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EFFECT OF REPLACING MAIZE WITH PEARL MILLET (DORA) ON THE PERFORMANCE OF BROILERS

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DECLARATION

This thesis is submitted as partial fulfilment for the award of a Degree of Bachelor of Agricultural science (Bsc. Agriculture). The work is the result of my own investigations. All sections of the text and results, which have been obtained from other sources, are fully referenced. I understand that cheating and plagiarism constitute a breach of university regulations and academic honesty, and this will be dealt with accordingly.

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Signed: _____ **Date:** 18 - 06 - 2012

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ABSTRACT

The effects of replacing Maize with Pearl Millet (Dora) on the performance and production of broiler chickens were investigated in a 42 – day feeding trial, at the University of Zambia Agricultural Field Station. One hundred and twenty (120) (Ross) unsexed broiler chicks weighing averagely 0.042kg per bird were randomly allotted to four experimental diets in which (T0) control, 20 percent pearl millet (T20), 40 percent pearl millet (T40) and 60 percent pearl millet (T60) served as the energy sources in a randomized complete block design (RCBD). Each treatment consisted of 30 birds and two replicates of fifteen (15) chickens each. The chicks were given constant illumination and had free access to fresh water and fed *ad libitum.* The standard managemental practices were performed for all groups, such as regular cleaning of drinkers/ chick fonts, turning and replacement of clean dry litter, and vaccination against Newcastle Disease and Infectious Bursal Disease. However the three (3) test materials (Pearl millet, maize meal and soyabean meal) were subjected to proximate analysis to determine their nutrient composition. At the end of the feeding trial the data obtained was subjected to analysis of variance in a randomized complete block design and analyzed using Genstat 14th edition statistical package. The results obtained had shown that they were no significant ($P>0.05$) differences in live weight gains and feed efficiency among all the treatment groups. The overall weight gains were 2.59kg, 2.71kg, 2.82kg and 2.93 kg and feed conversion ratio was 1.74, 1.61, 1.55 and 1.50 for T0, T20, T40 and T60 respectively. Moreover, (day 1 to 42), birds fed the pearl millet diets (40 and 60 percent) had greater body weight, and feed conversion compared to birds fed the maize and pearl millet 20 percent diets at ($P<0.05$). The results, however, suggests that the replacement of maize by pearl millet at between 40 and 60 percent is possible and results in a higher body weight gain as compared to those fed entirely on maize based diet.

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ABREVIATIONS

FCR	Feed Conversion Ratio
ANOVA	Analysis of Variance
RCBD	Randomized Complete Block Design
PAZ	Poultry Association of Zambia
FAO	Food and Agriculture Organization
NRC	National Agricultural Research Council
FCE	Feed Conversion Efficiency
kg	Kilogram
GART	Golden Valley Research Station
%	Percent
DCP	Di- Calcium Phosphate
CTA	Technical Centre for Agricultural and Rural Co-operation

CHAPTER ONE

1.0. INTRODUCTION.

1.1. BACKGROUND

Approximately forty three (43) million broiler chickens are produced per annum, coming from both formal and informal sectors (PAZ, 2011). According to Bentley (2001), the industry has benefited from rapid returns on investments and reasonably low startup costs. Not only this but also, broiler production cycles are six weeks as opposed to six months for pigs or several years for cattle. On the other hand, the broiler sector accounts for 50 percent of all processed livestock feed, 56 000 tonnes per year (Bentley and Bentley, 2001).

Feed is the biggest input cost for commercial poultry production ranging between 60-80% of total costs of producing a broiler chicken (CTA, 2004). Therefore, obtaining a well-balanced feed at a low cost can greatly improve profitability. While many producers buy commercially mixed poultry feeds, a cheaper option is for poultry producers to make their own feed using locally available resources, such as by-products from local industries for instance, breweries, fishing, oil mills, crop processing. Most farmers buy premixed vitamin feeds, since providing the correct quantities of vitamins are important, but difficult if farmers try to make their own.

1.2. Pearl Millet production

Pearl millet *(Pennisetum americanum)* has been widely grown in Africa and the Indian subcontinent since prehistoric times. It is generally accepted that pearl millet originated in Africa and was subsequently introduced into India. Pearl millet is well adapted to growing in areas characterized by drought, low soil fertility, and high temperature (Tornier, Munde and Kokane, 2009). It performs well in soils with high salinity or low pH and low organic matter. As a result of its tolerance to difficult growing conditions, it can be grown in areas where other cereal crops, such as maize or wheat, would not survive (Chisi and Muuka, 1996).

In Zambia Pearl millet is an important indigenous cereal food crop. Several improved varieties and a number of agronomic recommendations have been developed for different categories of farmers in different agro-ecological regions. The improved varieties are diverse in maturity, adaptation, height, seed color, and size. Generally, they are tolerant to prevailing diseases such as anthracnose, downy mildew, ergot, smut, viruses, leaf diseases, and sooty stripe. (Chisi, Anandajayasekeram, Martella, Ahmed, Mwape,1997).

