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The effect of feeding restriction with cassava flour on carcass composition of broilers

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Abstract

In order to promote poultry farming in resource-limited rural areas, the effects of feeding restriction with cassava flour on the carcass composition of broilers was studied. After three weeks on a restrictive diet (step 1), the broilers were re-fed during four weeks according to their physiological needs (step 2). In total, 75 four-weeks old chicks were randomly divided into three lots of 25 subjects. Lot I (control) is fed without cassava flour. The lots II and III are fed with diets containing respectively 10 and 30 % of cassava flour, with energetic and protein density of 85 and 70 % of the control. Eight broilers of each lot have been randomly selected and slaughtered at the end of each step. At the end of the restrictive step, the carcass yields and the weights of the digestive tracts are 67.1, 66.3, and 64.7 % and 178.5, 170.0, and 113.3 g respectively for the lots I, II, and III with a significant difference ($p \leq 0.05$) between lot I and III and then between lots II and III. After 4 weeks of re-feeding, the lots I, II, and III had respectively 69.9, 73.2, and 67.7 % of carcass yield as well as digestive tract weights of 178.3, 180.8, and 156.0 g. The carcass yield had been entirely made up ($p \geq 0.05$) to the broilers previously submitted on a restrictive diet. However, the weight of the empty cold carcass was not fully compensated ($p \leq 0.05$).

Keywords: broiler, cassava flour, carcass productivity, compensatory growth

1 Introduction

The breeding of short cycle animal species, such as poultry, has remarkably increased over the last decades because of its socio-economic importance and mainly its obvious dietary and nutritional value in underdeveloped countries such as the Benin Republic. A growing number of households, particularly in rural areas, are devoted to small size animal breeding, mainly in poultry farming. Poultry farming contributes a great extent to the provision of highly nutritious diet values and helps satisfy numerous social obligations (consumption, savings, schooling, health care, clothing, etc.). In order to improve the very low zoo-technical performance of local broilers, particularly the carcass yields, many traditional farmers and households do not hesitate to introduce improved and genetically efficient broilers strains. Two difficulties which farmers face in such a process of efficiency improvement are sanitary and dietary requirements of these improved progenitors. These broilers are not able to express their production and reproduction potentials unless their husbandry sanitary and dietary conditions are sufficiently improved. Broilers feed in order to be efficient requires both quantitative and qualitative norms. Indeed, broilers bred to grow quickly need a diet that gives them all the necessary nutrients in sufficient quantity. The raw materials used in the feeding of broiler chickens must satisfy the requirement of digestive and metabolic efficiency, because the digestive

