Effects of Year, Season and Diet on Semen Characteristics of indigenous Strains of Turkey in Bauchi, Nigeria

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Abstract

Experiment was conducted at the research farm of Abubakar Tafawa Balewa University, Bauchi to investigate the effect of year, season and diet on semen characteristics of indigenous strains of turkey over a period of 24 months (Jan 2005 – Dec. 2006). Jan – Mar, April – June, July – Sept, Oct – Dec; 2599ME/Kcal/14%CP; 2555ME/Kcal/18%CP, 2511ME/Kcal/22%CP, 2466ME/Kcal/26%CP being season and diet I, II, III and IV respectively. Parameters considered were liveweight, volume, concentration, motility, alive: death ratio, percentages normal and abnormal sperm cells. Data obtained were analyzed using analysis of variance (General Linear Model). The results show that semen colour and motility were higher and significant (P<0.001) in favour of year I while volume, concentration and percentage dead were in favour of year II. No significant difference was observed between years in liveweight, percentage live, percentages normal and abnormal. Highly significant (P<0.001) seasonal difference was observed in all the parameters considered. Higher liveweight, concentration and motility of 7.66 + 1.00kg, 6.18 + 36.68 x 10⁶ and 1.79 + 0.79 (season IV); best volume and colour of 0.23 + 0.11ml and 1.46 + 0.50 (season III); higher percentage dead and abnormal of 5.37 + 0.37 and 24.62 + 1.10 (season II); poor percentage live and normal of 70.00 + 1.11 and 71.38 + 5.90 (season I) were obtained. Similarly diet III gave significantly (P<0.001) higher liveweight of 7.69 + 3.48kg. Also diet II gave significantly (P<0.001) higher semen volume of 0.28 + 0.10ml and best colour and motility of 1.31 + 0.48 and 1.35 + 0.55. However, semen concentration, percentages live and dead; normal and abnormal were not significantly affected by dietary treatments. The study revealed the best season and diet which can lead to increase in reproductive efficiency of indigenous strains of turkey in Bauchi, Nigeria.

Keywords: Turkey, Semen, Characteristics, Season and Diet

Introduction

In Nigeria like other developing countries, poultry is the most widely distributed of all farm animal species and contributes approximately 20% of protein consumed (Ikumawoyi, 2001). In many rural areas, practically every family keeps poultry mostly in free and scattered manner to scavenge for food
on their own (Nwajiuba et al., 2002). Poultry population in Nigeria is estimated at 104.3 million comprising 72.4 million chicken, 11.8 million ducks, 4.7 million guinea fowls, 15.2 million pigeons and 0.2 million turkeys (FDLPCS, 1992), producing 107,000 metric tonnes of poultry products annually (FAO, 1995). Despite its great potentials in the supply of good quality animal protein and high rate of turnover on investment (Oluyemi, 1985; Ojewola, 1993), turkey forms only 0.6% of the Nigerian poultry population (Sonaiya, 1990). The imported ones form about 60% (Thear and Fraser, 1986), accounting for about 1.5g of daily protein consumed (Ojewola et al., 2000). Furthermore, turkey production has not been given the rightful attention in Nigeria although the bird grows faster and attains bigger mature size than most other poultry species. Its production therefore has largely remained at the small holder level due obviously to lack of information on specific management requirements. This may be attributable to low level of research as well as lack of incentives by government (Mbanasor and Sampson, 2004).

Reproductive performance of livestock is affected by genitalia infections, plane of nutrition, degree of management (Bekele et al., 1991) and season (Rekwot et al., 1987; Butswat et al., 2002).

In poultry, semen characteristics such as sperm concentration, viability and motility correlates positively with sperm quality index (McDaniel et al., 1998; Neuman et al., 2002; Parker and McDaniel, 2003).

Materials and Method

Location, Climate and Vegetation

The study was conducted at the poultry unit of the Abubakar Tafawa Balewa University, Teaching and Research farm, Bauchi. Over a period of two years (2005-2006). Bauchi is located on longitude 09° 49' E; latitude 10° 17' N and at an altitude of 609.3 metres above sea level (Nigerian Meteorological Agency, 2008) in the northern guinea savannah ecological zone of Nigeria (Kowal and Knabe, 1972). The mean annual rainfall is 1250mm while the annual temperature range is 11-40°C. The temperature range during the study was 15-37.9°C; mean monthly solar radiation was highest in April and lowest in August. August recorded the highest relative humidity of 84% while January had lowest of 33% (Table 1).

