The Effect of Dietary Protein (Groundnut Cake and Coconut Cake) on the Live Weight Gain, Spermioigams, Gonadal sperm Reserves and Fertility of Boars

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ABSTRACT

The study investigated the effect of dietary protein (groundnut cake and coconut cake) on the live weight gain, spermiograms, gonadal sperm reserves and fertility of boars. The study was conducted at the Swine unit of the Teaching and Research Farm, University of Uyo, Uyo, Akwa Ibom State. The university of Uyo was used in this study. It is located in the heart of Uyo, the capital of Akwa Ibom state, Nigeria. A total of 18 grower pigs of large white consisting of 15 boars and 3 sows were used for the study. The boars were randomly selected into 3 groups (T1, T2 and T3) of five based on average initial weights (20-25kg) and were tagged appropriately while the sows were randomly placed in 3 group (S1, S2 and S3) of 1 in each group. Three diets were made for the three treatment conditions. The boars in T1 which is the control group were given normal maize fed, boars in T2 which is the first treatment condition were given groundnut cake diet while boars in T3 which is the second treatment condition were given coconut cake. These pigs were fed twice daily and water supplied ad libitum. Finally, the sow in S1 was artificially inseminated with the semen of the Boar in condition group 1 (T1), S2 was artificially inseminated with the semen of treatment condition 2 (T2) while S3 was artificially inseminated with the semen of treatment condition 3 (T3). During the feeding trial, weekly feed consumption and weight changes were recorded, while weight gain, feed conversion. Result showed a significant difference on the live weight gain of boars between groups (P < 0.05). Also, there was a significant difference on the spermiogenes and gonadal sperm reserves of boars between groups (P < 0.05). Finally, there was no significant difference on the fertility of sows between the treatment conditions (P > 0.05). It was concluded that dietary protein of groundnut cake and coconut cake could completely replace maize as they improve the live weight gain and sperms quality of boars. Implications and recommendations were made from the findings of the study.

Keywords: Boars, Live Weight Gain, Sperm Quality/Reserve and Fertility.

I. INTRODUCTION

Over the years, fertility has been seen as a complex interaction of traits involving two individuals of different genetic composition, that is, male and female, and it is their ability to mate and produce viable offspring (Foote, 2002 as cited by Muhammed, 2011). Fertility is a major factor in the success of any breeding programme, it depends on numerous factors. Success starts with a male animal that is healthy, disease-free, and produces ample quantity of high quality semen. However, equally important is the fertility potential of the female and also the environmental influences. Each of these components must be maintained at high standard as maximum reproductive efficiency will be dependent on the high standard of each of the components (Kirby et al., 1998 as cited by Muhammed, 2011).

Semen quality is an important component of male reproduction, and like other phenotypic expressions, it no doubt consists of a genetic component, an environmental component and a variety of interactions between the two (Foote, 1978 as cited by Muhammed, 2011). Nutrition has been shown to have a significant effect on semen quality traits (Sotirov et al., 2002). Optimum feeding is essential to maintain males in good reproductive state (Rekwot et al., 1994 as cited by Muhammed, 2011). Starvation on the other hand leads to a marked reduction in semen production, but this can be almost completely reversed in about 14 days after the resumption of normal feeding (Obidi, Onyeanusi, Rekwot, Ayo & Dzenda, 2008). Studies on specific nutrient requirements for semen production are rare, especially in indigenous poultry species (Obidi et al., 2008). Some studies on dietary calcium levels on semen characteristics of chicken showed that semen characteristics and fertility differed insignificantly. During the growth of males, dietary protein influences the onset of sexual maturity, 9% crude protein diet or less delays sexual maturity in chicken (Surai, 2002). Adult White Leghorn cocks fed 9% dietary protein produced normal quantities of semen, and the diet contained 1% calcium and had an energy value of 2853 Kcal/kg (Lake, 1971). Pana Stoica, Dregotoiu, Misclosanu and Stanescu (2000) showed that Cornish broiler cocks, whose daily feed consumption was limited to 130 g/cock/day produced ejaculates whose sperm concentration did not differ significantly from those of their full-fed counterpart. Ezekwe, Udousi and Osita (2003) found that the effects of underfeeding local cocks on the semen quality traits appear to be more severe on the physical rather than on the biochemical characteristics. This shows that the spermatogenic functions of the testes are more responsive to underfeeding than the secretory activity of
the reproductive tract. Underfeeding diminished the ability of the gonads to respond to gonadotropin stimulation (Davies, Mann & Rowson, 1957). Moderate underfeeding or reduction of feed intake by 30% to 50% adversely affects semen production and quality (Ezekwe et al., 2003).