Variety name	Variety type	Maturity in days	Yield /ha
Kaufela	OVP	90-105	2.4 tons
Lubasi	OVP	95-110	2.6 tons
Kuomboka	OVP	95-110	2.8 tons
Dora	OVP	115-125	2.8 tons
Tuso	OVP	110-125	2.8 tons

(source: Chisi, 1997).

By improving management practices, recommended plant densities and planting practices, yield of pearl millet are expected to rapidly improve with the release of new hybrids over the next several years.

1.3. Nutrient composition of Pearl Millet

Pearl millet contains higher protein levels as compared to maize and approximately 85 percent of the energy content of maize. Maize usage is 60 to 70 percent of poultry diets and accounts for 60 percent of all production costs. Therefore, the replacement of maize by pearl millet in poultry diets would reduce the competition for maize between man and with livestock (Andrews and Kumar, 1992). Several studies indicate that metabolizable energy of pearl millet for non-ruminant animals is approximately equal to that of maize (Abate and Gomez 1984; Amato and Forrester 1995). When compared to maize on a weight basis, pearl millet is 8 – 60 percent higher in crude protein, 40 percent richer in lysine and methionine, and 30 percent richer in threonine (Burton, Wallace, and Rachie, 1972). Therefore, supplementation of pearl millet-soy diets with lysine or sulfur amino acids appears to be unnecessary (Andrews, *et al;* 1996). The use of pearl millet in poultry diets would reduce the need for protein supplementation, and therefore, reduce the feed cost per unit gain as compared to maize (Bramel-Cox, Anand Kumar, Hancock, and Andrews, 1995).

1.4. Anti- nutritional factors in Pearl Millet

Pearl millet has fewer anti-nutritional factors as compared to most grain crops. In contrast to wheat and sorghum, pearl millet grain is low in tannins, which limit palatability and inhibit protein digestion. There is no need for heat treatment of pearl millet to destroy protease inhibitors or other anti-nutrition factors. However, pearl millet can contain saponin anti-metabolites at levels of up to 200 parts per million (Sodipo and Arinze 1985). Saponins are known to damage membranes in the digestive tract. As a result Burtle and Newton (1995) have suggested caution when feeding high levels of pearl millet to fish species, which may be especially sensitive to saponin toxicity and has no effect on poultry.

1.5. Feed conversion

Broilers have a growth cycle of six weeks, which allows for repeated production throughout the year. Feed conversion ratio (FCR) of broilers is 2, of turkeys is 2.5 and of ducks is 2.5-3. Feed conversion ratio (FCR) depends on many factors, such as, age of birds, feed quality, duration of lighting, and the health of the birds. A ruminant will convert about 7 kg of feed to 1 kg of meat and a pig will convert about 3.5 kg of feed to 1 kg of meat where as a broiler will convert 1.75 kg of feed to 1 kg of meat. Therefore, the return from the investment in broilers is fast (FAO, 2010).

1.6. PROBLEM STATEMENT

Maize has been the major source of energy in poultry diets. However, inadequate production of the grain and the intense competition for maize between man and livestock in Zambia has made poultry rations to be expensive. This high cost of commercial diets for poultry may, if not addressed, result in lower incomes to poultry farmers and reduced protein intake among the communities. In order to alleviate such a threat alternative energy sources such as Pearl Millet should be exploited (Medungu, Kwaril, Igwebipuike, Nkama, Mohammed, and Hamaker, 2010). In addition, feed is the biggest input cost in commercial poultry production, therefore obtaining a well-balanced feed at a low cost can greatly improve profitability of the broiler industry.

1.7. JUSTIFICATION

Since feed is by far the biggest cost in broiler production, finding ways of reducing the cost while maintaining nutritional quality must be exploited. In addition, pearl millet matures quickly, and has low production cost as compared to maize (Davis, Dale, and Ferrireira, 2004). Therefore Pearl millet grain could potentially be incorporated in poultry diets in order to replace Maize. However, maize is predominantly grown by smallholders, and thus production fluctuates on a yearly basis. Commodity shortages have been reported throughout the year, and in order to avoid interruptions in feed production. Nevertheless, shortages adversely affect prices, which are largely born by the farmers.

Cromwell and Coffey (1993) exonerated millet from the anti-nutritional properties (phytate and tannins) and NRC (1996) has reported that millet has no tannins. On the other hand, pearl millet contains 5-7 percent oil and has higher protein and minerals which can promote high performance as compared to maize. Thus this research will study the effects of pearl millet as a source of energy on the production performance of the broilers.

1.8. OBJECTIVES

1.8.1. Overall objective

To study the effects of replacing maize with pearl millet as a source of energy on the performance of broiler chickens

1.8.2. Specific objectives

- To determine the live weight gain of broilers fed on pearl millet based diet compared to maize based diet as a source of energy.
- Determination of feed conversion ratio of broilers fed on pearl millet based diet compared to maize based diet as a source of energy.

