# NUTRITIONAL VARIETIONS AMONG DIFFERENT VARIETIES OF VELVET BEANS (MUCUNA PRURIENS) WHEN EVALUATED AS POTENTIAL PROTEIN SUPLEMENTS IN BROILER RATIONS.

MUSONDA

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# NUTRITIONAL VARIATIONS AMONG DIFFERENT VARIETIES OF VELVET BEANS (*MUCUNA PRURIENS*) WHEN EVALUATED AS POTENTIAL PROTEIN SUPPLEMENTS IN BROILER RATIONS

BY

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A RESEARCH PROJECT REPORT SUBMITTED TO THE SCHOOL OF AGRICULTURAL SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURE

DEPARTMENT OF ANIMAL SCIENCE

THE UNIVERSITY OF ZAMBIA

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# DEDICATION

This work is dedicated to the following people: My mother Annie Lombe, My husband Edwin Kikamba for being patient and encouraging, my daughter Patricia for understanding during my long absence from home.

## ACKNOWLEGEMENTS

I sincerely thank my supervisor, Dr. Simbaya for his input in this work.

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Many thanks also go to Miss. Maliti for her technical assistance during laboratory experiments. I also extend my gratitude to my classmates for their support and guidance during the same period.

## DECLARATION

This thesis has been compiled by myself and has not been accepted in any previous application for a degree at any university. I therefore, declare that this is a true reflection of my own work.

SIGNATURE.....

# ABSTRACT

This study was carried out t evaluate nutritional differences among four different varieties of velvet beans (*mucuna pruri ns*) i.e. yellow, speckled, cream white and black. 300g of each variety was ground to pass hrough a 2mm sieve and processed by socking in 0.2% sodium carbonate for 24 hrs, then a utoclaved at 120°C for 30 minutes to inactivate anti- nutritional factors. The varieties sample were evaluated for nutrient composition in triplicate using AOAC (1998). Proximate analysis re ults for were as follows; dry matter ranged from 92.9% in yellow variety to 93.3% in black va ety and these results showed no significant difference ($P < 0.05$). The results for other parame ers showed significant differences ($P < 0.05$) and ranges were as follows; on CP the range was 21.77% in black to 29.08% in cream variety. On CF the range was from 8.61% in cream to 10.9 % in black, Ash ranged from 2.77% in black to 3.21% in speckled and cream, EE ranged from 3.64% in cream to 4.00% in black, NFE ranged from 48.71% in cream to 53.09% in black var ety and Metabolizable energy range was from 3.73kcal in black to 3.87 kcal in cream variety. The results for calcium ranged from 0.93% in cream to 1.32% in speckled while phosphorus ra ged from and 0.08% in speckled to 0.6% yellow. Calcium results did not show significance diff rence ($P > 0.05$) among treatments. Diets were then formulated by substituting soya at 20% at eq al levels and a control diet containing soybean only was included, these were fed to Winstar rats for a period of 14days to determine DM and CP digestibility, feed intake, feed conversion ratio nd change in weight. The results for DM apparent digestibility ranged from 83.0% yellow o 87.0% control diet, while CP apparent digestibility ranged from74.0% in to 80.0% in con rol diet. The results showed no significant difference between diet containing speckled variety ar d the control diet. The average feed intake ranged from 14.28g in control diet to 18.50g in speck led diet per day, these results showed no significant difference ($P < 0.05$) between diet containi g speckled and control diet. The mean change in weights ranged from 9.67g in diet containin speckled to 14.50g in speckled diet. These results showed no significant difference between speckled diet and the control diet. Apparent Feed conversion ratio (FCR) also ranged from 1.04 in control to 1.74 in black, the results showed no significant difference between speckled diet and control diet. This study demonstrates that the diet containing speckled variety h d high apparent digestibility percentage in DM and CP, great increase in weight compared t soya diet and other diets containing other varieties of *mucuna pruriens*. Therefore, I recomm nd the speckled variety to be used in feed rations.

# LIST OF TABLES AND FIGURES

## ABBREVIATIONS AND ACRONYMS

CP..... Crude protein

EE.....Ether extracts

NFE.....Nitrogen free extracts

CF.....Crude fibre

FCR.....Food conversion ratio

LSD.....Least square difference

SEM.....Standard error of the mean

ACF.....Agriculture consultative forum

PAZ.....Poultry association of Zambia

AOAC.....Association of Analytical Chemists

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## CHAPTER 1

## 1.0 INTRODUCTION

Broiler meat accounts for 90% of Zambian poultry meat market (PAZ, 2010). However, intensive broiler production in Zambia has greatly been affected by high cost of production due to limited supply of feed ingredients, especially the conventional plant protein soya beans meal. The total annual production of soya beans in Zambia was 111,888 metric tonnes compared to 135,984 metric tonnes consumption for human and livestock in 2010/2011(ACF, 2010). The total imports of soya beans were 29 metric tonnes, while the total import of stock feed with soya beans was 84 metric tonnes. The total national monthly consumption of soya beans was estimated at 11,332 metric tonnes in 2010, out of which 1,103 metric tonnes was for human consumption and 10,229 metric tonnes was for feed formulation (Agricultural Consultative Forum 2011). This shows that there is more soya beans being used in livestock feed rations than it is for human consumption and causing a deficit of 23,983 metric tonnes of required total consumption for both human and livestock. This has lead to increased demand and high cost of soya beans.