The seasons in Bauchi had been classified into four according to rainfall pattern (Butswat, 1994).

i. January to March – late dry season.

ii. April – June is the early rainy season

iii. July – September is the late rainy season

iv. October – December, this is the
### Table 1: Mean Average Monthly Weather Record at Bauchi (2005-2006)

<table>
<thead>
<tr>
<th>Month</th>
<th>Temperature (°C)</th>
<th>Rainfall (mm)</th>
<th>Relative Humidity (%)</th>
<th>Solar Radiation (lux)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mini</td>
<td>Mum</td>
<td>Maximum</td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>16.2</td>
<td>32.1</td>
<td>0.0</td>
<td>33.0</td>
</tr>
<tr>
<td>February</td>
<td>20.9</td>
<td>36.7</td>
<td>0.4</td>
<td>36.0</td>
</tr>
<tr>
<td>March</td>
<td>23.0</td>
<td>37.8</td>
<td>0.0</td>
<td>36.0</td>
</tr>
<tr>
<td>April</td>
<td>24.3</td>
<td>37.9</td>
<td>26.2</td>
<td>47.0</td>
</tr>
<tr>
<td>May</td>
<td>29.6</td>
<td>35.3</td>
<td>126.2</td>
<td>67.0</td>
</tr>
<tr>
<td>June</td>
<td>29.6</td>
<td>32.3</td>
<td>218.1</td>
<td>73.0</td>
</tr>
<tr>
<td>July</td>
<td>22.6</td>
<td>30.2</td>
<td>199.9</td>
<td>79.0</td>
</tr>
<tr>
<td>August</td>
<td>21.7</td>
<td>29.2</td>
<td>296.8</td>
<td>84.0</td>
</tr>
<tr>
<td>September</td>
<td>21.8</td>
<td>30.5</td>
<td>156.5</td>
<td>76.0</td>
</tr>
<tr>
<td>October</td>
<td>21.5</td>
<td>33.0</td>
<td>30.2</td>
<td>70.0</td>
</tr>
<tr>
<td>November</td>
<td>16.9</td>
<td>33.3</td>
<td>0.0</td>
<td>48.0</td>
</tr>
<tr>
<td>December</td>
<td>15.0</td>
<td>31.7</td>
<td>0.0</td>
<td>36.0</td>
</tr>
</tbody>
</table>

Source: Nigerian Meteorological Agency (2007)
early dry season.

The vegetation of Bauchi had been previously described (Akwuchi, 1990, Butswat, 1994).

**Experimental Birds and their Management**

The indigenous turkeys are said to be non-descript, having multi-coloured plumage but have predominantly black plumage. Other plumage colours of indigenous strains include Black and White, Bronze and Ash. They have been described as hardy, disease tolerant and well adopted to the local environment (Roberts, 1996).

A total of 16 Jakes were obtained from Johny Livestock Farm. Before the arrival of the turkeys, there was thorough washing and disinfection of the pens, feeders, waterers using two germicide and wood shavings were used as litter materials.

Fresh experimental diets (Table 2) and clean water were supplied *ad-libitum* on daily basis to the jakes. Good ventilation was ensured and litter material was changed every four months. Treatment against external parasites (fowl lice) was carried out using Diazinol (Diazinase) Pfizer, USA. Antistress supplements containing vitamins and minerals were administered in water to the turkeys from time to time throughout the experimental period.

**Experiment**

To investigate the effects of high/low protein: metabolizable energy and season on semen characteristics. Semen was collected from the toms fed experimental diets in Table 2 for a period of 24 months and data on the following parameters taken, volume, concentration, motility, alive: death ratio, and percentage normal and abnormal sperm cells.