1.9. HYPOTHESES

- HO; Different inclusion rates of pearl millet on broiler rations does not have different effects on the live weight gains of broiler chickens.
- HA; Different inclusion rates of pearl millet on broiler rations have different effects on the live weight gains of broiler chickens.
- HO; Different inclusion rates of pearl millet on broiler rations does not have different effects on the feed conversion ratio of broiler chickens.
- HA; Different inclusion rates of pearl millet on broiler rations have different effects on the feed conversion ratio of broiler chickens.

CHAPTER TWO

2.0. LITERATURE REVIEW

The combination of low consumer purchasing power and the comparatively high meat prices restricts the per capita meat consumption of Zambia. According to Bentley (2001) the favoured sources of proteins amongst those available on the market are, in order of preference, fish, poultry, beef and lastly pork.

This presents a challenge to nutritionist to investigate the possibilities of utilizing other potential energy sources because, the major portion of the maize crop is diverted for other purposes such as, brewery and starch industries and human consumption.(Tornekar, Munde, and Kokane, 2009). One of the cheap energy sources available for replacing maize in poultry ration is pearl millet. The pearl millet grain with 11.5 percent crude protein and 2900 kcal Metabolizable Energy is just like maize (7 percent crude protein and 3330 kcal M.E.) in most of the qualities. Thus, pearl millet may replace maize in poultry feed as there is striking similarities in nutrient composition of both grains (Prasad and Panwar, 1997).

Feed accounts for 60 to 80 percent of the total expenditure in broiler production. For decades, maize has been the major feed ingredient used, with inclusion rates greater than 50 percent in most instances. Considering the high metabolisable content of maize (3,350 kcal/kg; NRC, 1994), it is the principal dietary energy source, contributing to approximately 65 percent of broiler metabolisable energy requirements (Cowieson, 2005). In recent years, however, maize has increasingly and preferentially been diverted toward human consumption. The risks that maize will be less available and marketed at uneconomically high prices have necessitated identifying alternative grains that could totally or partially replace maize in broiler diets, thereby sustaining the economic feasibility of the industry.

Pearl Millet *(Pennisetum americanum),* commonly known as bulrush millet is the most drought tolerant of all cereals (Muliokela, 1995). It performs better than other cereals on poor soil under moisture stress, higher heat and shows spectacular response to favourable environment and better management. It is grown almost entirely as a rain fed crop in the semi arid regions of south Asia and Africa where the mean annual rainfall ranges from 200-800mm (Mahalakshmi and Bidinger, 1985).Pearl millet was developed as a food crop and is still primarily used this way in Africa and India, its grain is most likely to be used for animal feed in many countries. Several studies have been conducted on its potential for various types of animals, including poultry, cows, pig, and fish. In general, it performs comparably to maize in animal diets, with small advantages in certain situations. The main commercial market to date for grain-type pearl millet has been the broiler market. Lack of familiarity with the crop has limited its use in other livestock feed markets (Eziesh and Olomu, 2008). However, as feed formulators and buyers become more familiar with the crop, its potential markets will expand. A one-to-one substitution of pearl millet

for maize in a feed formulation is usually appropriate (Andrews, Hanna, Rajewski and Collins, 1996).

There are several measures that can be used to evaluate the performance of a flock of broilers – growth rate, days to market, and feed efficiency. Feed is typically the most costly expense in broiler production. As a result, feed efficiency is typically the primary tool by which a flock is evaluated. Feed efficiency is calculated by dividing feed intake by weight gain, resulting in typical values around 1.6 -1.8 for 42 day old broilers (Ngosa, 2010). Thus the lower the number (referred to as Feed Conversion Ratio – FCR) the more efficient the flock was in using the feed supplied. In other words, feed conversion ratio (FCR), feed conversion rate or feed conversion efficiency (FCE) is a measure of an animal's efficiency in converting feed mass into increased body mass. This is the least amount of feed that is required for unit body weight gain. Animals that have a low feed conversion ratio are considered efficient users of feed. As feed costs represent 60-65 percent of the total cost of broiler production, the efficient conversion of feed into live weight is essential for profitability, and small changes in feed conversion ratio at any given feed price can have a substantial impact on financial margins (Cowieson, 2005). Therefore, growth and feed intake should correlate for any broiler production in order to maximize profit.

CHAPTER THREE

3.0. MATERIALS AND METHOD

3.1. Experimental birds

One hundred and twenty (120) day old, chicks were procured from Ross Breeders. On arrival chicks were weighed, and randomly distributed in four different treatments with two replicates. Each replicate contained 15 birds and 30 birds per treatment. The chicks were given constant illumination and had free access to fresh water and fed *ad libitum*.The standard managemental practices were performed for all groups. During the experiment period the birds were immunized against Newcastle Disease and Infectious Bursal Disease (refer to appendix 3).

3.2. Test ingredients

The pearl millet was bought from Golden Valley Research Station (GART) while the rest of the other ingredients (such as soybeans and maize meal) were procured from Livestock Services. Proximate analysis was done for the three test ingredient as shown in table 2.