The limited supply and high cost of soya beans as a conventional protein source in broiler diets has constituted a major economic concern to broiler chicken farmers. This has lead to high cost of feed and hence increasing the total cost of production. The problem is further compounded by high level of adulteration of feed by some farmers in an attempt to supplement protein level, so that they can produce at a lower cost. For this reason, there is need to reduce on the amount of soya beans used in livestock rations by exploring alternative replacements.

The utilization of underutilized tropical legumes like velvet beans (*mucuna pruriens*) has been indentified and used in poultry feed formulation because it possesses similar nutritional profile as soya beans (Tuleum *et al.*, 2008). However, there are different varieties of velvet beans that are grown in different parts of the world. In Zambia most varieties have been developed for soil fertility improvements such as sam (white seed coat), green and NIRS 16 (black). Many other wild varieties grow in different parts of Zambia on virgin lands (Nyirenda et.al, 2003). Thus, there is need to evaluate the nutritional differences among these different varieties of velvet beans on nutrient content, so that the best variety with acceptable nutrient levels could be used as protein source in feed rations to reduce on the quantity of soya beans used.

## 1.1 PROBLEM STATEMENT

The limited supply and high cost of soya beans as a conventional protein source in livestock diets has constituted a major economic concern to livestock farmers. This has lead to high cost of feed and hence increasing the total cost of production. There is a need to look for alternative plant protein source if the cost of production is to be reduced.

## 1.2 JUSTIFICATION

Soya is in limited supply and often too expensive. Velvet beans identified as a potential alternative to soya beans, but its use is limited by low protein content and high levels of anti nutritional factors. Different varieties of velvet beans may have different levels of nutrients hence the need to look at the chemical composition and feeding quality characteristics of the various varieties of velvet beans. This will help to identify the best cultivar to be used in feed rations as plant protein source and reduce the use of expensive soya beans.

## 1.3 OVERALL OBJECTIVE

To evaluate the differences in the chemical composition, nutrient digestibility and feeding quality characteristics of different cultivars of velvet beans when used as alternative protein replacements to soya beans meal in broiler rations.

## 1.4 SPECIFIC OBJECTIVES

1. To determine the nutrient content found in different varieties of velvet beans.
2. To determine digestibility of nutrients in different varieties of velvet beans compared to soya beans.
3. To determine the feed intake, change in weight and feed conversion ratio for different varieties of velvet beans varieties compared to soya beans.

## 1.5 HYPOTHESIS

- HO: There are no significant differences in the composition of nutrients among different varieties of velvet beans.
- HA: there are significant differences in the composition of nutrients among different varieties of velvet beans.

- HO: There is nc significant difference in digestibility of nutrients found in different varieties of velve beans compared to soya beans.
- HA: There is a ignificant difference in digestibility of nutrients found in different varieties of velve beans compared to soya beans.
- HO: There is no significant difference in feeding quality characteristics of different varieties of velve beans compared to soya beans.
- HA: There is a ignificant difference in feeding quality characteristics of different varieties of velve beans compared to soya beans.

## CHAPTER 2

## 2.0 LITERATURE REVIEW

Velvet beans (*mucuna pruriens*) are flowering legume plants and the flowers could be white, dark purple or light purple hanging in clusters. The plant produces clusters of pods containing seeds known as mucuna seeds. The name velvet bean is derived from a fact that the plant is covered in soft hairs when young. However, as the velvet bean matures, it losses these hairs. The leaves are ovate shaped, with sharp points and grooved sides.

### 2.1 Origin and Climatic conditions

Velvet beans originated from Southern Asia and it was introduced in southern states of United States of America in the late 19$^{th}$ century and in the tropics in the early 20$^{th}$ century (Eiliotta *et al.*, 2003). Velvet bean is cultivated in tropical areas, such as the Caribbean, India and Africa. Velvet beans require warm temperature of 20°C to 30°C throughout the growing period, a frost free period of 180 to 240 days with an average rainfall of between 600 and 2500mm/year. A wide range of soil types are suitable, provided that they are well drained, since velvet beans cannot stand water logging. They tolerate fairly acid soils, with a pH of between 5 and 6.5 (Siddharya *et al.*, 1996).