**Table 2: Composition of Experimental Diets (%)**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>56.53</td>
<td>43.20</td>
<td>29.87</td>
<td>6.53</td>
</tr>
<tr>
<td>Full-fat</td>
<td>12.87</td>
<td>26.20</td>
<td>39.53</td>
<td>52.87</td>
</tr>
<tr>
<td>Wheat</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Wheat ofal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bone meal</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Limestone</td>
<td>7.007</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
</tr>
<tr>
<td>Salt</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Premix</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Calculated Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>14.00</td>
<td>18.00</td>
<td>22.00</td>
<td>2600</td>
</tr>
<tr>
<td>Metabolizable energy (kcal/kg)</td>
<td>2599</td>
<td>2555</td>
<td>2511</td>
<td>2466</td>
</tr>
<tr>
<td>Crude fibre (%)</td>
<td>1.70</td>
<td>1.70</td>
<td>1.70</td>
<td>1.70</td>
</tr>
<tr>
<td>Ether extract (%)</td>
<td>3.57</td>
<td>3.57</td>
<td>3.57</td>
<td>3.57</td>
</tr>
<tr>
<td>Calcium (%)</td>
<td>3.56</td>
<td>3.56</td>
<td>3.56</td>
<td>3.56</td>
</tr>
<tr>
<td>Phosphorus (%)</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td>Methionine (%)</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
</tbody>
</table>

**Semen Collection and Evaluation**

Actual semen collection was also carried out by two persons using the manual lumber message method (Quinn and Burrows, 1937; Watson, 1990).
Procedures for evaluating turkey semen characteristics measurements in the present study were carried out as described by Sexton (1981).

**Data Analysis**

Dietary and seasonal effects on the various semen characteristics were determined using analysis of variance (ANOVA). Means were separated using Duncan’s Multiple Range Test (DMRT) (Duncan, 1955).

**Results**

**Effect of Year and Season on Liveweight and semen characteristics**

Year has no significant effect on liveweight. Liveweights of 7.19 ± 3.2kg and 7.19 ± 1.44kg were recorded in years I and II, respectively. However, liveweight was significantly different (P<0.001) among seasons being 6.89 ± 3.57, 7.09 ± 3.10, 7.26 ± 0.88 and 7.66 ± 1.00kg for late dry, early rainy, late rainy and early dry seasons, respectively (Table 3).

The effects of year and season on semen characteristics are also shown in Table 3.

The effect of year on volume, colour, concentration, motility and percentage live/dead showed a significantly higher (P<0.001) values in year II having higher values of 0.19 + 0.11ml, 1.57 + 0.50, 5.28 + 15.31 x 10⁶, 2.06 + 0.73 and 4.44 + 0.78% than in year I which had mean values of 0.16 + 0.22ml, 1.44 + 0.51, 5.11 + 24.82 x 10⁶, 1.90 + 0.83, and 4.29 + 0.81% respectively. The effect of year on the remaining semen characteristics namely percentage live, percentage normal and percentage abnormal were however not significant.

Highly significant (P<0.001) seasonal effects were obtained in liveweight and in all the semen characteristics considered, with the highest liveweight in the early dry season (7.66 ± 1.00kg), followed by late rainy season (season III) and early rainy season (Season II) which recorded liveweights of 7.26 ± 0.88 and 7.09 ± 3.10kg while least liveweight of 6.89 ± 3.57kg was obtained in late dry season (Season I) respectively. Highest volume of 0.23 ± 0.11ml was obtained in late rainy season followed by 0.19 ± 0.09 and 0.14 ± 0.11ml in early rainy and early dry season, respectively while the least value of 0.12 ± 0.29ml was recorded in the late dry season. The best colour of 1.46 ± 0.50 was obtained in late rainy season while least colour of 1.56 ± 0.50 was obtained in early rainy season, respectively. Also, highest sperm concentration of 6.18 ± 36.68 x 10⁶ was obtained in early dry season followed by 5.63 ± 10.46 x 10⁶ and 5.15 ± 13.56 x 10⁶ obtained in late rainy and late dry season while least sperm concentration of 4.5 ± 11.47 x 10⁶ was obtained in the early rainy season.