Table 1: showing the Chemical Composition of Test Ingredients

Nutrient percent	Test Material		
	Millet	Maize	Soya beans
Moisture (water)	10.55	10.35	8.65
Crude protein (CP)	11.46	8.77	43.57
Crude fibre (CF)	3.78	4.77	5.57
Ether Extract (EE)	5.99	7.78	11.98
Ash	1.48	6.03	4.55
Nitrogen-Free Extract*	66.74	62.3	25.68
ME (kcal/kg)	3400	3350	3570
Dry matter (DM)*	89.45	89.65	91.35
Calcium (ca)	0.83	0.73	0.89
Phosphorus (p)	0.40	1.3	0.75

The above are means of 2 determinations

*NFE (Nitrogen Free Extracts) = 100%- (moisture%+ crude protein% + crude fibre%+ ether extract% + ash%)

*Dry matter (DM) = 100% - Moisture

3.3. Experimental Diets

Standard maize-soybean meal based broiler starter and finisher diet (T0) was formulated. Maize was replaced with pearl millet quantitatively at the level of 20% (T2), 40% (T3), 60 % (T4), as shown in the table, each of the three experimental diets were offered *ad libitum* as mash to two replicates of commercial chick broilers day old, with each replicate comprising 15 chicks of mixed sex. Pearl Millet was ground to pass through a 3mm diameter screen. The experimental diets were in mash form and were formulated to meet or exceed NRC (1994) broiler nutrient requirements for macro- and micronutrients (Table 1).

Table 2: showing the ingredients and Chemical Composition of the experimental diets.

DETAILS.	TREATMENTS (DIET)				
	INGREDIETS	T1- 00	T2- 20	T3- 40	T4- 60
Starter (0-4 Weeks)	Maize (%) Pearl millet (%) Soya (%)	55.98 00 41.52	37.53 20.00 39.97	19.07 40.00 38.43	0.63 60.00 36.87
Nutrient composition of starter diet (calculated)	Lysine (%) Methionine (%) DCP (%) Limestone. (%) Salt.(%) Vit. premix (%)	0.2 0.5 0.6 0.5 0.4 0.3	0.2 0.5 0.6 0.5 0.4 0.3	0.2 0.5 0.6 0.5 0.4 0.3	0.2 0.5 0.6 0.5 0.4 0.3
		100	100	100	100
Finisher (5-6 Weeks)	Maize Pearl millet Soya	64.61 00 32.89	46.14 20.00 31.36	27.68 40.00 29.82	9.25 60.00 28.25
Nutrient composition of finisher diet (calculated)	Lysine (%) Methionine (%) DCP (%) Limestone. (%) Salt.(%) Vit. premix (%)	0.20 0.50 0.60 0.50 0.40 0.30	0.20 0.50 0.60 0.50 0.40 0.30	0.2 0.5 0.6 0.5 0.4 0.3	0.2 0.5 0.6 0.5 0.4 0.3
		100	100	100	100

CHAPTER FOUR

4.0. RESULTS AND DISCUSSION

4.1. RESULTS

The data obtained was subjected to analysis of variance in a randomized complete block design using the method described by Steel and Torrie (1980). Genstat statistical package was used to analyze the data collected. The result of the trial indicated that the final body weight, feed consumption and feed conversion ratio (FCR) were not significantly affected by variation in the diet, ($P<0.05$), meaning that the birds from T20, T40 and T60 were not adversely affected in performance by the inclusion of pearl millet in the diet as compared to control which was the maize diet.

Mean performance of the experimental birds

Details	T0	T20	T40	T60
Weight	2.59	2.71	2.82	2.93
Feed consumption	4.47	4.37	4.35	4.31
Feed conversion ratio	1.74	1.61	1.55	1.50

4.1.1. Bird Performance

Overall (day 1 to 42), birds fed the pearl millet diets (40 and 60 percent) had greater body weight, feed intake, and feed conversion compared to birds fed the maize and pearl millet 20 percent diets at ($P<0.05$) as shown in table 3. Throughout the experimental period birds fed the pearl millet diet (40 and 60 percent) were consistently heavier than birds fed the maize and pearl millet 20 percent diets. However, increased body weight occurred among birds fed diets containing pearl millet compared with those fed the maize diet. Body weight did not differ much between birds fed the pearl millet 40% (2.83kg) and 60% (2.93kg) diets at any time point. In addition, body weight of birds at day 42 did not differ with those fed the maize based diet (2.59kg) and 20% (2.71kg) pearl millet diet. Nevertheless, at day 42, birds consumed more of the maize based diet (4.47kg) and 20% (4.37kg) pearl millet diet compared to the diets containing 40% (4.35kg) and 60% (4.31kg) pearl millet. Moreover, throughout the entire 42 day, feed conversion ratio was greater among birds fed the maize and pearl millet 20 percent diets than those fed the pearl millet 40 and 60 percent, diets. However, at day 42, feed intake and feed conversion ratio did not differ between birds fed diets containing 40 and 60 percent Pearl Millet. Hence, they consumed less of the diets containing 40 and 60 percent pearl millet than the diets containing maize, and 20 percent pearl millet. As a result, feed conversion ratio was far much better with diets containing 60% (1.50), 40% (1.55), than with 20 percent (1.61) pearl millet and with maize (1.74).