It is necessary to evolve a feeding programme for breeding birds that will improve their reproductive efficiency, reduce the high cost of feeding and does not inflict damage to their reproductive functions. Protein level is a limiting factor in the diet of birds; its optimal level is a prerequisite not only for a rapid growth, but also for the normal condition of breeders by influencing the quantitative and qualitative parameters of semen (Sotirov et al., 2002). The studies by Meyer et al. (1980) on the volume of ejaculate and the concentration of spermatozoa showed that the feeding of exotic male turkeys (toms) with diets containing 12% and 17% protein, respectively resulted in significantly better results when the high dietary protein level was used. According to previous investigators (Cherms, Stoller, Macilwraith, Africa & Halloran, 1981; Brown, 1982; Cecil, 1984; Cecil, 1986; and Sexton 1986), the low dietary protein content (12.8%) decreases the quality of semen. The use of 17% dietary protein levels in turkey toms up to the age of 28 weeks and 8% protein thereafter resulted in a satisfactory sperm production up to the end of the breeding period (age of 47-52 weeks) (Cecil, 1986). However, this study is aimed at examining the effect of groundnut cake and coconut cake on the live weight gain, spermiogram and gonadal sperm reserves of male pigs.

II. MATERIALS AND METHODS

Location of the Study

The experiment was conducted at the Swine unit of the Teaching and Research Farm, University of Uyo, Uyo, Akwa Ibom State. The university of Uyo was used in this study. It is located in the heart of Uyo, the capital of Akwa Ibom state, Nigeria. The town became the state capital following the creation of the state on September 23, 1987 from the then erstwhile cross river state. Uyo serves a dual purpose of the state capital and local government headquarters and shares common boundaries with Itu, Uruan, Ibesikpo Asutan, Abak and Etinan local government areas. The core language of Uyo people is Ibibio. They are predominantly Christians with some fraction of traditional worshippers. The state is located in the south-south geopolitical zone of the country, lying between latitude 40321 and 50331 North and longitude 70251 and 80 East. The state is bounded on the east with Cross River state, west with Rivers state and Abia state and on the South with Atlantic Ocean. The state has 31 local government areas and a population of 5-million people living in the state. Experimental Animals

A total of 18 grower pigs of large white consisting of 15 boars and 3 sows were used for the study. The boars were randomly selected into 3 groups (T1, T2 and T3) of five based on average initial weights (20-25kg) and were tagged appropriately while the sows were randomly placed in 3 group (S1, S2 and S3) of 1 in each group.

Procedures

Complete randomized design was adopted for the study. The pigs were randomly placed in three groups (Group 1, Group 2 and Group 3) of five, and were tagged appropriately.

Three diets were made for the three treatment conditions. The boars in T1 which is the control group were given normal maize fed, boars in T2 which is the first treatment condition were given groundnut cake diet while boars in T3 which is the second treatment condition were given coconut cake. These pigs were fed twice daily and water supplied ad libitium. Finally, the sow in S1 was artificially inseminated with the semen of the Boar in condition group 1 (T1), S2 was artificially inseminated with the semen of treatment condition 2 (T2) while S3 was artificially inseminated with the semen of treatment condition 3 (T3). During the feeding trial, weekly feed consumption and weight changes were recorded, while weight gain, feed conversion ratio and protein efficiency ratio were estimated to assess performance of the grower pigs. They were acclimatized for a period of two weeks during which the males were trained for semen collection. The boars were trained to mount a collection dummy and their semen collected by the gloved-hand method as described by Sorensen (1979). Here two vinyl gloves were put on the hand thereafter, the boar’s prepuce was gently reached by messaging the penis through the prepuce to aid evacuate preputial fluids as well as stimulating pelvic thrusting. Then the boar will then start to thrust and extends his penis out of the prepuce, and then the corkscrew-shaped penile tip was grasped with the fingers with uniform pressure applied. After proper pressure was applied, the boar extends his penis and ceases thrusting and after a brief pause, the boar begins to ejaculate. The first few jets of an ejaculate during the thrusting were allowed to go on the ground because it’s usual function to flush out urethra. After the thrusting ceased, fluid and gel components were collected using a pre-warn (38°C/100°F) insulated thermos and later the fluid were filtered to remove the gel fraction using a mesh filter placed over the mouth of graduated thermos and the volume was recorded before evaluation of other semen characteristics like colour, motility (gross and individual), concentration, percentage live and dead cells and morphology. The same set of procedures was used for semen collection before and during treatment.