### 2.2 Use of velvet beans

The crop is grown mixed with other vigorous growing crops such as Maize, to improve soil fertility through nitrogen fixation (buckles, 1995). In Zambia, it is grown to improve soil fertility prior to introduction of the chemical fertilizer- based Lima programme in Zambia (Kaonga, 2002). Velvet beans are nutritious animal feeds; the mature seeds are used in compound feeds after treating them to remove ant-nutritional factors, additionally the foliage can be fed to ruminants and non-ruminant animals (Eilita *et al.*, 2003, Chikangwa *et al.*, 2009). At this level, birds exhibits better growth performance in feed intake, weight gain, feed convention ratio and protein efficiency ratio in both the starter and finisher diets (Vadivel *et al.*, 2011). Like any other beans, *M. pruriens* contains protein, vitamins and minerals making it an attractive and important source of plant protein for feeding animals (FAO, 1994).

## 2.3 Nutrient composition of velvet beans

The proximate composition of mature seeds contain; Moisture 10%, Protein 24.4%, Fat 5.7%, Nitrogen Free Extractives 5 .5%, Fibre 6.4%, ash 3%, Calcium 0.18%, Phosphorus 0.99%, Potassium 1.3%, Vitamin A 50iu/100g, Thiamine 0.5mg/100g, Riboflavin 0.20mg/100g, Niacin 1.7mg/100g (Ravindran *et al*, 1988) The oil present in the seeds have been found to be highly unsaturated with 47.2% linoli: acid, 14.2%t oleic acid, 3.8% Linolenic acid and 0.5% palmitoleic acid. The saturated fatty aci s are Palmitic 19.5%, Stearic 12.6% and Arachidic 2.2%. Amino acids present are Isoleucin , leucine, lysine, Methioninie, Cystine, Phnylalanine, Tyrosin, Threonine, Valine, Arginine, Histine, Alanine, Aspartic acid, Glutamic acid, Glycine, Proline and Serine. (Rehr *et, al.* 1973)

## 2.4 Nutrient composition variation of velvet beans seeds

The composition of nutrients may vary slightly in different varieties of velvet beans especially in protein content. The differen e is seen from proximate analysis of different varieties of *Mucuna pruriens* analysed by Dwight *et al.*, (2006) found mottled type to have 27.7% CP, while black and white was 25.8% CP. The a nalysis of nutrients in Zambian local varieties by Nyirenda *et al.*, (2003) also showed a diffe ence in crude protein content were speckled had 24.95%, green 23.7% and black 22.5%. I the research by Tuleum *et,al* (2001), the crude protein in cream velvet beans was found to be 28.1% Cp in white and 24% Cp in speckled and black types.

## 2.5 Anti-nutritional factors of velvet beans

Velvet beans contain anti- nutritional factors like trypsin inhibitors, tannins and cyanide (Ravindran and Ravindran, 1988), anticoagulants (Houghton and Skari, 1984) and L- 3,4 dihydroxyphenylalanine (L Dopa) a potentially neurotoxin agent occurs in large amounts in mucuna (Carew *et al.*, 2003) Other anti-nutritional factors include haemagglutinin, chemotrypsin inhibitors, anti-vitamins, p otease inhibitors, phytic acid, flatulence factors and saponins (Emenalom and janardhan n,2000). The anti-antinutritional factors phytate, trypsin and chemotrypsin adversely affe t the protein digestibility; while L-Dopa causes vomiting and severe diarrhoea (Gupta, 1987). T ese substances unless destroyed by heat or some other suitable treatment can exert advers physiological effects when ingested by animals (Liener 1980). However, it has been sugges ed that the consumption of velvet beans in low levels of certain anti-nutrients may produce healt benefits while avoiding some of the adverse effects associated with their large intake (Thompsor , 1988).

The feeding potential of th : of velvet can be enhanced by reducing these ant-nutritional factors using different treatment m :thods such as socking in sodium hydroxide then autoclaving, boiling, and toasting (Olaboro *et a* ., 1991). According to Vadivel *et al.*,( 2011), Soaking velvet beans in 0.2% sodium carbonate sc ution and exposing it to autoclaving treatment results in maximum reduction of various anti- n tritional substances.

# CHAPTER 3

## 3.0 MATERIALS AND MI THODS

### 3.1 LOCATION

The study was conducted at the University of Zambia in the School of Agricultural Sciences in Animal Science Department The chemical composition analysis was done in the animal nutrition laboratory, and experiment for feeding trials with Winstar rats was also done in the same laboratory.

### 3.2 MATERIALS

Speckled, White, yellow anc black velvet beans varieties were collected from Kasisi Agricultural Training Centre, while Soya beans cake, Dicalcium phosphate (DCP), methionine, broiler premix, salt, lysine, and limestone ai d cassava meal were procured from Livestock Services Co-operative Society in Lusaka. The Win :tar rats were obtained from the Animal Care Unit of the Department Biological Sciences in the S hool of Natural Sciences at the University of Zambia.

### 3.3 PROCESSING OF VE .VET BEANS

The processing of velvet be ns was done by soaking 300g of velvet seeds of each variety in 0.2% sodium carbonate for 24 h s after which the beans were dried and autoclaved at 120°C for 30minutes using an autocla e in the Food Science Laboratory. The samples were ground to pass through a 2mm sieve.

### 3.4 CHEMICAL COMPO SITION ANALYSIS

Proximate analysis was dor e on processed velvet beans following AOAC methods (1998). All analyses were done in tripli ates.