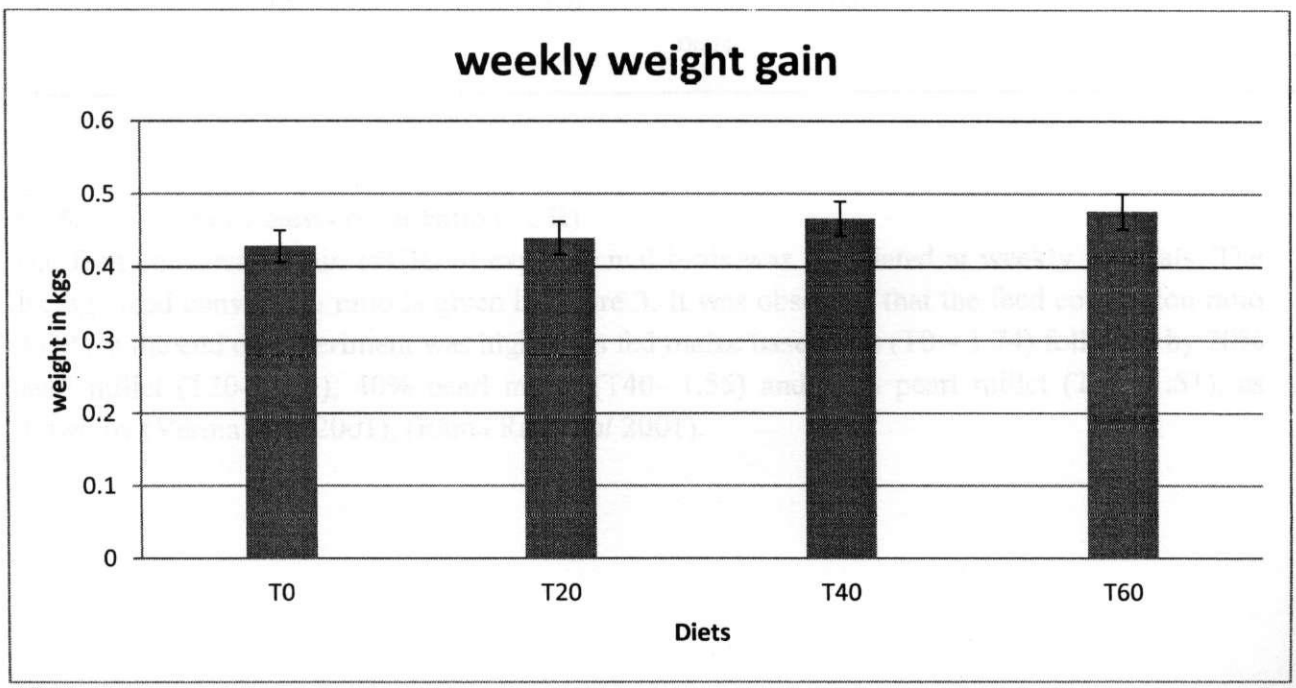
4.1.2. Nutrient composition

The proximate composition of the experimental diets and test ingredients are presented in Tables 1 and 2 respectively. The crude protein levels are higher in pearl millet (11.46%) compared to maize (8.77%). The crude protein levels obtained are similar to the 9 and 11.5 percent crude protein levels reported by Tornekar (2009) for maize, and pearl millet respectively. The metabolisable energy was 3400kcal/kg which is similar to the findings of Fancher *et al.,* (1987), Banerjee *et al.*, (1998).The calculated composition of experimental starter and finisher ration is given in table 1. The crude protein of the different starter diets for the different treatments of 23 percent in accordance with the replacement of maize by pearl millet in graded levels. The replacement of grains was further reflected in metabolisable energy content of experimental starter diet above 3200 kcal/kg on all diets. The crude protein of about 20 percent content of finisher ration and 3200 kcal/kg of metabolisable energy respectively which are similar to Verma *et al.* (2001).

4.1.3. Weekly weight gain

The weight gain of experimental birds was assessed by recording the weekly body weight of birds. The average weekly cumulative body weight in kilogram/bird and weekly gain in body weight in kilogram was recorded. It was observed that the birds under group T60 grew faster and where heavier (2.93kg) followed by birds under group T40 (2.83kg), then birds under group T20 (2.71kg) and lastly birds under group T0 (2.59kg), ($P<0.05$). It may be seen from figure1 below that the replacement of maize by pearl millet in experimental diet resulted in increased body weights of experimental birds, Reddy *et al.* (1989), Thakur *et al.* (1992).