Testicular, epididymal and vas deferens sperm reserves were determined using the homogenization haemocytometric technique (Obidi et al., 2008) with modifications. Three toms from each group were
sacrificed for this procedure. The left and right testicles were carefully removed, trimmed of extra tissues and measured; the weight, length and circumference were recorded (Plate X, Plate XI and Plate XII). After careful removal of the tunica albuginea with a scalpel blade, each testicle was weighed again and homogenized in 20 mls of physiological saline with an antibiotic (Streptomycin 1:20 v/v), using a mortar and pestle. The epididymis and vasa deferentes, were carefully removed, trimmed of extra tissues and measured; the weights, lengths and diameters were recorded. They were first miniced with pair of scissors and each was homogenized in 10 mls of physiological saline containing the antibiotic. The homogenate volume was recorded and stored at 5 oC for 24 hours. They were mixed through shaking at intervals during the period of storage.

The homogenates were diluted 1:50 v/v using physiological saline. They were shaken for about a minute and filtered. Volumes of the filtrates were recorded and the sperm/spermatids reserves in the suspension were determined using Neubauer haemocytometer. Two counts were made for each suspension at a magnification of X 40. The number of spermatozoa counted was then multiplied by the dilution factor to obtain the number of sperm cells/ml of the homogenate; this was multiplied by the volume of the homogenate to obtain the total number of sperm cells in the homogenate.

Two (2) mls of blood was aseptically collected every week from the wing vein of each pig after the first semen collection of every week. The haemogram (complete blood count and packed cell volume) was determined in the haematology laboratory.

**Statistical Analysis**

Statistical package “Graph pad prism version 6.0” was used for the analysis. Data are expressed as mean ± SEM (standard error of mean). The differences in the mean values of the semen parameters, sperm penetration holes and gonadal and extragonadal sperm reserves between the three groups were compared using Repeated Measure Analysis of Variance (ANOVA). Correlation matrix analysis was used to determine the relationship between live weights of the toms and their semen parameters.

### III. RESULT

Table 1: Mean (±S.E) proximate and amino acid composition (% DM) of extracted coconut meal

| Nutrients               | Percent     |
|-------------------------|-------------|
| Moisture                | 9.54 ± 0.10 |
| Dry matter              | 90.46 ±0.10 |
| Crude protein           | 22.75 ±0.22 |
| Ether extract           | 2.89 ± 0.03 |
| Crude fibre             | 12.11 ±0.24 |
| Total ash               | 7.41 ±0.11  |
| Nitrogen free extract   | 54.84 ±0.32 |
| Calcium                 | 0.40 ±0.02  |
| Total Phosphorus        | 0.63 ±0.01  |
| AME (kcal/kg)           | 1552.33 ±11.82 |
| TME (kcal/kg)           | 1810.23 ±5.31 |

| Amino acids | Percent     |
|-------------|-------------|
| Alanine     | 1.13 ±0.10  |
| Arginine    | 1.99 ±0.09  |
| Aspartic acid | 1.01 ±0.01 |
| Glutamic acid | 2.70 ±0.03 |
| Glycine     | 0.52 ±0.05  |
| Histidine   | 0.44 ±0.27  |
| Isoleucine  | 1.76 ±0.14  |
| Leucine     | 0.59 ±0.15  |
| Lysine      | 2.36 ±0.05  |
| Methionine  | 0.34 ±0.11  |
| Phenylalanine | 0.81 ±0.25 |
| Serine      | 0.71 ±0.02  |
| Threonine   | 0.62 ±0.04  |
| Tyrosine    | 0.27 ±0.14  |
| Valine      | 0.44 ±0.12  |

Table 1 above shows the crude protein content and amino of extracted coconut meal (ECM).