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tract of poultry is shorter than that of other domestic animals. According to Rougière (2010), total transit is relatively rapid in chickens compared to monogastric mammals. On average, the average residence time in the digestive tract varies between 5 and 9 hours. So, to compensate the relatively short digestive tract and rapid digesta transit time, high-performing birds need easily digestible nutrient-dense diets (Phocas *et al.*, 2014). Poultry farming thus becomes a very uncertain activity for these rural households because of its high cost. According to several authors (Detimmerman *et al.*, 1992; Picard *et al.*,1993; Agreste Conjoncture, 2015) the feeding of monogastric animal species, especially poultry occupies more than $^{2}/_{3}$ of the total cost of production. This diet is all the more onerous because it uses grains of cereals that usually are concurrently a part of the human diet. In Benin, one of the most utilised essential raw materials in broilers diets is maize, which can be used as whole kernels or maize meal in feed. For the production of a poultry diet, farmers generally mix 50 to 70 % of maize as an energy source into the diet (Salami & Odunsi, 2003; Teguia *et al.*, 2004; Ukachukwu, 2008). However, maize is a staple food for the population in Benin. Therefore, the periodical unavailability and inaccessibility of this diet ingredient limit its permanent use as raw material in the formulation of broiler diets. As a result, periodic feed restriction as a feeding strategy is necessary because of the increasing scarcity of food resources for humans and livestock. Indeed, climate change is becoming increasingly unfavourable for agricultural activities, especially for the production of food crops. According to Baudoin (2010), the Benin agriculture is mainly rain-fed, losses or yield reductions are a common risk exacerbated by climate change. The challenge for local traditional breeders is to be able to adapt to this new situation. The strategy of periodic feed restriction in broiler chicken production offers the alternative of a more efficient management of feed resources at the village level. Moreover, it helps to avoid metabolic disorders, excessive fat deposition and therefore makes the production profitable (Sahraei, 2012). The objective of the study is to be able to partially replace maize with cassava flour in the feed of genetically improved broiler chickens. The aim of this feeding strategy is to reduce the usual high production costs of traditional local poultry farmers who do not have enough resources. Because cassava as a source of food energy is more available and more accessible, it is expected that the use of cassava flour in poultry diets will lead these poultry producers to be less dependent on maize. Many studies have been carried out on the feeding of broilers based on cassava flour with sometimes contradictory results (Tada *et al.*, 2004; Zanu & Dei, 2010; Ngiki *et al.*, 2014; Motielal *et al.*, 2016). Since cassava flour is more fibrous than maize (Ngiki *et al.*, 2014), its incorporation into the diet of monogastric animal species, especially poultry, certainly affects zoo-technical performance, specifically carcass yield and carcass composition (Zanu *et al.*, 2017; Okosun & Eguaoje, 2017). The level and duration of the incorporation of cassava flour into the broiler feeding thus determine the extent of the consequences on expected performance. One of the consequences is undoubtedly the increase in feed consumption which can be economically compensated by a decrease in the nutritional value of the ration. It has been shown that poultry primarily seek to cover their dietary energy needs (Hossain *et al.*, 2012). This explains the fact that these animals tend to consume more feed with low energy density (Leeson *et al.*, 1996). Short-term feed and nutritional deprivation are likely to induce a bulimic reaction in many animal species that may result in compensatory growth (Sainz *et al.*, 1995; Toukourou & Peters, 1999; Hoch *et al.*, 2003; Więcek *et al.*, 2008). This phenomenon, whose bio-physiological mechanism is still poorly understood, can be used as an effective strategy for the efficient management of food resources. Several studies showed the possibility to replace 10 to 80 % maize with cassava flour in the broilers diets without any significant difference in their production efficiencies and other zoo-technical parameters (Eshiett *et al.*, 1980; Gomez & Valdivieso 1983; Garcia & Dale 1999). Cassava flour is more available and accessible than maize in almost all areas in Benin. It may be strategic to partially replace maize with cassava flour in broiler diets therefore limiting protein and energy content of the diet. The research question is the following: Can the broilers previously submitted to a restrictive diet made up of cassava flour reconstitute their carcass once their food condition is normalized?

2 Materials and methods

2.1 Framework

The test is conducted at the Faculty of Agronomy Application and Research Farm of the University of Parakou. The township of Parakou is located in the centre of the Benin Republic between 19° 21′ North latitude and 36° 2′ East longitude. With an average altitude of 350 m, it covers an area of 441 km^2, 30 km^2 of which is urbanized. The climate is Sudano-Guinean type with an annual average rainfall that varies between

Table 1: *Composition of feed rations for the broilers.*

Ingredients	*Starting regime*	*Finishing-growth regime*			
	Regime I	*Regime II (control)*	*Regime III*	*Regime IV*	*Refeeding diets*
Maize (%)	65	70	30	20	70
Cottonseed cake (%)	7	0	4	6	0
Soybean meal (%)	8	10	5	3	10
Fishmeal (%)	6	4	4	2	4
Cassava flour (%)	0	0	10	30	0
Malt brewery residues (%)	0	0	6.5	6.5	0
Maize bran(%)	0	0	25	20	0
Wheat bran (%)	8	12	12	9	12
Oystershell (%)	1.2	1.2	1.2	1.2	1.2
Table Salt (%)	0.25	0.25	0.25	0.25	0.25
Ironsulphate(%)	0.05	0.05	0.05	0.05	0.05
CMV (%)	4.5	2.5	2	2	2.5
Total	100	100	100	100	100
ME (Kcal/kg DM)	3000.00	3100.00	2650.00	2170.00	3100.00
CP (%)	20.00	18.76	16.40	13.10	18.76

CMV: Concentrated Mineral Vitamin; ME: Metabolisable Energy; CP: Crude Protein.

1000 and 1500 mm and two seasons that alternate as follows: a rainy season from mid-April to mid-October and a dry season from mid-October to mid-April. In this part of Benin, the temperature oscillates between 28 and 35 °C.