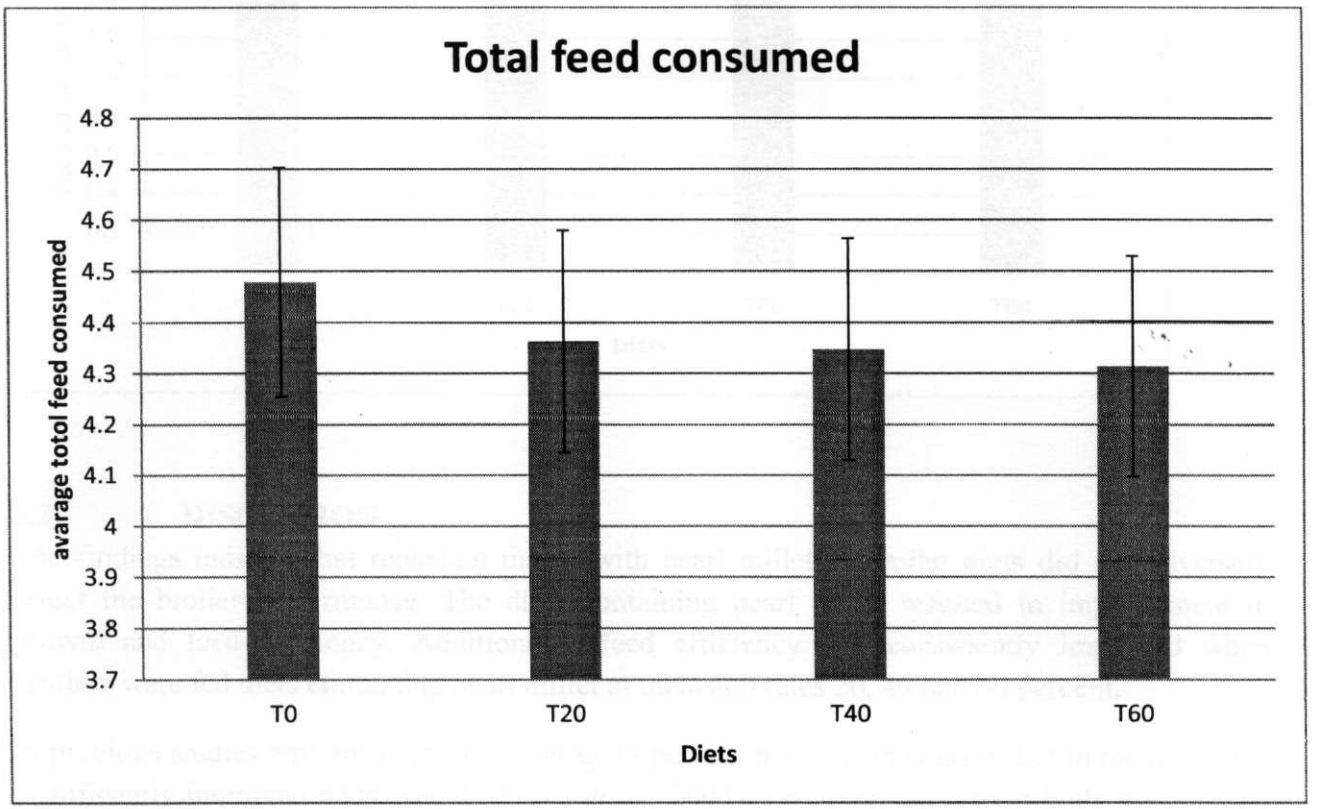
Figure1: ***Showing average weekly weight gain***



4.1.4. Total feed consumption

The feed consumption of experimental chicks was recorded at weekly intervals (refer to figure 2). The average feed consumption per bird up to week six (6) in different groups ranges from 4.4 kg to 4.2kg. The chicks on maize diet consumed more feed than all other groups, whereas chicks under T20 were second followed by group and lastly T60 group, Reddy and Reddy (1989).

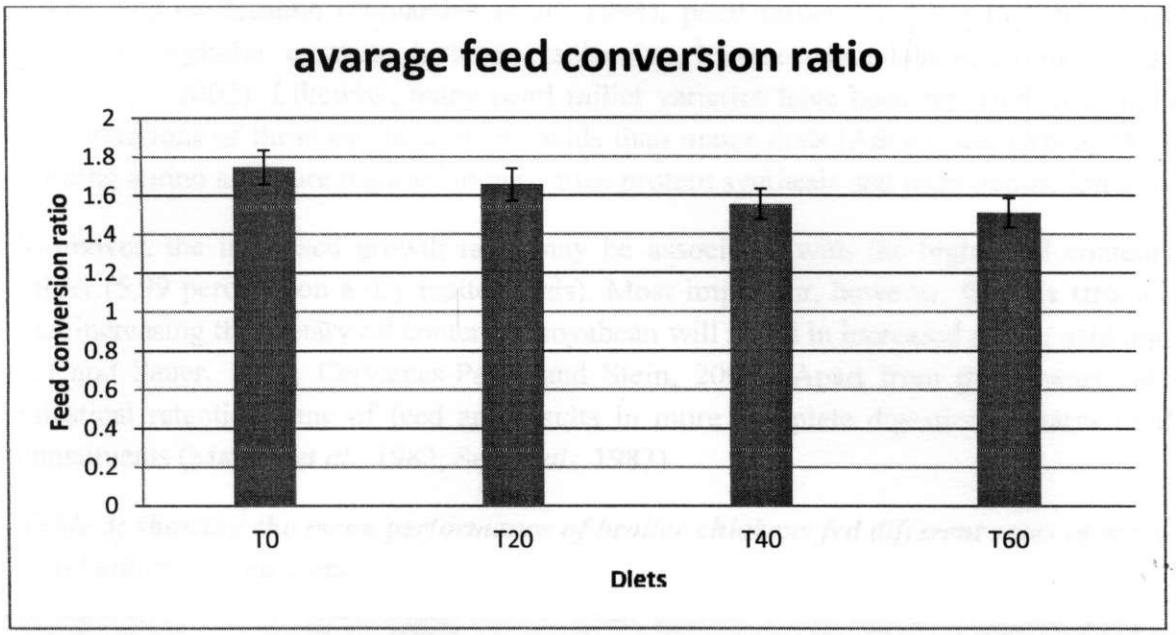
Figure 2: Showing total feed consumed.