The best sperm motility of 1.79 ± 0.79 was recorded in early dry season followed by 1.96 ± 0.73 and 1.97 ± 0.76 obtained in late rainy and early rainy seasons while late dry season recorded least motility of 2.12 ± 0.82. Similarly
### Table 3: Liveweights and Semen Characteristics by Year and Season (Means + SD)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Liveweight (kg)</th>
<th>Volume (ml)</th>
<th>Colour</th>
<th>Concentration (X10⁶)</th>
<th>Motility</th>
<th>% Live</th>
<th>% Dead</th>
<th>% Normal</th>
<th>% Abnormal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>1360</td>
<td>7.19±2.56</td>
<td>0.17±0.19</td>
<td>1.50±0.51</td>
<td>5.30±21.15</td>
<td>1.97±0.79</td>
<td>75.76±4.29</td>
<td>4.36±0.80</td>
<td>80.12±6.35</td>
<td>19.88±3.65</td>
</tr>
<tr>
<td>I</td>
<td>744</td>
<td>7.19±3.20</td>
<td>0.16±0.22</td>
<td>1.44±0.51</td>
<td>5.11±24.82</td>
<td>1.90±0.83</td>
<td>75.82±4.57</td>
<td>4.29±0.81</td>
<td>80.11±6.06</td>
<td>19.89±3.94</td>
</tr>
<tr>
<td>II</td>
<td>616</td>
<td>7.19±1.44</td>
<td>0.19±0.11</td>
<td>1.57±0.50</td>
<td>5.53±15.31</td>
<td>2.06±0.73</td>
<td>75.69±3.92</td>
<td>4.44±0.78</td>
<td>80.14±6.74</td>
<td>19.86±3.26</td>
</tr>
<tr>
<td><strong>Season</strong></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Season</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>370</td>
<td>6.89±3.57b</td>
<td>0.12±0.29</td>
<td>1.48±0.50</td>
<td>5.15±13.56c</td>
<td>2.12±0.82a</td>
<td>78.12±3.19b</td>
<td>3.81±0.65d</td>
<td>78.93±4.40b</td>
<td>18.07±2.60b</td>
</tr>
<tr>
<td>ii</td>
<td>373</td>
<td>7.09±3.10b</td>
<td>0.19±0.09b</td>
<td>1.56±0.50</td>
<td>4.50±11.47</td>
<td>1.97±0.79b</td>
<td>70.00±1.1b</td>
<td>5.37±0.37b</td>
<td>71.38±5.90b</td>
<td>24.62±1.10b</td>
</tr>
<tr>
<td>iii</td>
<td>342</td>
<td>7.26±0.88b</td>
<td>0.23±0.11a</td>
<td>1.46±0.50</td>
<td>5.63±14.61b</td>
<td>1.96±0.73b</td>
<td>77.84±3.08b</td>
<td>4.03±0.42b</td>
<td>77.88±3.92b</td>
<td>18.12±3.08b</td>
</tr>
<tr>
<td>iv</td>
<td>275</td>
<td>7.66±1.00b</td>
<td>0.14±0.11c</td>
<td>1.48±0.53b</td>
<td>6.18±36.68e</td>
<td>1.79±0.79c</td>
<td>77.82±1.31b</td>
<td>4.12±0.41b</td>
<td>77.93±5.92b</td>
<td>18.07±1.08b</td>
</tr>
</tbody>
</table>

Values in a column per treatment with different superscripts are significantly different:

SD = Standard Deviation

**NS:** Not significant

******* Significant at P<0.001

Year: i - 2005, ii - 2006, iii - Late dry, iv - Early dry

Season: i - Late dry, ii - Early rainy, iii - Late rainy, iv - Early dry
best percentage live, percentage dead, percentage normal and percentage abnormal of 78.12 + 3.19, 3.81 + 0.65, 78.93 + 4.40 and 18.07 + 2.60 respectively were obtained in late dry season followed by 77.84 + 3.08, 4.03 +0.42, 77.88 + 3.92, 18.12 + 3.08; and 77.82 + 1.31, 4.12 + 0.41, 77.93 + 5.92 and 18.07 + 1.08 in the late rainy season and early dry season respectively. Poor percentage live, percentage dead, percentage normal and percentage abnormal of 70.00 + 1.11, 5.37 + 0.37, 71.38 + 5.90 and 24.62 + 1.10 respectively were obtained in early rainy season.

**Effect of Dietary Treatments on Liveweight and Semen Characteristics**

The overall means and means of liveweight and the various semen characteristics by dietary treatments are shown in Table 4.