2.2 *Diet Compositions*

The following four types of diet are prepared (Table 1). Diet 0 (starting diet) is given to all chicks up to the age of 4 weeks. Diet I (growth-finishing diet) is served to the chickens in lot I (control) during growth-finishing period which lasts seven weeks. Diet II is served to chickens in lot II during dietary restriction period and diet III is served to chickens in lot III during the same period. All diets are composed and made from the following raw materials: maize grain, wheat bran, soybean meal, cottonseed meal, fish meal and cassava flour, which are commonly available and accessible at the local markets. In order to obtain the energy and protein levels required in the rations of lots II and III (regime III and IV in Table 1), certain raw materials, in particular, fish meal, soybean meal, cottonseed cake, maize bran and wheat bran, have been readjusted (Table 1). The goal is to restrict protein and energy to a specific level using cassava flour essentially. During the refeeding phase, all lots were subsequently fed at the same level as the control.

2.3 *Animal materials and experimental design*

On the whole, 75 chicks of *hubbard* strain are used. On reception, the chicks receive various usual sanitary treatments (vaccination against *Newcastle*, antibiotic treatment, vitamins, and vaccination against *Gumboro* disease anti-coccidian treatment). The chicks are raised in a room preheated at 35 °C with charcoal during the first week. They are installed on litter made of wood chips at a density of 20 chicks per m^2. The starting phase corresponds to the first four weeks. From the fifth week, the chicks are randomly grouped in 3 lots of 25 subjects at the rate of 20 chicks per m^2. The feed is served twice daily at fixed hours (8.30 am and 5.30 pm) in wooden linear feeders. Drinking water is always available in five litre semi-automatic plastic containers. All the chicks are individually identified by a numbered plastic ring secured to their feet. The experimental design is a *Fisher's* random block design whose treatments are described in Table 2.

2.4 *Broiler slaughtering and carcass dissecting*

Eight broilers are randomly chosen from each lot after each dietary phase and are fasted for twelve-hours prior to slaughtering but were given water during this period. The animals were not stunned prior to slaughter. The slaughtering is executed by jugular vein severing at the neck level. Then, they are soaked in 60 °C hot water

Table 2: *Experimental design of the study.*

Criteria for study	*Test phases*						
	Phase 1	*Phase 2*			*Phase 3*		
	Starting	*Control*	*Restriction*		*Control*	*Refeeding*	
		Lot I	*Lot II*	*Lot III*	*Lot I*	*Lot II*	*Lot III*
Test duration (weeks)	4	3	3	3	4	4	4
Number of chicks at the beginning of each phase	75	25	25	25	17	17	17
Cassava flour in the diet (%)	0	0	10	30	0	0	0
Physiological needs of energy and protein in the diet (%)	100	100	85	70	100	100	100
Number of slaughtered chickens at the end of each phase	0	8	8	8	8	8	8
Number of chicks at the end of each phase	75	17	17	17	9	9	9

and plucked manually. Their body weight is noted before slaughtering. The carcass cutting is done according to the methods described by Ricard *et al.* (1967). The feet are severed at the *tibiotarsis-metatarsia* articulation and the head is dissociated from the neck at the skull-atlas junction. The abdominal fat and all the viscera were then removed in order to obtain the eviscerated carcass. By abdominal fat, we mean the fatty tissue which covers the abdominal wall and surrounds the gizzard. The broiler residues and offal (heart, liver and gizzard) are weighed individually just after slaughter by way of 100 ± 1 g. The dressed carcass was weighed hot, just after slaughter, and cold after 24 hours *post mortem* in the refrigerator at 4 °C. The carcass yield was determined by making the ratio between the weight of the carcass eviscerated without head and feet and live weight before slaughter.

2.5 Data analysis

Statistical analysis of the collected data is performed with SAS (Statistical Analysis System) 9.2 software. The dependent variables such carcass yields and carcass compositions were previously tested for their normal distribution. The statistical model used for the analysis of variance (ANOVA) was as follows:

$$Y_{ijk} = \mu + a_i + b_j + e_{ijk},$$

where:

- Y_{ijk}**:** is an observed value of the dependent variable of interest Y;
- μ**:** the average of the dependent variable of interest Y;
- a_i**:** the fixed effect of dietary level ($i = 1, 2, 3$) ;
- b_j**:** the fixed effect of the live weight of the chicks at the end of the initial period (continuous variable);
- e_{ijk}**:** variance residue.