Moisture content was deter nined by drying 2g of each sample in a drying oven at a temperature of 105°C for 12hours, the d fference between the weight before and after drying was calculated to determine the moisture cor tent, this was then expressed as a percentage of the original sample weight.

Protein content was determ ned using the kjeldahl method. Where 1g of each sample was digested in 12ml concentrated sulph uric Acid. The digest was then cooled to room temperature and 75ml distilled water was added a d mixed thoroughly. Then 50ml of 40% sodium hydroxide was added to release ammonia. Volati ized ammonia was then collected in a receiving flask containing 25ml

of 4% boric acid indicator for 5minutes to obtain ammonium borate. This was then titrated with 0.01N hydrochloric acid tc the first trace of pink colour. To estimate the amount of Nitrogen the following formula was use( ;

Crude protein = (Titration Blank) x 0.1 x 14.007 x 100 divide by sample weight. The Nitrogen content was converted to cr ude protein by multiplying by factor of 6.25.

Ether Extract was determir ed using soxhlet method. 2g (W1) of each sample was weighed and put in a pre-dried extracti n thimble. The fat was extracted with 200ml of petroleum ether for 6hours in a previously dri d and weighed extraction flask (W2). After 6hours, the solvent was evaporated. The flask was cooled and weighed (W3) and the crude fat was then calculated by applying the following forn ula; %fat =W3 –W2 divide by W1 x100

Ash determination was d( ne by combusting 2g in a muffle furnace for 4hrs at 550°c. The difference in weight betwe :n the empty crucible and the crucible containing Ash gave the ash content of the sample.

Crude fibre was done by u: ing Weende method, where by 0.5g of each sample was weighed (w) and placed in a beaker. 15( ml of 1.25% sulphuric acid was added and the contents in the beaker were heated over a hot plat :. After boiling for 30 minutes, the contents were rinsed with 100mls hot water. The contents wer e washed back in the flask using 10mls sodium hydroxide and 150mls of 1.25% sodium hydroxid( and the contents in the beaker brought back to boil again for another 30 minutes. The contents v ere then filtered through sintered crucibles, rinsed and the crucibles washed with 100mls of hot water. The crucibles were then dried in an oven overnight at 105°C (A). The crucible was then placed in a muffle furnace at 550°C for 1hour to burn off remaining organic matter (B). The loss in weight on burning represented the fibre in the original sample. The crude fibre was then expres :ed as percentage by mass using the following formula; % crude fibre = (A – B)/W x 100Gross er ergy was obtained by summation of the known energy contributed by the analysis of crude prote in, crude lipid and carbohydrate fractions of the sample. This was calculated as follows;

Energy contributed by crud( protein = protein content sample % x 5.4 kcal/g = X

Energy contributed by crud( lipid = lipid content of sample % x 9.5 kcal/g =Y

Energy contributed by carb ohydrate was calculated as nitrogen free extract using the following formula;

NFE (crude carbohydrate) = 100 – (% moisture + % crude protein + % crude lipid + % Ash).

Then energy contributed by crude carbohydrate = energy in crude protein sample x 4.1 kcal/g =Z

The energy values given fo each component (kcal/g) are the average values obtained for a whole range of types of material when 1g is completely combusted in a calorimeter. Gross energy (GE kcal/g) = (X + Y + Z)/100.

Calcium and Phosphorus v ere determined by weighing 1g ash sample, added 10mls of 3N Hcl and boiled to yellow colou r. The sample was filtered, 5mls was taken and 100mls of distilled water was added to fill up o fill up to the mark. 1g of ammonium Oxalate, drops of methyl red then boil, cool and filter. At this point calcium was determined by adding 25mls ammonium sulphate and titrated to pi k colour while solution was boiling using potassium permaganent. Phosphorus was determir ed using Vanodo-molybdate method spectrophotometrically. The chemical composition analy sis is shown in appendix 1.

## 3.5VELVET BEANS DIGESTIBILITY AND FEEDING TRIAL

### 3.5.1EXPERIMENTA L DESIGN

30 Wister rats were randon ly allocated to the 5 dietary treatments with 6 replications per treatment in a completely r ndomised design (CRD) and each rat was treated as experimental unit on which data was collecte .

### 3.5.2 MANAGING WINS TAR RATS

Feed and water was offe ed Adlibitum. The rats were subjected to standard management procedures and each rat wa taken as individual replication. The feeding trial lasted for a period of 10 days during which feed ntake was recorded daily. Feed intake was determined by subtracting the left over feed on the fo lowing day from the quantity (30g) given on the previous day. Faecal matter was collected daily dried and weight recorded. The tables for average feed intake faecal matter recorded are shown n the appendix 2.0 and 3.0 respectively.

The initial body weight of the experimental rats was taken prior to the commencement of the experiment, and the final body weight gain was determined at the end of the experiment after 10days. Changes in body weight were determined by subtracting initial body weight from final body weight. The results ob ained are also shown in the appendix 5.0.