4.1.5. Feed conversion ratio (FCR)

The feed conversion ratio (FCR) of experimental birds was calculated at weekly intervals. The average feed conversion ratio is given in figure 3. It was observed that the feed conversion ratio (FCR) at the end of experiment was high birds fed maize based diet (T0 – 1.74) followed by 20% pearl millet (T20- 1.65), 40% pearl millet (T40- 1.55) and 60% pearl millet (T60- 1.51), as shown by (Verma *et al.*2001), (Rama Rao *et al* 2001).

Figure 3: Showing feed conversion ratio



4.2. DISCUSSION

The findings indicate that replacing maize with pearl millet in broiler diets did not adversely affect the broiler performance. The diets containing pearl millet resulted in improvement in growth and feed efficiency. Additionally, feed efficiency was consistently improved when broilers were fed diets containing pearl millet at inclusion rates 20, 40 and 60 percent.

In previous studies with broilers, substituting 33 percent maize with pearl millet in the diets also significantly improved body weight (Davis *et al.,* 2003). However, equivalent body weight gain and feed efficiency responses were observed when replacing 5 to 75 percent of maize with pearl millet in broiler diets (Davis *et al.*, 2003; Hidalgo *et al.*, 2004; Manwar and Mandal, 2009) and in pig diets (Lawrence *et al.,* 1995). In layers, partial (50 percent) or total replacement of maize with pearl millet had no effect on body weight, feed conversion, and egg production (Collins *et al.* 1997; Amini and Ruiz-Feria, 2007). Pearl millet is also a satisfactory feed for laying hens. Kumar *et al.,* (1991) found increased egg size and better feed conversion when pearl millet was substituted for maize at 60 percent by weight. The higher methionine and energy content of pearl millet might explain these results. Using more recent estimates of nutrient content, Collins *et al.,* (1995) found millet and maize gave equivalent egg production and feed efficiency. . In contrast, Dove and Myer (1995) found that replacement of more than 67 percent of maize with pearl millet resulted in an increased feed conversion ratio.

Therefore, the results demonstrate that pearl millet can partially or totally replace maize in broiler diets without negatively affecting broiler performance. Whereas maize is markedly

deficient in several amino acids, including lysine, methionine, threonine, tryptophan, arginine, valine, and methionine (Fernandez *et al.,* 1994), pearl millet is richer in lysine, methionine, threonine, arginine, cysteine, histidine, isoleucine, leucine, phenylalanine, tyrosine, and valine (Yin *et al.,* 2002). Likewise, many pearl millet varieties have been reported to contain greater concentrations of these essential amino acids than maize does (Adeola and Orban, 1995). These limiting amino acids are required to maximize protein synthesis and meat deposition in broilers.

Moreover, the increased growth rates may be associated with the higher oil content in pearl millet (5.99 percent, on a dry matter basis). Most important, however, there is strong evidence that increasing the dietary oil content or soyabean will result in increased amino acid digestibility (Li and Sauer, 1994; Cervantes-Pahm and Stein, 2008). Apart from this dietary oil increase intestinal retention time of feed and results in more complete digestion of non- lipid dietary constituents (Mateos *et al.,* 1982; Sell *et al.,* 1983).

Table 3: showing the mean performance of broiler chickens fed different rates of maize and pearl millet – based diets.

