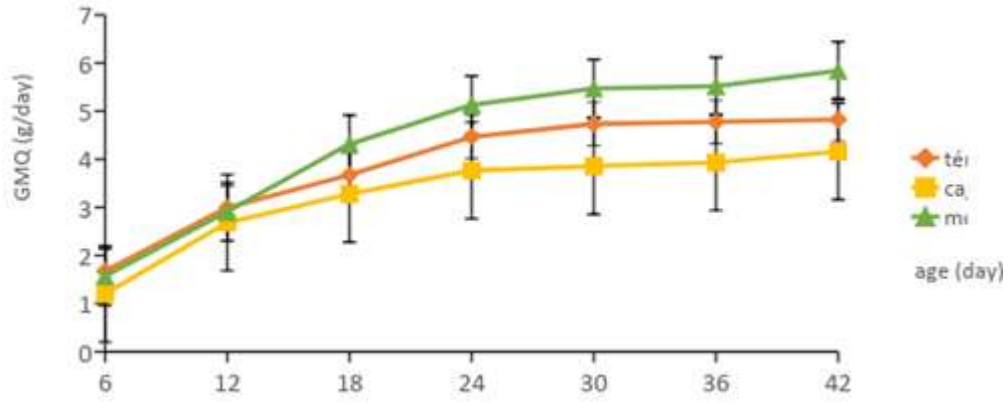

The numbers of the same indexed lines of the same letters are not significantly different at P <0.05

Table 3: Impact of food treatments on zootechnicals parameters

	Treatements		
parameters	Control	Cajanus	Moringa
Initial live weight (g)	7,346 ± 0,55[a]	7,461 ± 0,72[a]	7,371 ± 0,62[a]
Final live weight (g)	155,505 ± 11,31[a]	151,72 ± 13,53[a]	165,544 ±10,58[b]
GMQ (g/jour)	3,88 ± 1,186[a]	3,27 ± 1,035[a]	4,567 ± 1,594[b]
GMT (g)	148,159[a]	143,611[a]	155,173[b]

The numbers of the same indexed lines of the same letters are not significantly different at (P <0.05)

Table 4:Effect of diet on the consumption index

	Consumption index (IC)		
Age (days)	control	cajanus	moringa
1 à 14	2,7 ± 0,08 [a]	2,5 ± 0,41 [a]	2,2 ± 0,2 [b]
15 à 28	4,2 ± 0,22 [a]	3,7 ± 0,27 [b]	3,6 ± 0,23 [b]
29 à 42	5,8 ± 0,08 [a]	5,9 ± 0,12 [a]	4,7 ± 0,2 [b]
1 à 42	4,2 ± 03 [a]	4,1 ± 0,35[a]	3,5 ± 0,25[b]

The numbers of the same indexed lines of the same letters are not significantly different at (P <0.05)

Table 5: Effect of diet on quail health

	Treatments		
	control	moringa	cajanus
1 to 14 days			
Effective	180	180	180
Morbidity (%)	10 (5,6) [a]	7 (3,9) [b]	15 (8,3) [a]
Mortality (%)	7 (3,9) [a]	9 (7,5) [a]	14 (7,7) b
HRI (%)	17 (9,4) [a]	16 (13,3) [a]	29 (16,1) [b]
15 to 28 days			
Effective	163	164	151
Morbidity(%)	2 (1,23) [a]	1 (1,22) [a]	2 (1,4) [a]
Mortality(%)	5 (3,1) [a]	4 (3,1) [a]	5 (3,4) [a]
HRI (%)	7 (4,3) [a]	5 (4,3) [a]	7 (4,7) [a]
29 to 42 days			
Effective	156	159	144
Morbidity(%)	1 (0,64) [a]	1 (0,63) [a]	0 (00)
Mortality(%)	2 (1,3) a	2 (1,3) [a]	2 (1,4) [a]
HRI (%)	3 (1,9) [a]	3 (1,9) [a]	2 (1,42) [a]
1 to 42 days			
Effective	180	180	180
Morbidity(%)	13 (7,2) [a]	9 (5) [b]	17 (9,4) [a]
Mortality(%)	14 (7,8) [a]	15 (8,3) [a]	21 (11,7) [b]
HRI (%)	27 (15) [a]	24 (13,3) [a]	38 (21,1) [b]

The numbers of the same indexed lines of the same letters are not significantly different at (P <0.05)

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