3 Results

The average live body weight of the broilers at slaughtering, after three weeks of feed restriction (seven weeks of age), was 1264.5, 1174.9, and 802.1 g respectively for the control lot (I), lot II, and III. The average live body weights were 1.57 and 1.46 times significantly ($p \leq 0.05$) heavier for broilers in lot I and II than those in lot III, respectively. The substitution of maize with cassava flour at 30 % in the diet affected the dressed cold carcass weight and the carcass yield of broilers after three weeks of restrictive feeding. The broilers in lot I (control) shown respectively 38.85 and 2.42 % more ($p \leq 0.05$) dressed cold carcass weight and carcass yield, than those of lot III and 8.25 % and 0.85 % ($p \geq 0.05$) than those in the lot II (Table 3). At the end of seven weeks of testing, the full digestive tract weighed 178.5, 170.0, and 113.3 g respectively for broilers in lot I (control), II, and III, with lot I and lot II being significantly different ($p \leq 0.05$) from lot III. Between the two phases of feeding, the gastrointestinal tract experienced a weight increase in subjects previously subjected to a nutritional restriction. It was nearly 38 % among the subjects of lot III against 6.33 % in those of lot II. Subjects in the control group had almost no change (−0.11 %) in their digestive tract. The heart, gizzard, liver, head, feet and abdominal fat have been particularly affected by the dietary restriction with the partial substitution of maize with cassava flour in the diet. Chickens of lot I (without cassava flour in the diet) show an average weight of 8.4, 45.5, 30.8, 36.4, 54.9, and 32.7 g respectively for the heart, gizzard, liver, head, feet and abdominal fat (Table 3). Some of these values are close to those obtained by Ricard (1988) on chickens produced by crossing between *Cornish* and *White Rock* types reared under confined conditions at a density of 10 subjects per m^2 and slaughtered at seven weeks of

Table 3: *Carcass composition of broilers after the period of feed restriction and refeeding.*

Carcass characteristics	*Experimental lots*								
	Lot I (control)			*Lot II*			*Lot III*		
	Step 1	*Step 2*	*Difference (%)*	*Restriction (Step 1)*	*Refeeding (Step 2)*	*Difference (%)*	*Restriction (Step 1)*	*Refeeding (Step 2)*	*Difference (%)*
Slaughter weight (g)	$1264.5^a \pm 49.3$	$1894.4^a \pm 99.6$	49.82	$1174.9^a \pm 48.9$	$1811.1^a \pm 99.9$	54.15	$802.1^b \pm 49.1$	$1341.4^b \pm 99.6$	67.23
Dressed cold carcass (g)	$848.8^a \pm 37.6$	$1323.\ 8^a \pm 76.3$	55.96	$778.8^a \pm 37.3$	$1325.2^a \pm 76.5$	70.17	$519.\ 1^b \pm 37.4$	$908.4^b \pm 76.3$	75.01
Carcass yield (%)	$67.1^a \pm 9.8$	$69.\ 9^a \pm 8.3$	4.10	$66.\ 3^a \pm 9.8$	$73.2^b \pm 9.0$	10.40	$64.7^b \pm 10.1$	$67.7^a \pm 9.5$	4.64
Full gastrointestinal Tract (g)	$178.5^a \pm 8.8$	$178.3^a \pm 6.5$	-0.11	$170.0^a \pm 8.9$	$180.8^a \pm 6.5$	6.33	$113.3^b \pm 8.8$	$156.4^b \pm 6.5$	37.99
Heart (g)	$8.\ 4^a \pm 0.6$	$11.0^a \pm 0.9$	31.54	$7.3^a \pm 0.6$	$9.97^a b \pm 0.90$	35.83	$5.\ 7^b \pm 0.6$	$8.0^b \pm 0.9$	41.77
Gizzard (g)	$45.5^a \pm 1.7$	$62.2^a \pm 3.2$	36.50	$46.4^a \pm 1.7$	$62.3^a \pm 3.2$	34.27	$37.1^b \pm 1.7$	$54.2^a \pm 3.2$	46.14
Liver (g)	$30.\ 8^a \pm 1.3$	$36.7^a \pm 1.9$	19.25	$30.4^a \pm 1.3$	$34.9^a \pm 1.95$	14.69	$17.95^b \pm 1.3$	$25.7^b \pm 1.9$	43.12
Head (g)	$36.\ 4^a \pm 1.1$	$52.4^a \pm 3.7$	44.18	$33.\ 1^a \pm 1.1$	$46.7^a \pm 3.7$	41.28	$28.4^b \pm 1.1$	$43.\ 6^a \pm 3.7$	53.32
Feet (g)	$54.\ 9^a \pm 2.1$	80.0 ± 5.8	45.75	$46.7^b \pm 2.1$	$71.7^a \pm 5.8$	53.60	$37.4^c \pm 2.1$	$64.\ 3^b \pm 5.8$	71.75
Abdominal fat (g)	$32.\ 7^a \pm 3.1$	$43.\ 5^a \pm 7.6$	33.01	$20.\ 4^b \pm 3.8$	$46.7^a \pm 7.6$	129.08	$16.\ 7^b \pm 3.8$	$31.\ 1^b \pm 7.6$	86.37