Most of the nutrient composition of extracted coconut meal (ECM) estimated in this experiment was comparable to those listed in NRC (1994). The observed AME (1552 kcal/kg) was in close agreement with NRC.
value (1525 kcal/kg). The lysine and methionine content of ECM were 0.59 and 0.34 per cent, respectively. The critical amino acids, lysine (0.59 per cent) and methionine (0.34 per cent) were lower in ECM compared to values given in NRC (1994) for other vegetable protein sources, which are commonly used in poultry feed like soybean meal (2.69 and 0.62 per cent) sunflower meal (1.00 and 0.50 per cent) and groundnut meal (1.54 and 0.54 per cent). However, this was in agreement with the findings of Creswell and Brooks (1971) who observed extremely low level of lysine (0.48 per cent) and methionine (0.37 per cent) in coconut meal when compared to other protein sources used in poultry feed. The glutamic acid (2.70 per cent), leucine (2.36 per cent) and arginine (1.99 per cent) contents were very high in ECM and among this high arginine might interact with lysine as observed by Leeson and Summers, (2001).

Table 2: Mean (±S.E) proximate and amino acid composition (% DM) of extracted groundnut meal (EGM)

| Nutrients                  | Percent  |
|----------------------------|----------|
| Moisture                   | 10.54 ± 0.10 |
| Dry matter                 | 39.46 ± 0.10 |
| Crude protein              | 24.75 ± 0.22 |
| Ether extract              | 3.89 ± 0.03  |
| Crude fibre                | 10.11 ± 0.24 |
| Total ash                  | 8.41 ± 0.11  |
| Nitrogen free extract      | 44.84 ± 0.32 |
| Calcium                    | 0.80 ± 0.02  |
| Total Phosphorus           | 0.73 ± 0.01  |
| AME (kcal/kg)              | 1542.33 ± 11.82 |
| TME (kcal/kg)              | 1814.23 ± 5.31 |

| Amino acids                 |           |
|-----------------------------|-----------|
| Alanine                     | 3.13 ± 0.10 |
| Arginine                    | 4.99 ± 0.09 |
| Aspartic acid               | 6.01 ± 0.01 |
| Glutamic acid               | 3.70 ± 0.03 |
| Glycine                     | 0.82 ± 0.05 |
| Histidine                   | 0.64 ± 0.27 |
| Isoleucine                  | 1.86 ± 0.14 |
| Leucine                     | 3.89 ± 0.15 |
| Lysine                      | 2.56 ± 0.05 |
| Methionine                  | 1.54 ± 0.11 |
| Phenylalanine               | 1.91 ± 0.25 |
| Serine                      | 1.81 ± 0.02 |
| Threonine                   | 1.82 ± 0.04 |
| Tyrosine                    | 1.47 ± 0.14 |
| Valine                      | 1.54 ± 0.12 |

The observed AME (1542 kcal/kg) was in close agreement with NRC value (1525 kcal/kg). The lysine and methionine content of EGM were 1.56 and 1.54 per cent, respectively. The critical amino acids, lysine (1.56 per cent) and methionine (1.54 per cent) were almost the same in EGM compared to values given in NRC (1994) for other vegetable protein sources, which are commonly used in poultry feed like soybean meal (2.69 and 0.62 per cent) sunflower meal (1.00 and 0.50 per cent) and coconut meal (0.59 and 0.44 per cent). However, this was not in agreement with the findings of Creswell and Brooks (1971) who observed extremely low level of lysine (0.48 per cent) and methionine (0.37 per cent) in coconut meal when compared to other protein sources used in poultry feed. The glutamic acid (3.70 per cent), leucine (3.89 per cent) and arginine (4.99 per cent) contents were very high in EGM and among this high arginine might interact with lysine as observed by Leeson and Summers, (2001).

Table 3: Preliminary or initial results of live weight gain and semen parameters before treatment

| Parameters          | Group 1(Maize feed) n* = 5 | Group 2(GC) n = 5 | Group 3(20% CC) n = 5 |
|---------------------|-----------------------------|-------------------|-----------------------|
| Live weight (kg)    | 3.1000 ± 0.2363             | 4.425 ± 0.1828    | 4.315 ± 0.2317        |
| Semen Volume (mLs)  | 0.118 ± 0.008               | 0.123 ± 0.009     | 0.118 ± 0.008         |
Values with different superscripts (across rows) differ significantly (P < 0.005).