The effects of dietary treatments on liveweight, semen volume, colour and motility were highly significant (P<0.001). Highest liveweight and semen volume of 7.69 + 3.48kg and 0.28 +0.10ml were obtained on toms fed diets III and II. However liveweights of 7.26 + 0.67, 7.00 + 1.86, 6.90 + 3.32kg and semen volumes of 0.13 + 0.07, 0.13 + 0.08, 0.13 + 0.29ml obtained for toms fed diets II, I, IV and I, III, IV respectively did not differ significantly. Similarly, best colour and motility of 1.31 + 0.48 and 1.35 + 0.55 were obtained in toms fed diet II. The least colour and motility of 1.60 + 0.49, 1.58 + 0.50 and 2.33 + 0.67, 2.30 + 0.76 were recorded in toms fed diets IV and I respectively.

The effect of diet on the remaining semen characteristics namely, concentration, percentage live, percentage dead, percentage normal and percentage abnormal were not significant.

**DISCUSSION**

**Effects of Year and Season on Liveweight and Semen Characteristics**

The toms used for this study had already reached sexual maturity before the commencement of the experiment as they were above 28 weeks of age. Furthermore, the climatic conditions in the two years (2005 and 2006) in Bauchi were almost similar (Table 1). The aforementioned, might have been the probable reason for the non significant difference observed in the liveweights of the toms between the two years (2005 and 2006). The significantly lower liveweight obtained in the late dry season as compared with other seasons is as expected. Since this season (January-March) had the highest temperature and moderate relative humidity during the study. Feed and water consumption can be a matter of concern during hot weather. Feed consumption rates usually decrease and birds may not ingest enough of the proper nutrients to maintain growth or production at the desired level.
Table 4: Liveweights and Semen Characteristics by Dietary Treatments (Means + SD)

<table>
<thead>
<tr>
<th>Dietary Treatment</th>
<th>N</th>
<th>Liveweight (kg)</th>
<th>Volume (ml)</th>
<th>Colour</th>
<th>Concentration (X10^9)</th>
<th>Motility</th>
<th>% Live</th>
<th>% Dead</th>
<th>% Normal</th>
<th>% Abnormal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>1360</td>
<td>7.19±2.56</td>
<td>0.17±0.19</td>
<td>1.50±0.51</td>
<td>5.30±21.15</td>
<td>1.97±0.79</td>
<td>75.76±4.29</td>
<td>4.36±0.80</td>
<td>80.12±6.35</td>
<td>19.88±3.65</td>
</tr>
<tr>
<td>Dietary Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>356</td>
<td>7.00±1.86b</td>
<td>0.13±0.07b</td>
<td>1.58±0.50b</td>
<td>5.32±13.33</td>
<td>2.33±0.67b</td>
<td>75.80±4.53</td>
<td>4.32±0.74</td>
<td>77.12±3.92</td>
<td>19.88±4.08</td>
</tr>
<tr>
<td>II</td>
<td>360</td>
<td>7.26±0.67b</td>
<td>0.28±0.10b</td>
<td>1.31±0.48b</td>
<td>5.44±19.09</td>
<td>1.35±0.55c</td>
<td>75.90±3.89</td>
<td>4.35±0.74</td>
<td>78.25±3.76</td>
<td>19.75±3.74</td>
</tr>
<tr>
<td>III</td>
<td>293</td>
<td>7.69±3.48b</td>
<td>0.13±0.08b</td>
<td>1.50±0.50b</td>
<td>5.13±13.24</td>
<td>2.30±0.76b</td>
<td>75.70±3.82</td>
<td>4.38±0.75</td>
<td>77.09±3.83</td>
<td>19.91±3.17</td>
</tr>
<tr>
<td>IV</td>
<td>351</td>
<td>6.90±3.32b</td>
<td>0.13±0.29b</td>
<td>1.60±0.49b</td>
<td>5.27±32.14</td>
<td>1.98±0.74b</td>
<td>75.64±4.78</td>
<td>4.39±0.94</td>
<td>77.02±3.05</td>
<td>19.98±3.95</td>
</tr>
</tbody>
</table>

Values in a column per treatment with different superscripts are significantly different

1. SD = standard deviation
2. *** Significant at P<0.001
   NS = Not significant
Heat exposed birds will consume less feed in order to reduce the thermogenic effect associated with nutrient absorption, assimilation and utilization (Withers, 1992). Decreased feed consumption and reduced blood flow to the gastrointestinal tract decrease metabolic energy input (Veldkamp et al., 2002). In heat-stressed animals blood flow to the upper respiratory tract and other organs active in heat dissipation increases at the expense of capillary blood flow to the digestive system (Wolfenson, 1986).

