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BODY NUTRIENTS AND ENERGY UTILIZATION BY BREEDING CATTLE EGRETS (*Bubulcus ibis L*) IN NORTH EASTERN NIGERIA

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ABSTRACT

Nutrient and energy reserves are necessary and essential ingredients for successful reproduction in animals such as birds. Mean nutrients and energy reserve levels in breeding cattle egrets based on protein and fat were: Protein 56 .9% (males) and 56.3% (females) during pre-laying ; 56.3% (males) and 55.4% (females) during laying; and 56.39 (males) and 57.09 (females) during post -laying periods. Fats is 22.6% (males) and 23.4% (females) during pre-laying; 22.0% (males) and 21.2 %(females) during laying; and 23.2% (males) and 24.4% (females) during post – laying periods. Protein and fat reserve were generally lower during laying than the pre-laying and post –laying periods. Energy utilization was also significantly (P <0.05) different between the three breeding periods.

Keywords: Energy reserve, energy utilization, egg-laying, metabolism, Nutrients, pre- laying, post laying.

INTRODUCTION

Bellairs (1977), defined nutrients as substances which serve as resources of metabolic energy, raw materials for growth or repair of tissues and general body functions and maintenance. Flying birds, require large amounts of nutrients, to maintain the high level of metabolic activities and breeding birds require additional nutrients for reproduction. According to Ezeokeke and Iyayi (2001), metabolic process in the body of animal requires energy. So animal eat first of all to satisfy this need.

Harvey (1971) and Krapu (1981) reported that some species of birds lay up nutrients and energy reserve for reproduction without which, particularly in females, the reproductive phase may fail. Studies by several authors including Ankney and Scott (1980), Gauthier *et al.*, (1994), Jones and Ward (1976), Perrins (1970) and Thomas and Popko (1981), on cow birds (*Molathrus ater*); Rock Ptarmigan (*Lagopus mutus rupestris)*; Red-billed dioch (*Quelea quelea*); Black – birds (*Agelaius phoenniceus*) and Great Snow geese (*Chen caerulescens atlanticus*) revealed that protein , fat and mineral re-

serves utilized in eggs formation were obtained from food consumed prior to and during the breeding periods.

According to Hohman (1986), nutrient reserve depletion has been observed in the Ring –necked duck (*Aythya collaris*; Mallards (*Anas platyrhynchos*) and Wood duck (*Aix sponsa*). Also males of Ruffed Grouse (*Bonasa umbellus*), have been reported to loss their fat reserve during breeding, while attending to mates (Servello and Kirkpartrick, 1988). But such have not been reported on the Cattle Egrets in the tropics during pre-laying and post laying breeding stages. This study is, therefore set out, to investigate the nutrient reserve and energy reserve utilization in breeding cattle egrets in the north eastern Nigeria. Specifically, to determine if there is nutrient reserve depletion, post - breeding nutrient reserve and energy reserve utilization and that these do not differ with sites. Also the differences in the nutrient reserve and nutrient reserve utilization during breeding stages is not zero.

MATERIALS AND METHODS

Nutrient determination

One hundred and eight (108) mature breeding Cattle Egrets were collected from Mbodewa, Jebra and Konduga breeding sites in the Sahel and Savannah zones of northeast Nigeria. Thirty six birds per site and 12 birds per breeding period (6 males and 6 females) were first collected in the breeding seasons of 1992 and 1993 and repeated in 2002 and 2003 because the birds change breeding sites constantly. The mean results of the four years were analysed.

Birds were obtained through random shooting and sex determined before carrying out chemical analysis on them using the pectoralis major, breast, ambient thigh and biceps wing muscles; as well as thigh bones (femur, fibula) and the combined weights of crop, heart, liver and intestines. Sample specimens were oven dried and ground into powder and solution for analysis prepared according to the requirements of each nutrient and equipment used. The method described by the Association of Official Analytical Chemists (AOAC, 1984), were used to determine moisture, crude protein, fat and mineral contents in an individual bird.

Moisture content was determined by oven drying method, using the procedure described by Egal *et al.* (1981). From each of the six sample specimens, 5g was weighed out into six separate porcelain dishes of known weights. Samples were placed in a vacuum oven drier and dried at 95^0C for 24 hours, and later cooled and weighed to a constant. Treatment was repeated for all the six samples and the percentage moisture content (on wet basis) were determined by the following formula:-

Moisture content =wet weight-dry weight (g).