**Table 3.1: Mean (± SEM) semen parameters and live weights of boars fed different levels of protein diets**

| Parameters            | Group 1 (Maize feed) n* = 5 | Group 2 (GC) n = 5 | Group 3 (20% CC) n = 5 |
|-----------------------|-----------------------------|--------------------|------------------------|
| Live weight (kg)      | 3.29 ± 0.25                 | 4.39 ± 0.20        | 4.63 ± 0.22            |
| Semen Volume (mLs)    | 0.17 ± 0.00                 | 0.24 ± 0.02        | 0.27 ± 0.03            |
| pH                    | 7.86 ± 0.06                 | 6.03 ± 0.06        | 7.85 ± 0.07            |
| Mass motility (%)     | 72.01 ± 1.34                | 78.00 ± 1.36       | 81.00 ± 1.19           |
| Individual motility (%) | 81.18 ± 1.29            | 83.58 ± 1.26       | 84.39 ± 1.12           |
| Concentration (x109)  | 4.33 ± 0.43                 | 5.99 ± 0.56        | 6.77 ± 0.61            |
| % Live sperm (%)      | 73.81 ± 1.36                | 79.14 ± 1.32       | 80.80 ± 1.12           |
| Total Defects (%)     | 17.43 ± 1.07                | 16.31 ± 0.99       | 15.89 ± 0.80           |

GC = Groundnut cake, CC = Coconut cake. Values with different superscripts (across rows) differ significantly (P < 0.005).

Mean (± SEM) body weight changes of boars fed varying levels of protein diets were before treatment were 3.1000 ± 0.2363, 4.425 ± 0.1828 and 4.315 ± 0.2317 and after the treatment were given, their live weight were 4.29 ± 0.25 kg, 5.39 ± 0.20 kg and 5.63 ± 0.22 kg for Groups 1, 2 and 3 respectively. The differences recorded among the groups did not differ significantly (P < 0.05) as the scores gotten before the treatment were higher than scores gotten after treatments. Also, on the different level between the control group (Group 1) and the treatment groups (Group 2 & 3) a significant difference were observed (P < 0.05) as boars in treatment 2 and 3 showed higher body weight than those in treatment 1 with treatment conditions 3 having the highest live body weight.

Also, Mean (±SEM) semen volumes of the three groups of boars fed varying protein diets with group 1 being the control group were 0.17± ± 0.01 ml, 0.24± ± 0.02 ml and 0.27± ± 0.02 ml. A significant (P < 0.05) difference was observed between Groups 1 and 2, but there was also a significant difference between Groups 1 and 3 but no significant (P > 0.05) difference was observed between Groups 2 and 3. This could be because both groundnut cake and coconut cake are both proteinases diet and will increase the same or almost closely amount semen in the boars in which the cakes were given. These differences were also seen in their weekly trend.

The results (mean ± SEM) of semen concentrations of the three groups are 4.33± ± 0.428 X 109, 6.99± ± 0.56 x 109 and 6.77± ± 0.612 X 109. There was significant (P < 0.05) difference between groups 1 and 2. There was also a significant (P < 0.05) difference between groups 1 and 3 but the difference between group 2 and group 3 was not significant (P > 0.05).

Furthermore, the mean (± SEM) counts of live spermatozoa are 75.81± ± 1.36 %, 80.14± ± 1.32 % and 81.80± ± 1.12 % for groups 1, 2 and 3 respectively. Significant (P < 0.05) differences were observed between groups 1 and 2 and between groups 1 and 3, but there was no significant (P > 0.05) difference between groups 2 and 3. Finally, the results (mean ± SEM) of the total sperm defects, are 18.43 ± 1.07 %, 17.31 ± 1.00 % and 16.31 ± 0.99 %. The difference observed between the three groups was not significant.

**Table 4: Gonadal and Extra gonadal sperm reserves of turkey boars fed varying levels of diets.**

| No of Animals          | Group 1 (Maize feed) n* = 5 | Group 2 (GC) n = 5 | Group 3 (20% CC) n = 5 |
|------------------------|-----------------------------|--------------------|------------------------|
| Testicles sperm reserve (x109/gm) | 0.18± ± 0.00 | 0.20± ± 0.00 | 0.19± ± 0.00 |
| Epididymis sperm reserve (x109) | 0.08± ± 0.00 | 0.13± ± 0.01 | 0.17± ± 0.00 |
| Vas deferens sperm reserve (x109) | 2.01± ± 0.06 | 2.83± ± 0.22 | 3.65± ± 0.27 |