The apparent feed conversion ratio was then calculated from data collected for feed intake and data collected from change in weight for a period of 10 days. Feed conversion ratio was then determined by dividing the average feed intake by average body weight gain.

### 3.5.3 DIET COMPOSITION

The four treatment diets contained different varieties of velvet beans at the same inclusion level to replace soya, beans at 20% and fifth treatment diet of soya beans only was included as a control. Velvet beans and soya bean meal contributed 45%, while basal diet contributed 55% in all the treatments. The dietary composition and the calculated analysis of nutrient content are shown in the following tables.

Table 1.0 Dietary Composition (%) of different treatment diets.

| INGREDIETS | TREATMENT DIETS | | | | |
|---|---|---|---|---|---|
| | YELLOW | SPECKLED | CREAM | BLACK | SOYA |
| Soya bean cake | 25 | 25 | 25 | 25 | 45 |
| Velvet meal | 20 | 20 | 20 | 20 | _ |
| Cassava meal | 42.1 | 42.1 | 42.1 | 42.1 | 42.1 |
| Fish meal | 5 | 5 | 5 | 5 | 5 |
| Soya oil | 5 | 5 | 5 | 5 | 5 |
| limestone | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 |
| Dicalcium phosphate | 1.82 | 1.82 | 1.82 | 1.82 | 1.82 |
| Lysine | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| Methionine | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| Broiler premix | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 |
| Salt | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 |
| **total** | **100** | **100** | **100** | **100** | **100** |

Table 2.0 calculated analysis of nutrient content in diet.

| | |
|---|---|
| Energy | 3,089 Kcal |
| Crude protein | 19% |
| Calcium | 18.2g |
| phosphorus | 5.8g |
| Methionine | 0.8g |
| Lysine | 0.8g |

### 3.5.4 APPARENT DIGESTIBILITY OF NUTRIENTS.

Proximate analysis in diet was done and the results were used in calculating digestibility of nutrients in the treatments.

Apparent digestibility was calculated by subtracting amount of nutrient in faecal output from the amount of nutrients in feed intake, divided by feed intake and then converted to a percentage McDonald *et al.*, (1986).

### 3.6 DATA ANALYSIS

Analysis of variance (ANOVA) was used in the analysis of quantitative data using the Genstat 14th edition. For multiple comparison and differentiating means with and among treatments the least square difference (LSD) was used and Duncan's multiple range test was used to separate statistically different means.

# CHAPTER 4 RESUL TS AND DISCUSSION

## 4.1 CHEMICAL COM POSITION ANALYSIS

The results for chemical con position of velvet beans are shown in following table.

Table 2.0 chemical composi ion (%) mean + SEM).

| Parameter | varieties | | | | |
|---|---|---|---|---|---|
| | Yellow | S eckled | Cream | Black | SEM(+/-) |
| DM | 92.9 | 93.2 | 93.1 | 93.3 | ± 0.15 |
| Ash | $3.13^{b}$ | $3.21^{b}$ | $3.21^{b}$ | $2.77^{ab}$ | ± 0.10 |
| Cp | $24.98^{b}$ | $24.66^{b}$ | $29.08^{c}$ | $21.77^{a}$ | ±0.29 |
| EE | $3.29^{b}$ | $3.09^{b}$ | $2.64^{a}$ | $4.00^{c}$ | ±0.13 |
| CF | $10.73^{b}$ | $9.07^{a}$ | $8.61^{a}$ | $10.99^{b}$ | ±0.39 |
| NFE | $50.77^{b}$ | $53.57^{c}$ | $48.71^{a}$ | $53.09^{c}$ | ±0.56 |
| ME/kcal | $3.75^{a}$ | $3.83^{b}$ | $3.87^{b}$ | $3.73^{a}$ | ±0.04 |
| Calcium | $1.00^{a}$ | $1.32^{b}$ | $0.93^{a}$ | $1.17^{ab}$ | ±0.07 |
| Phosphorus | $0.61^{d}$ | $0.08^{b}$ | $0.48^{c}$ | $0.48^{c}$ | ±0.01 |

**Note.** Values with different uperscript within rows are significantly different ($P < 0.05$).

The results for all the nutr ents analysed showed a significant difference ($P < 0.05$) except in moisture content. The data was further subjected to least square difference (LSD) for multiple comparisons and Duncan M ltiple range for separation of means.

Crude protein results show d no significance difference ($P > 0.05$) between yellow and speckled variety while black and wh te differed significantly ($P < 0.05$) from each and from two other varieties. Black velvet reco ded lowest protein content of 21.77% (black), and 29.97% (cream) which recorded the highest.

The ether extract values sh owed no significant difference ($P > 0.05$) between yellow and speckled while black and cream dif ered significantly ($P < 0.05$) from each other and from the two other varieties. The lowest was c eam 2.63% and highest was black with 4.00%.

The Crude fibre results sh wed no significance difference ($P > 0.05$) between yellow and black but there was a significant d ifference ($P < 0.05$) between the subset groups. The highest value was recorded in black with 10.9 % and lowest was cream with 9.06%.