Turkeys exhibit distinct behaviour during hot weather, such as decreased feed intake, spreading and dropping of wings to expose unfeathered areas, reduced physical activity, assuming positions in cool places and taking advantage of conductive and convective heat loss, increased water consumption, wetting of wattles and neck to enhance evaporative cooling and increased panting (Ferket, 1995). Butswat (1999) also reported decreases in nutrient intake in poultry especially energy at ever-increasing rate as environmental temperature increased within the range of 21-33°C. In the present study the environmental temperature during the season with the least liveweight was about 38°C (Table 1) which exceeds the range earlier suggested by Butswat (1999) for most tropical poultry. Wailbel and Macleod (1995) determined that heat production per metabolic weight in hot was higher than in cool environments, which may be caused by the expense of more energy to remove body heat (i.e. increased panting, change in posture and other heat-stress behaviour as mentioned earlier). These factors contributed to the depressed liveweight of toms in the late dry season as compared to the remaining seasons.

Among the semen characteristics considered in the present study: significantly (P<0.001) higher semen volume, concentration and percentage dead were obtained in the second year i.e. year ii (Table 3). This was not in agreement with earlier reports by Sexton (1986) that in most turkey commercial flocks, males undergo a decline in both quantity and quality of semen after five months of productivity; the causes of deviation of the present results probably could be partly due to getting used to semen ejaculation by the toms and increased experience of semen harvest acquired by the harvester in the second year. Significantly (P<0.001) superior colour and motility ratings of 1.44±0.51 and 1.90±0.83 obtained in year one as compared with 1.57±0.50 and 2.06±0.73 obtained in year two agree with the results earlier reported by Bakst (1990) that in turkeys viability of spermatozoa decreases as male age progresses beyond the first year.

All the semen characteristics considered in the present study were significantly (P<0.001) affected by season. Reproductive activity in many birds is a seasonal phenomenon, although its cyclical nature is more apparent and pronounced in some species (Hafez, 1980; Banerjee, 2006), breeds or strains...
(Perek and Snapir, 1963, Saeid and Al-Soudi, 1975, Kabir et al., 2008). Highest semen volume of 0.23+0.11ml was obtained in the late rainy season (July-September) while lower semen volume of 0.12+0.29ml was produced in the late dry season (January-March). Virtually no study has been conducted with regards to seasonality of semen characteristic in toms in Nigeria, however, in other poultry species such as chicken (Egbunike and Nkanga, 1999; Machebe and Ezekwe 2007; Kabir et al., 2008) and Guinea Fowl (Onuora, 1982a and b; Butswat et al., 2002) similar results were obtained. Highest semen obtained in the late rainy season may probably have been due to the seasonal changes in spermatogenesis in response to temperature and solar radiation changes. During the study period, late rainy season had the lowest temperature and solar radiation (Table 1). However Sexton (1986) obtained better semen output in terms of quality and quantity at controlled temperatures of 20-25°C which were lower than the lowest temperature of 29.2°C (Table 1) recorded in the late rainy season. Significantly (P<0.001) lower semen volume of 0.12+0.29ml was produced in the late dry season. Late dry season had the highest temperature, minimum relative humidity and highest solar radiation (Table 1). Feed intake in turkey is reduced at high temperatures to balance dietary energy intake with caloric requirements (Veldkamp et al., 2002). It was earlier reported (Saeid and Al-soudi, 1975; Egbunike and Nkanga, 1999) that higher environmental temperatures prevalent during dry season affect the ability of cocks to produce semen. Also prolonged period of exposure of toms to light has been reported (Woodard et al., 1978; Sexton, 1986; Siopes, 1986) to reduce semen yield. Kabir et al. (2008) observed higher ejaculation time during early and late dry seasons than early and late rainy seasons which was an indication that poultry responded faster to massage during the cooler periods by emitting semen in a shorter time. semen concentration was significantly (P<0.001) affected by season. Highest semen concentration of 6.18+36.68 x 10^9 was obtained in the early dry season and the lowest concentration of 4.50+11.47 x 10^9 in the early rainy season. After the late dry season, the early dry season had the next lower temperature and moderately lower relative humidity (Table 1). Generally the results obtained on concentration agree with those earlier reported by Kabir et al. (2008) with indigenous strains of cock in Nigeria. Best sperm motility and colour ratings of 1.79+0.79 and 1.46+0.50 were obtained in early dry and late rainy seasons and poor values of 2.12+0.82 and 1.56+0.50 respectively were also obtained during late dry and early rainy season. This result is similar to the earlier reports by Onuora (1982b) and Butswat, et al. (2002) with guinea fowl in Nigeria. The percentages live and normal sperm of 70.00+1.11% and 71.38+5.00% obtained in the early rainy season are lower than the minimum
requirements of 78 and 80% for optimum fertility respectively (Sexton, 1986). Similarly the highest percentages dead and abnormal sperm cells of $5.37 \pm 0.37\%$ and $24.62 \pm 1.10\%$ obtained in the early dry season in the present study are above the maximum 4 and 18\%, requirements for optimum fertility earlier reported by Sexton (1986). The lower percentages live and normal sperm cells and highest percentages dead and abnormal sperm cells in the early dry season could be probably due to relatively higher temperature and higher relative humidity coupled with prolonged period of solar radiation (Table 1) of this season as earlier reported. Onuora (1982b and Sexton 1986) reported a similar observation in tropical and temperate regions of Ibadan, Western Nigeria and Europe. However, the values obtained in the remaining seasons were within the required range by Sexton (1986) using exotic strains of turkey. In general, the observed variations in ejaculate quality among seasons can be attributed to seasonal changes in spermatogenesis and semen production of turkey in response to changes in temperature (Veldkamp et al., 2002), the adverse effect of which has been explained to be due to heat stress which reduces feed intake and causes testicular rest (Saeid and Alsoudi, 1975) and in day length (Onuora, 1982a and b; Sexton, 1986) during different seasons.