Values with different superscripts (across rows) differ significantly (P < 0.005)
The mean (± SEM) sperm reserves of testis, epididymis and vas deferens of the three groups of boars, fed varying levels of diets are presented in Table 4. The testicular sperm reserves per gram of testicle are 0.18± ± 0.00, 0.20± ± 0.00 and 0.19± ± 0.00 for Groups 1, 2 and 3, respectively. There were significant (P< 0.05) differences in testicular sperm reserves between groups 1 and 2, and groups 1 and 3 (P < 0.05) but no significant (P > 0.05) difference between groups 2 and 3. The mean (± SEM) epididymis sperm reserves of the groups 1, 2 and 3 were 0.08± ± 0.00, 0.13± ± 0.01 and 0.17± ± 0.00 respectively. There was significant (P< 0.05) difference between the testicular sperm reserves in groups 1 and 2, and between groups 1 and 3 (P < 0.05) but no significant (P > 0.05) difference was between groups 2 and 3. The mean (± SEM) vas deferens sperm reserves are 2.01± ± 0.06, 2.83± ± 0.22 and 3.65± ± 0.27. There was significant (P< 0.05) difference between the testicular sperm reserves in Groups 1 and 2, and Groups 1 and 3, but difference between groups 2 and 3 was not significant.

Table 5: Mean values of blood parameters of turkey toms fed varying Levels of diets.

| Blood parameters                  | Group 1(Maize feed) n* = 5 | Group 2(GC) n = 5 | Group 3(20% CC) n = 5 |
|-----------------------------------|-----------------------------|-------------------|-----------------------|
| Packed Cell Volume (%)            | 30.20 ± 2.85^a             | 32.8 ± 1.39^b     | 31.6 ± 1.54^b         |
| White Blood Cell (X103/μl)       | 3.30 ± 0.68^a              | 6.09 ± 2.37^b     | 3.70 ± 0.51^a         |
| Heterophils (%)                   | 8.40 ± 1.03                | 7.60 ± 2.25       | 8.80 ± 1.74           |
| Lymphocytes (%)                   | 89.40 ± 1.17               | 90.60 ± 2.50      | 89.80 ± 0.97          |
| Monocytes (%)                     | 1                           | 2                  | 3                     |
| Eosinophils (%)                   | 0                           | 1                  | 3                     |
| Basophils (%)                     | 0                           | 0                  | 0                     |
| Band Cells (%)                    | 0                           | 0                  | 0                     |
| Total Protein                     | 4.64 ± 0.44                | 4.25 ± 0.50       | 4.34 ± 0.27           |
| Haemoglobin (g/dL)                | 7.90 ± 1.90^a              | 11.24 ± 0.47^b    | 10.84 ± 0.51^b        |

Values with different superscripts (across rows) differ significantly (P < 0.005)

Mean (± SEM) values of blood parameters are presented in table 5. The mean Packed Cell Volume (PCV) and Haemoglobin Concentration (Hb) values revealed significant differences (P< 0.05) between groups 1 and 2 and groups 1 and 3, but there was no significant difference (P > 0.05) between groups 2 and 3. The mean WBC counts show significant differences between all the groups while no significant differences were found between all the groups in the mean values of total protein, heterophils, lymphocytes, monocytes eosinophils, basophils and band cells.

Table 6: Semen Parameters from Live Breedings and Pregnancy Results

| Male pigs | Female pig | Estimated activity | Estimated concentration Low Medium High | Sperm Live (%) | Morphologically Normal (%) | Pregnancy |
|-----------|------------|--------------------|----------------------------------------|---------------|----------------------------|-----------|
| T1        | S1         | 50                 | 2                                      | 75            | 72                         | YES       |
| T2        | S2         | 80                 | 3                                      | 85            | 80                         | YES       |
| T3        | S3         | 85                 | 3                                      | 90            | 82                         | YES       |
| Av./Range for pregnancies | 71.67 (0 – 85) | 2.67 (1 -3) | 83.33 (0 – 90) | 78.00 (0 – 82) | 3 | Pregnancies |

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pregnancies, they are comparable to each other, thus suggesting once again that semen parameters in boars vary widely from male to male and collection to collection. This also suggests that even with such variation in semen parameters and diets, pregnancy can still be achieved. It makes sense that the sperm activity percentages and live sperm percentages would be greater in breedings that resulted in pregnancies because the more live and active sperm in an ejaculate the higher the chance of one sperm being able to reach, penetrate, and fertilize an oocyte. However, the differences seen from the breedings in this trial were significant enough to determine what exact values for percent active sperm and live sperm are necessary to achieve a pregnancy. For the breeding of male T1 to female S1, the estimated activity percentage was observed to be 85%. When the percentage of morphologically normal sperm was analyzed for this portion of the study the results were similar. For breeding that achieved pregnancies the percent of morphologically normal sperm was 78.00%. This could mean that energy diets like maize meal could also causes fertility in sows as dietary protein meals such as coconut cake and groundnut cake could do also. Therefore, one could say that meal type do not significantly differ in fertility, (P>0.05). However, more research is needed to validate this conclusion.