Ash content among the vari ties showed no significant difference ($P > 0.05$) among three varieties yellow, speckled and crea n while black differed significantly($P < 0.05$) from the rest and recorded the lowest value o 2.77%.

Results on Nitrogen free e tractives (NFE) results showed that, yellow and cream were found to be significantly different ($P < 0.05$) from each other and from other varieties while speckled and black did not differ signific antly ($p< 0.05$) from each other. The lowest value was obtained as 48.71% cream and the highe st was 53.57% in speckled.

Results on Metabolizable e ergy results showed that yellow and black did not differ significantly ($P > 0.05$) and also speckl d and cream did not differ but there was a significant difference ($P>0.05$) between the two gr ups.

Calcium results showed t at there was no significant difference ($P> 0.05$) among yellow, speckled and black. But spec kled differed significantly from the rest with 1.32%.

The results for phosphorus s owed the least value of 0.08% in speckled variety and this differed significantly from the rest.

## 4.2 APPARENT DIGEST BILITY OF NUTRIENTS RESULTS

Table 3.0 Apparent digestib lity (%) for protein and dry matter, mean + SEM.

| Treatment | Dry matter | Crude protein |
|---|---|---|
| Yellow | 85.1[a] ±0.09 | 76.[ab]± 0.317 |
| Speckled | 83.0[a] ±0.09 | 74.0[a]± 0.317 |
| Cream | 84.1[a] ±0.09 | 75.[ab]± 0.317 |
| Black | 83.2[a] ± 0.09 | 75.1[ab]± 0.317 |
| soya | 87.0[c] ±0.09 | 80.0[c]±0 0.317 |

**Note.** Values with different superscripts within columns are significantly different ($P < 0.05$).

Apparent digestibility resul s showed no significant differences ($P > 0.05$) for crude protein dry matter among the different varieties of velvet beans, but control diet differed significantly from the rest.

### 4.3 FEEDING AND GROW H PERFORMANCE

Table 4.0 shows the result obtained for feed intake, weight gain and Food Conversion Ratio (FCR) Mean+ SEM.

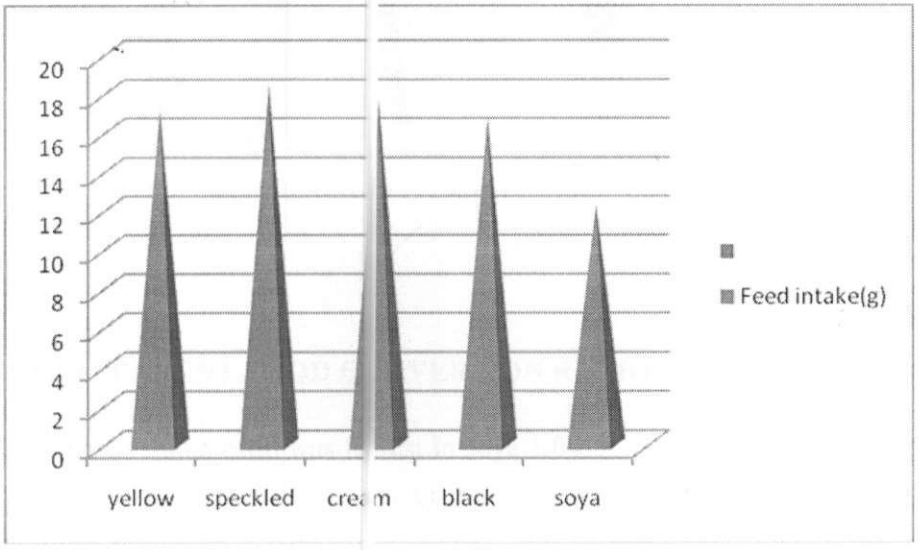
| Parameter | treatment (variety of velvet + soya) | | | | | |
|---|---|---|---|---|---|---|
| | Yellow | speckled | cream | black | soya | SEM |
| Feed intake (g) | 17.19[b] | 18.50[b] | 17.63[b] | 16.79[ab] | 14.28[a] | ± 0.932 |
| Weight gain (g) | 11.50[b] | 14.50[a] | 10.17[bc] | 9.67[bc] | 13.67[a] | ± 2.204 |
| FCR | 1.49[ab] | 1.28[ab] | 1.73[b] | 1.74[b] | 1.04[a] | ± 0.256 |

**Note.** Values with differen superscript within rows are significantly different ($P < 0.05$).

### 4.3.1 FEED INTAKE

The results for feed intake sho ved no significant differences ($P > 0.05$) of the three treatment diets containing yellow, cream and black varieties, while control diet differed significantly($P < 0.05$) from other treatments by rec rding the lowest ratio of 14.28g and the highest was recorded in speckled with 18.50g.