The values on the same line during the same period (step 1or step 2) with the same letters are not significantly different at the 5 % threshold.

age. Indeed, the author has registered 7.6 g for the heart, 29.8 g for the liver and 33.3 g for the abdominal fat. The weight of these organs significantly declined ($p \leq 0.05$) for lot III compared to lot I. It should be noted that organs such as feet and abdominal fat were already negatively affected ($p \leq 0.05$) by the 15 % of the energy and protein's restriction, corresponding to the treatment in lot II.

At the end of the refeeding phase, which lasted 4 weeks, the broilers showed on average, the dressed carcass weights of 1323.8, 1325.2 and 908.4 g, respectively, for lot I (control), II and III with a significant ($p \leq 0.05$) gap between broilers in lot III and the others. The carcass yield at the end of the refeeding phase was 69.9 %, 73.2 % and 67.7 % respectively in lot I, II and III. This significant superiority of the carcass yield observed in the subjects of lot II compared to those of lot I (control) is certainly due to better food efficiency, due to the phenomenon of compensatory growth. The extent of this efficacy was less remarkable in the subjects of lot III previously subjected to a much more severe food restriction. However, no significant differences in carcass yield were noted between chickens in lot I (control) and those in lot III. Outside the gizzard and head, all other organs listed, showed a significantly lower weight by chickens in lot III compared to other lots (Table 3).

4 Discussion

The use of cassava flour in the diet of broilers submitted to dietary restriction has clearly affected the development of the carcass and its composition. This shows that the energy and protein density of the diet is one of the determinants of the level of protein synthesis in animal growth. Like most species, body composition of poultry depends on the energy and protein density of the diet (Lebret *et al.*, 2015). The body weight average at slaughtering, the dressed carcass weight average and the broilers' carcass yield progressed along with an increase in the energy and protein density of the diet, which negatively corresponds with the level of cassava flour in the diet during the period of feeding restriction. With 30 % cassava flour in the diet, the broilers in the lot III show a significantly lower body weight at slaughtering than those in lot I and II. The diet containing 10 % cassava flour for broilers in lot II did not significantly affect the body weight at slaughtering, the dressed carcass weight and carcass yield after three weeks of feed restriction. Only broilers in lot III submitted to a dietary restriction containing 30 % of cassava flour in substitution of maize have a significant decrease in the development of their carcass. The subjects in lot II, regardless of their 15 %

reduced level of energy and protein restriction compared to the control and a substitution of 10 % of maize with cassava flour in the diet, have shown any change in the carcass yield. According to McMillan & Dudley (1941) and Vogt (1966) cited by Morgan *et al.* (2016), cassava in poultry diets reduced the performances. Protein and specific amino acids, such as lysine and methionine which are necessary in broilers diets, are very low in cassava flour. However in the study conducted by Ngandjou *et al.* (2011), the 50 % substitution of maize with cassava flour led to a significant rise in broiler carcass yield after seven weeks of testing. This result is certainly due to the high dietary protein content of the diet. Indeed the author incorporated 18.6 % of crude protein in the diet, compared with 13.1 % in the present study. Above the 50 % introduction rate, the author has remarked no significant difference among the broilers in different lots of testing. These results clearly show that cassava flour can validly replace maize in broiler feed, if measures to increase the protein content of the ration are taken. The use of cassava residues in substitution of maize in the broilers feed has a significant effect on all carcass parameters except the heart in the study conducted by Kana *et al.* (2014). Carcass yields were definitely higher with the broilers fed a diet lacking cassava residues compared to the one in which maize has been replaced by 50, 75 and 100 % cassava residues in the diet. This is explained by the fact that cassava residues that are more fibrous than maize are much less valorised by poultry. Other raw materials rich in fibre, such as cereal bran may, from a certain proportion, negatively affect the performance of poultry. The introduction of 20 % of rice bran in broilers diet resulted in a significant reduction of hot carcass weight in the study conducted by Deniz *et al.* (2007). The weak development of the digestive tract of broilers in this study, particularly in lot III, is the result of high dietary restriction (70 % of control diet). Pokniak *et al.* (1984) have made the same remarks on the broilers submitted to a quantitative restriction of 45 % between the 14th and 28th day. All the registered organs, in particular the heart, the stomach, the liver, the head, the feet and the abdominal fat have been more or less severely affected by the various treatments to which the broilers were submitted. The abdominal fat has considerably declined. Unlike the other organs, a substitution of 10 % maize with cassava flour resulted in a reduction of over 37 % of abdominal fat. This reduction has passed over 50 % for a 30 % substitution of maize with cassava flour. Rations containing cassava flour are found to be less nutritious in energy and protein. This results in a relatively low abdominal fat deposition proportional to the degree of maize substitution with cassava flour. This shows clearly that in a situation of under-feeding, the adipose reserves are initially mobilized to meet the metabolic requirement.