**IV. DISCUSSION**

Live weights of the boars taken throughout the period of the study showed significant differences (P < 0.05) between the mean (± SEM) live weights of the three groups. The results of the different values of semen parameters of boars fed with maize meal, groundnut meal and coconut cake showed that semen volume was higher in group 3, followed by group 2 with Group 1 having the least volume. There was no significant (P < 0.05) difference between Group 2 CP and group 3. The significant differences between group 1 and group 2, and between group 1 and Group 3, were probably due to the different protein levels fed. This is contrary to the reports of Perry (1960) and Etches (1996) in cockerels and Jibril et al. (2011) in rams, who reported higher reproductive performance in lower CP level than in higher CP levels. The results are in agreement with those reported by Rekwot et al. (1987), and Rekwot et al. (1988) in bulls, Louis et al. (1994) in boars, Ladokun et al. (2006) in pubertal rabbit bucks, Ghonim et al. (2010) in drakes, who reported better performance in animals fed higher CP levels than those fed lower CP levels. It also agrees with the work of Sotirov et al. (2002) who reported higher ejaculate volume in turkeys fed 17% CP than in their counterparts fed 14% CP.

Although the ejaculate volumes obtained in Group 1 (12% CP) were similar to those reported by Zahraddeen et al. (2005) in indigenous turkey toms, they were not within the ranges reported by Burke (1984), Bakst (1990) and Christensen (2005) in exotic breeds. The volumes obtained in group 2 (16% CP) and group 3 (20% CP) were within the range given for the exotic breeds and was higher than the 0.17 ± 0.02 ml reported by Zahraddeen et al. (2005) in local breeds, but similar to the report by Yahaya et al. (2013). The differences observed between the values in this work and the values reported by Zahraddeen et al. (2005) in the same breed might be due to the difference in feeding. Zahraddeen et al. (2005) fed 10% CP which was lower than the 12%, 16% and 20% used in the present study.

Semen concentration was significantly higher in group 3 than in Group 1, the result in group 2 was also significantly higher than that in group 1. This was apparently due to the effect of the difference in the levels of protein in their diets. This disagrees with the works by Jibril et al. (2011) who reported higher semen concentration in a group of rams fed 15% CP than that of their counterparts fed 18% CP. This might be attributed to the optimum utilization of dietary protein at about 15% CP in that specie and breed. The result, however, is similar to that reported by Rekwot et al. (1987) and Rekwot et al. (1988) in bulls; Louis et al. (1994) in boars; Ladokun et al. (2006) in pubertal rabbit bucks; Ghonim et al. (2010) in drakes, who reported better performance in animals fed higher CP levels than those fed lower CP levels. It also agrees with the report of Sotirov et al. (2002), who observed higher semen concentration in turkeys fed 17% CP than in those fed 14% CP. There was however no significant difference between group 2 and Group 3. This might be attributed to the optimum utilization of dietary protein at about 16-20% CP in this breed of turkeys, considering the results obtained in the present study. Semen concentration in the present study is higher than the 2.8 ± 74.3 x10⁹ /ml and 4.66 ± 70.73 x10⁹ /ml reported by Zahraddeen et al. (2005) in local and exotic breeds, respectively. The values obtained in Groups 2 and 3 are, however, similar to the report by Yahaya et al. (2013) (6.22 ± 0.305 x10⁹ /ml) and that by Cecil and Bakst (1988) (7.90 ± 1.19 x10⁹ /ml). They also fell within the range of 6-12 billions per ml reported by Christensen (2005) for exotic breeds. The significant differences observed between groups 1 and 2 and also between groups 1 and 3 may be attributed to the difference in the level of crude protein in their diets. This agreed with the work by Sotirov et al. (2002), who observed increase in both mass and individual motilities of sperm in turkeys fed 17% CP than in those fed 14% CP. It also agreed with the report by Ghonim et al. (2010), who reported higher sperm motility though without significant difference in drakes fed higher crude protein than in those fed lower crude protein. There was no significant difference (P < 0.05) between groups 2 and 3 in terms of live sperm count. There was, however, significant difference between the two groups and group 1, this is perhaps so because optimum protein level increased the viability of the sperm cells in groups 2 and 3 as against group 1, where 12% CP which was fed may be considered suboptimal in this breed. The result...
disagreed with that by Jibril et al. (2011), who observed no difference in sperm viability of Yankasa rams placed on different protein diets. However it agreed with that by Sotirov et al., (2002) and Ghonim et al. (2010) who observed significant differences in the percentage live sperm of turkeys and drakes respectively fed varying levels of crude protein. The difference observed in the values of sperm morphology count between all the groups was not significant (P < 0.05). This agreed with the result of Sotirov et al. (2002) and Jibril et al. (2011), who reported no significant difference in the percentage of abnormal sperm in turkeys and rams, respectively, fed varying levels of protein diet. The result disagreed with that by Ghonim et al. (2010), who found differences in drakes, based on differences in the level of protein consumed.