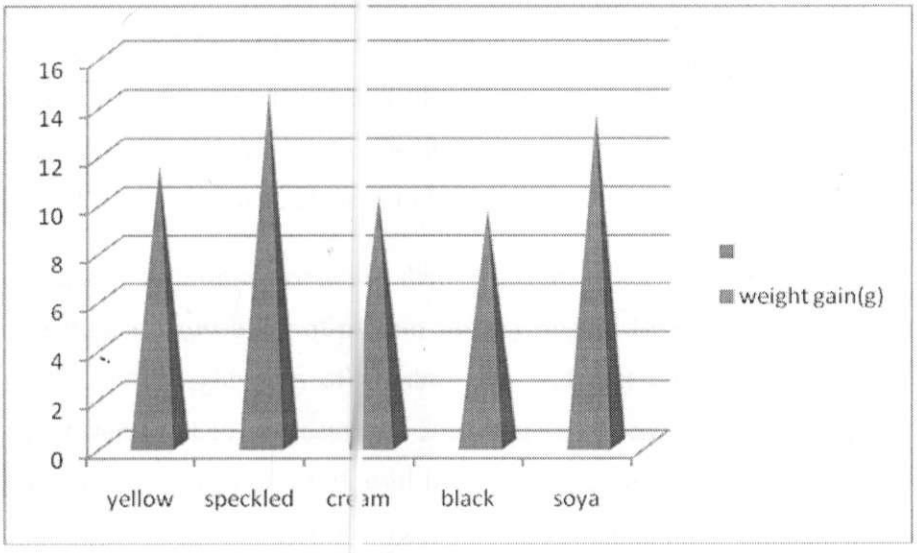
Figure 2.0 Average feed intak (g) per day.




### 4.3.2 WEIGHT GAIN

The highest weight gain of 1 .5g was recorded in speckled and this was followed by control diet with 13.67g. This could be is a result of high feed intake, and low feed conversion ratio in speckled diet. While weight ain in control diet could be as a result of lowest FCR and highest protein digestibility recorded.

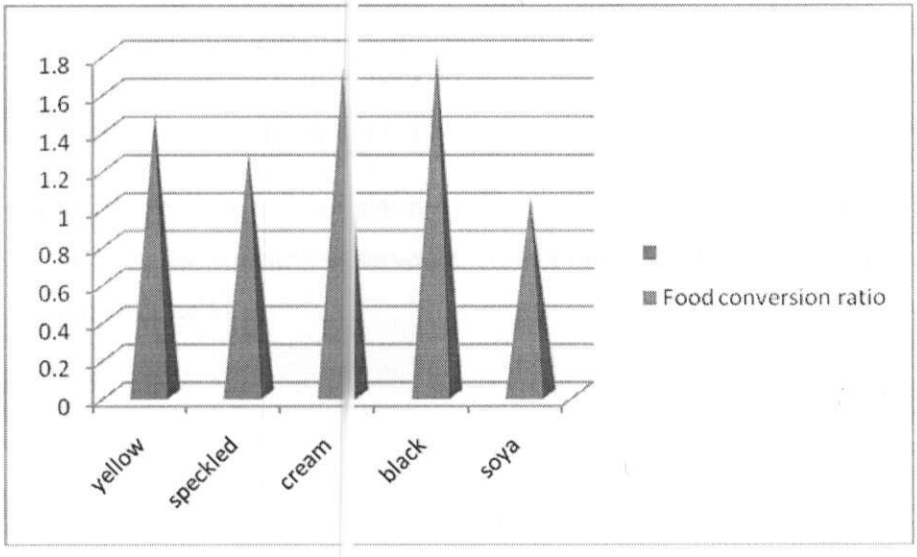
Figure 4.0 weight gain (g) for period of 10 days.




### 4.3.3 APPARENT FOOD CONVERSION RATIO

Food conversion ratio was lowest in soya 1.04, followed by diet containing speckled velvet bean meal with 1.28. Low FCR in speckled may as a result of high feed intake and high weight gain.

Figure 3.0 Apparent Food conversion ratios.



# CHAPTER 5 CONC LUSION AND RECOMMENDATION

## 5.1 CONCLUSION

The research demonstrated ' nat, there is a significance difference among the varieties of velvet beans (*mucuna pruriens*) in contents of nutrients. But this difference is not directly related to growth performance when u: ed in feed rations.

The use of different varietie: in diets produced results that were not significantly different in feed in apparent digestibility of p otein and dry matter. However, the results for food conversion ratio (FCR) and weight gain of Control diet and diet containing speckled velvet meal did differ significantly when subjecte l to least square difference. The highest protein digestibility was recorded in control diet foll wed by speckled. Average feed intake was highest in speckled diet and lowest in control diet. F ed conversion ratio was lowest in control diet followed by speckled and weight gain was high st in speckled diet followed control diet. The results shows that speckled velvet beans can l e used to replace soya beans in feed ration because of its low feed conversion ratio and high w ight gain recorded.

Therefore, the conclusion s that speckled velvet beans can produce better results in growth performance if included in liets at 20% among other varieties, though other varieties can still be used were speckled variety i s not available.