**Effect of Dietary Treatments on Liveweight and Semen Characteristics**

Dietary protein requirements must be considered within the context of dietary energy requirements, which is dependent upon metabolic body size and the rate of body weight gain. Reece and McNaughton (1982) observed that dietary protein (lysine) requirement was related to the energy intake by a fixed ratio. The significantly ($P<0.001$) higher liveweight obtained in toms fed diet III supports previous observations made with the turkey by Salmon (1986) that in the turkey body weights and efficiency of food utilization but not feed intake increased with each increment in nutrient density especially energy, protein ratio. As dietary metabolizable energy or protein concentration increase, quantity of carcass fat increases, especially in the instance of metabolizable energy, concurrently, amounts of carcass water decrease (Sell et al., 1985).

Several studies using breeder toms have shown that reproductive performance was maintained when birds were fed diets containing varying levels of crude protein and metabolizable energy. Significantly ($P<0.001$) higher semen volume and better semen colour and motility were obtained from toms fed diet II. In view of the energy levels used in the present study, the result obtained agrees with earlier reports by Sexton (1988) that semen weight and other quality parameters were linearly and positively related to the dietary energy levels. Muller (1973) and Cecil (1982) have suggested that lysine content of the diet regulates feed consumption but Nilipour et al. (1988) observed that toms consumed feed to meet their energy
requirements irrespective of dietary lysine content. The wide gap between the proteins, energy levels of the remaining dietary treatments could be the cause of lower semen volume, poor colour and motility ratings.

In a separate study Meyer et al., (1980b) observed that low dietary protein reduced semen volume and spermatozoa concentration at 33 weeks of age but there were no significant differences thereafter. Similarly decreasing energy levels was reported (Ascott and Parker 1963; Sexton et al., 1989) to result in lower levels of spermatozoa production and fertility. The non significant effect of dietary treatments on semen concentration, live, dead, normal and abnormal percentages agrees with results earlier reported (Krueger et al., 1979; Meyer et al., 1980a and b; Cecil, 1981 and 1982; Nilipour et al., 1988).

References


Sir et al., Effects of Year, Season and Diet on Semen Characteristics Bauchi, Nigeria

Ministry of Aviation, Bauchi Airport.