The refeeding phase has been marked by a significant rise in all carcass components as well as carcass yield in broilers in all lots and more particularly in broilers previously submitted to a dietary restriction containing cassava flour. Carcass yield was 69.9, 73.2, and 67.7 % respectively for lots I, II, andIII. This carcass yield, in particular in the control lot is almost identical to that of 69.56 % obtained by Malher *et al.* (2015) on chickens of Ross strain slaughtered at a live weight of 1.9 kg. The weight increase of cold carcass of broilers in lot I (control) was 14.21 % less than broilers in lot III and 19.05 % less than of broilers in lot II. Carcass yields deduced from the ratio between live weight at slaughter and cold dressed carcass weight recorded an increase in all lots of broilers and in particular by broilers in lots II andIII, previously subject to a restrictive diet with cassava flour. The more energy and protein restriction in the diet has been severe, the more broilers have known an improvement of their carcass weight after the refeeding phase. Broilers of lot II previously subjected for three weeks to a diet containing 10 % cassava flour with an energetic and protein density of 85 % showed, after the refeeding phase which lasted four weeks, a carcass yield significantly higher than those of lot I (control).Such a reaction can be explained by better use of nutrients within the limit of the substitution rate of maize by cassava flour in the diet. Indeed, a periodic feed restriction is usually accompanied by a better nutritional efficiency that can persist beyond the restriction period. According to Van Eenaeme *et al.* (1998), Rossi *et al.* (2001) cited by Hoch *et al.* (2003), re-feeding results in a sharp increase in protein synthesis, degradation, and protein gain throughout the body and in myofibrillar muscle proteins. This increase in protein may be, according to the same authors, 50 % higher in re-fed animals compared to the control fed *ad libitum*. Broilers in lot III, despite a spectacular rise in dressed carcass weight, have not succeeded in fully compensating the delay registered during the dietary restriction. Consequently, the four weeks scheduled for the refeeding period was insufficient to ensure complete compensation. However, the organs such as the stomach, and head did not present any difference compared to those in lot I and II. The spectacular increase of the weight of the digestive system, particularly in broilers, previously subjected to severe food restriction (lot III) clearly illustrates the extent of the metabolic activity that led to the intensification of the synthesis of organic tissues. At this rhythm, it is certainly not excluded that these subjects know full compensation if the period of refeeding was prolonged. According to Leeson & Zubair (1997), it is mainly digestive organs such as gizzard, pancreas, crop and liver that improve food consumption and thus promote compensatory growth. Susbilla *et al.* (1994) found no difference in liver weights in broiler chicks subjected to 75 and 50 % dietary restriction between 5 and 11 days of age.The whole full digestive tract with an average approximately weight of 178g has not undergone any variation in broilers of control lot between the two dietary phases. This value is closer to the observation made by Ricard & Rouvier (1967). They obtained a total weight of 167.9 g from broilers of *Bress* strain aged 11 weeks.

5 Conclusion

A short period of qualitative food restriction with cassava flour in poultry was found to be an alternative for local breeders with insufficient maize corn. Being able to partially replace, over a period of three weeks, ingredients, such as maize, with cassava flour, a more available and accessible ingredient, without unduly affecting the zoo-technical performance of poultry can be considered as an alternative to mitigate the financial burden inherent in broilers breeding. This can contribute to the fight against poverty. The substitution of 10 % maize with cassava flour associated with an about 15 % energy and protein restriction in the diet over a period of three weeks may be considered in broilers aged four weeks, without any significant change in their final carcass productivity. A level of substitution of 30 % associated to a restriction of 25 % turns out to be too high and does not allow for complete compensation even after four weeks of refeeding.

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