Significant difference (P < 0.05) was observed in all the parameters of testicular, epididymal and vas deferens reserves between the Groups. This might be attributed to the variation in the crude protein contents of their various diets. This result agrees with the work of Ladokun et al. (2006), who observed significant difference in gonadal and extragonadal sperm reserves in rabbit bucks fed varying protein diets. The reserves are similar to the result of Cecil et al. (1988), who reported 122–127 x 106 sperm cells/g, 58 x106 (ejaculated) and 204 x 106 sperm cells (rested), 3160 x 106 sperm cells (ejaculated) and 10320 x 106 sperm cells (rested), and 3248 x 106 sperm cells (ejaculated) and 10524 x 106 sperm cells (rested) for gonadal sperm reserve, epididymal, vas deferens and total extragonadal reserves, respectively.

There is positive correlation (P < 0.05) between live weights of the toms and their semen parameter such as semen volume, semen concentration, live sperm and percentage normal cells. Although the difference in the correlation coefficient between the three groups is not significant, it can be seen that the live weight is poorly correlated to volume in Group 1, while it is positively correlated in Group 2 and 3. This result agreed with the finding of Barth and Chaudhari (2002) in cocks, Butswat and Zaharadden (1998) in bucks. The reason for the observed correlation may be because the optimum protein utilization in turkeys is between 16% CP and 22% CP. The observed difference between groups 2 and 3 and group 1 may be as a result of the difference in protein content of their diet, while 12% CP is perhaps more far away from the optimum, 16% CP and 20% CP are closer to it; and, hence, the similar values in the correlation matrix.

V. CONCLUSION

The experiment was conducted at the Swine unit of the Teaching and Research Farm, University of Uyo, Uyo, Akwa Ibom State. The University of Uyo was used in this study. It is located in the heart of Uyo, the capital of Akwa Ibom state, Nigeria. A total of 18 grower pigs of large white consisting of 15 boars and 3 sows were used for the study. The boars were randomly selected into 3 groups (T1, T2 and T3) of five based on average initial weights (20-25kg) and were tagged appropriately while the sows were randomly placed in 3 group (S1, S2 and S3) of 1 in each group. Three diets were made for the three treatment conditions. The boars in T1 which is the control group were given normal maize fed, boars in T2 which is the first treatment condition were given groundnut cake diet while boars in T3 which is the second treatment condition were given coconut cake. These pigs were fed twice daily and water supplied ad libitum. Finally, the sow in S1 was artificially inseminated with the semen of the Boar in condition group 1 (T1), S2 was artificially inseminated with the semen of treatment condition 2 (T2) while S3 was artificially inseminated with the semen of treatment condition 3 (T3). During the feeding trial, weekly feed consumption and weight changes were recorded, while weight gain, feed conversion.

Result showed a significant difference on the live weight gain of boars between groups (P < 0.05). Also, there was a significant difference on the spermiogenes and gonadal sperm reserves of boars between groups (P < 0.05). Finally, there was no significant difference on the fertility of sows between the treatment conditions (P> 0.05). It is therefore recommended that:
1. Protein diet especially groundnut meal and coconut cake Should be encouraged in the feeding of pigs to reduce over dependence of maize feeds by our farmers which have led to high cost of raising birds thereby discouraging farmers from investing in the poultry business.
2. Protein diet especially groundnut meal and coconut cake Should be encouraged in the feeding of boars as it aids in the live weight of boars, sperm quality in terms of volume, concentration and effectiveness.
3. Public extension/ advisory staff should be mobilized to convey these results to practicing farmers.

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