### 5.2 RECOMMENDATIONS

The recommendation is tha speckled variety can be included in the diets to replace soya beans at 20% so as to reduce on the a mount of soya bean to use in feed formulations.

I also recommend that, a sir ilar research be conducted in day old chicks (broilers) for a period of six weeks so as to clearly o serve the growth rate of birds, unlike the way it was used on Winstar rats for 10 days.

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# 7.0 APPENDICES

APPENDIX 1.0 Chemical co: ıposition in velvet beans

| Parameter | Treatment1 ( yellow) | | | Treatment 2 (speckled) | | | Treatment 3 (cream) | | | Treatment 4 (black) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Replication | | | Replication | | | Replication | | | Replication | | |
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Moisture. | 7.19 | 7.10 | 6.9 ) | 6.40 | 6.43 | 6.40 | 6.90 | 6.74 | 6.99 | 6.94 | 7.15 | 7.03 |
| Ash | 3.00 | 3.25 | 3.1 ł | 3.34 | 3.20 | 3.10 | 3.30 | 3.24 | 3.10 | 2.75 | 2.90 | 2.65 |
| Cp | 25.39 | 24.51 | 25. )4 | 24.77 | 23.99 | 25.21 | 29.41 | 29.94 | 30.55 | 21.36 | 22.24 | 21.71 |
| EE | 3.40 | 3.18 | 3.3 ) | 3.20 | 2.76 | 3.30 | 2.84 | 2.34 | 2.72 | 4.18 | 3.84 | 3.98 |
| CF | 10.99 | 11.20 | 10. )0 | 8.99 | 9.60 | 8.60 | 7.80 | 8.60 | 9.40 | 10.40 | 11.80 | 10.77 |
| NFE | 50.03 | 50.75 | 51 ;3 | 53.30 | 54.02 | 53.39 | 49.75 | 49.14 | 47.25 | 54.37 | 52.07 | 52.83 |
| kcal/kg | 3.75 | 3.71 | 3.7 3 | 3.83 | 3.77 | 3.89 | 3.90 | 3.85 | 3.85 | 3.78 | 3.70 | 3.72 |
| Ca | 1.04 | 0.96 | 1.0 ) | 1.46 | 1.12 | 1.38 | 0.84 | 0.99 | 0.96 | 1.10 | 1.06 | 1.34 |
| P | 1.01 | 1.1 | 1.1 2 | 0.40 | 0.38 | 0.39 | 0.54 | 0.51 | 0.55 | 0.46 | 0.44 | 0.48 |

APPENDIX 2.0 chemical co ıpositions in diet (%).

| Treatment | Crude protei | Crude fibre | Ether Extract | NFE | Ash |
|---|---|---|---|---|---|
| Yellow | 18.95 | 4.70 | 10.28 | 51.54 | 5.90 |
| Speckled | 18.98 | 4.00 | 13.16 | 48.53 | 6.50 |
| White | 18.65 | 2.54 | 11.16 | 52.87 | 6.10 |
| Black | 18.56 | 4.20 | 11.24 | 51.60 | 5.80 |
| Soya | 18.91 | 2.30 | 12.2 | 49.81 | 7.95 |

APPENDIX 3.0 chemical co npositions in faecal matter (%).

| Treatment | Crude protei | Crude fibre | Ether Extract | NFE | Ash |
|---|---|---|---|---|---|
| Yellow | 30.38 | 11.2 | 2.60 | 25.92 | 18.0 |
| Speckled | 29.50 | 8.10 | 2.54 | 30.36 | 18.1 |
| White | 28.19 | 7.80 | 1.98 | 32.85 | 17.38 |
| Black | 27.66 | 10.30 | 2.08 | 30.52 | 18.14 |
| Soya | 25.74 | 7.55 | 2.64 | 31.32 | 22.00 |

APPENDIX 4.0 Average fe d intake (g) per day.

| Treatment | Replications | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Yellow | 18.05 | 15.36 | 15.96 | 14.27 | 20.17 | 19.36 |
| Speckled | 19.39 | 16.02 | 19.10 | 14.63 | 22.95 | 18.93 |
| White | 18.82 | 18.26 | 19.44 | 15.63 | 15.20 | 18.42 |
| Black | 14.79 | 15.17 | 20.03 | 17.26 | 15.70 | 17.78 |
| soya | 12.69 | 12.10 | 18.11 | 14.00 | 13.14 | 15.66 |

APPENDIX 5.0 Change in weight gain (g) for a period of 10days.

| Treatment | Replication | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Yellow | 19.0 | 9.0 | 12.0 | 9.0 | 7.0 | 15.0 |
| Speckled | 11.0 | 21.0 | 28.0 | 8.0 | 8.0 | 11.0 |
| White | 11.0 | 8.0 | 20.0 | 9.0 | 6.0 | 7.0 |
| Black | 6.0 | 14.0 | 7.0 | 11.0 | 7.0 | 13.0 |
| Soya | 12.0 | 13.0 | 14.0 | 14.0 | 8.0 | 21.0 |