Parameters	Treatment (Diets)			
	T0 – 00%	T20 – 20%	T40 – 40%	T60 – 60%
Mean initial live weight (kg)	0.042	0.042	0.040	0.042
Mean final body weight (kg)	2.59	2.71	2.82	2.93
Overall weight gain (kg)	2.54	2.67	2.78	2.89
Weekly feed intake (kg)	0.75	0.72	0.72	0.72
Weekly weight gain (kg)	0.43	0.43	0.47	0.48
Feed conversion ratio	1.74	1.61	1.55	1.50
Total feed intake (kg)	4.48	4.37	4.35	4.31

CHAPTER FIVE

5.0. CONCLUSION AND RECOMMENDATIONS

In conclusion replacing maize with pearl millet in broiler diets, results in significant improvements in growth and feed efficiency. The dietary incorporation of pearl millet required less soyabean meal and caused broilers to reach market weight earlier. Hence, the use of pearl millet improves the economics of broiler production. Therefore, this study demonstrates that the pearl millet can replace maize at between 40 and 60 percent in broiler diets without negatively affecting broiler performance.

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APPENDEX 1

Table 4: One way analysis of variance for feed conversion ratio

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
REP stratum	1	0.008192	0.008192	2.62	
TREATMENT	3	0.066573	0.022191	7.08	0.071
Residual	3	0.009397	0.003132		
Total	7	0.084162			

Table 5: One way analysis of variance for weekly weight gain

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
REP stratum	1	0.0004805	0.0004805	3.20	
TREATMENT	3	0.0029590	0.0009863	6.57	0.078
Residual	3	0.0004505	0.0001502		
Total	7	0.0038900			

Table 6: One way analysis of variance for weekly feed consumption

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
REP stratum	1	0.00001250	0.00001250	0.14	
TREATMENT	3	0.00085300	0.00028433	3.11	0.188
Residual	3	0.00027450	0.00009150		
Total	7	0.00114000			

Table 7: One way analysis of variance for average final body weight

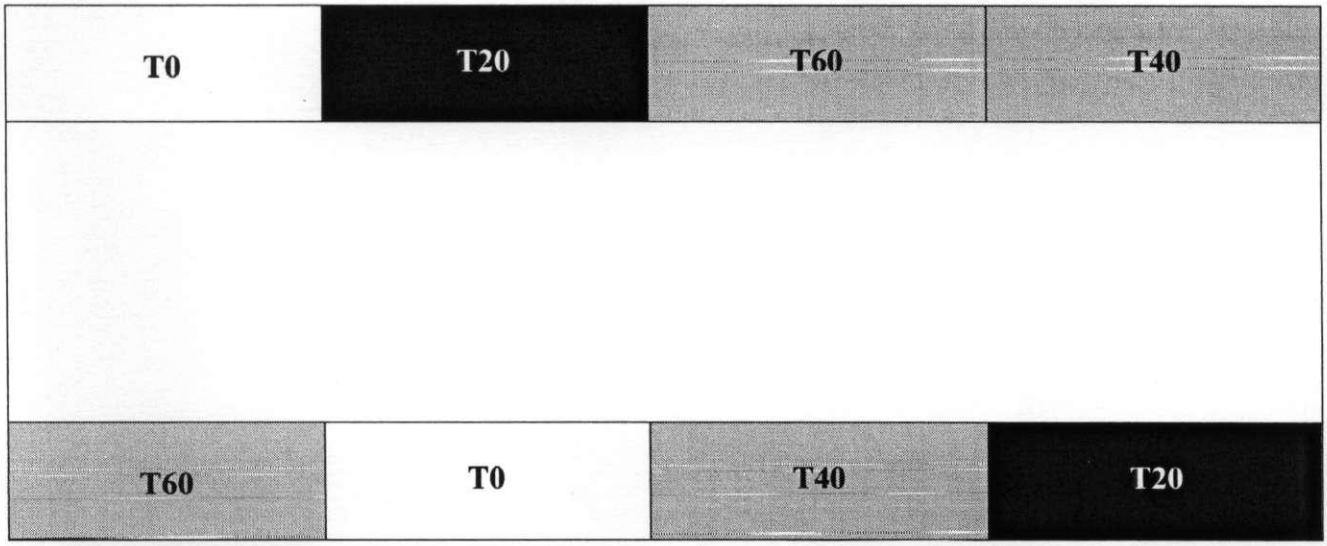
Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Replication	1	0.017422	0.017422	3.15	
Treatment	3	0.130067	0.043356	7.85	0.062
Residual	3	0.016578	0.005526		
Total	7	0.164067			

Table 8: One way analysis of variance for average total feed

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Replication	1	0.000648	0.000648	0.22	
Treatment	3	0.030978	0.010326	3.48	0.166
Residual	3	0.008892	0.002964		
Total	7	0.040518			

Appendix 2

Schematic presentation of the experimental design



Key

T0 – Control (no pearl millet inclusion)

T20 – 20% pearl millet included in the diet

T40 – 40% pearl millet included in the diet

T60 – 60% pearl millet included in the diet.

Appendix 3

Table 9: Vaccination programme.

Age/ days	Vaccine	Application method	Disease
10	Tad Gumboro	Drinking water	Infectious Bursal Disease (IBD)
12	NCD Lasota	Drinking water	Newcastle disease (ND)
18	Tad Gumboro	Drinking water	Infectious Bursal Disease (IBD)
21	NCD Lasota	Drinking water	Newcastle disease (ND)