% Moisture content =(Wet loss⁄initial weight) × 10 0

Crude protein was determined by the Kjeltech- System method where one (1) gram each of dried and milled bird samples were weighed and transferred into a clean clearly labeled digestion tube and two (2) Kjeltabs tablets (digestion tablets) were added. Twenty (20ml) of concentrated sulphuric acid, were also added and heated to 420^0C for 45 minutes. Six samples were digested at a time and digestion was com-

pleted only when the sample solution turned light- yellow or pale. The solutions were distilled and titrated against 0.1 NHCl. A blank solution was also distilled and titrated against 0.1NHCL and the titrated values used to estimate the crude protein content by the formula below:

% crude protein = $(A - B_X$ Nx 14. 01 x 6.25 / W) × 10 0

where: -

A = ml. of acid used in titrating sample;
B = ml of acid used in titrating blank;
N= Normality of titrating acid (0.1N HCl);
6.25 = Nitrogen conversation factor for protein;
14.01= constant;
W= initial weight of sample taken for digestion; and
100= percent conversion factor

Fat content was determined by using Soxhlet Extraction, with reflux condenser fitted onto an already weighed small flat bottomed flask. One (1) gram each of the six specimens were weighed out and transferred into six different "fat free" extraction thimbles of known weights. Petroleum (diethyl) ether was added to each and allowed to siphon (circulate over) ten to twelve times. The flasks with the fat were detached, dried in vacuum oven and weighed to a constant. Percentage fat was then determined using the formula:

$$\text{Fat} = W_2 - W_1$$

$$\% \text{ Fat} = (\text{Weight of fat} / \text{Weight of sample}) \times 100$$

where:- W_1 = weight of thimble ;
W_2 = weight of thimble and fat

Mineral (Ash) content was determined by the use of pyrolysis method using five (5) grams each of the six samples (Femur, tibia, thigh bones, breast, thigh muscles, wing muscles), were weighed out and poured into a weighed porcelain dish and placed in the entrance of an open furnace. The samples fume out without catching fire, for about 4-6 hours, until grey –white coloured remnant remained. The remnants were cooled in desiccators, weighed to a constant and the percentage ash content determined using the formula;

$$\text{Ash} = W_2 - W_1$$

where: % Ash content = (Weight of ash / Weight of sample) × 100
W_1 = Weight of porcelain; W_2 = Weight of porcelain and ash.

RESULTS

Nutrient Reserves

Results from samples analyzed revealed that nutrient reserves for male and female egrets were significantly ($P < 0.05$) different and there were lower protein contents at the laying compared to pre-laying and post – laying periods (Table 1).Generally, the females were observed to have lower protein reserve than males for the four years study period. The mean difference between males and females at both Mbodewa and Konduga was 0.003% and 0.00% for Jebra Sites.

Fat content was significantly ($P < 0.05$) lower during laying than pre- laying and Post-laying stages for all the sites (Table 2). This table also shows that females had more fat than males at Mbodewa and Konduga

sites, but the other way round at Jebra site. Nutrient levels varied significantly (P< 0.05) between the two sexes, except for fat (Table 3). However, there was no significant difference (P> 0.05) in mean nutrient reserves between sites.

Energy levels

Energy levels refers to the energy lost (cal / g) during the laying and gained (cal /g) during the post – laying periods from protein and fat reserves, by male and female Cattle Egrets, Mbodewa , Jebra and Konduga sites. Table 4 shows that both male and female egrets significantly (P<0.05) lost energy from protein reserves at two of the study sites (Mbodewa and Jebra), but gained energy in Konduga study site by 4.8 cal/g. However, both sexes significantly gained energy (P < 0.05) from protein at all the sites after laying (Table 4). In terms of fat reserve, both sexes lost energy at all the sites, but gained energy at Mbodewa and Konduga, while they lost some energy at Jebra (Table 4).

Table 1: Site Comparison for mean protein reserve levels for male and female breeding Cattle egrets for seasons (April to September) for three sites (Decimally transformed data)

Site	Mbodewa		Jebra		Konduga	
	Male	Female	Male	Female	Male	Female
1	0.562	0.568	0.572	0.565	0.573	0.571
2	0.554	0.555	0.553	0.551	0.554	0.554
3	0.561	0.563	0.554	0.564	0.573	0.583
Mean	0.559	0.562	0.560	0.560	0.566	0.569

LSD (Male) = 0.00197
LSD (Female) = 0.00170
DF= 107; ℓ = 0.05
Stages: 1. Peer- laying and nest – making (March – May); 2. Laying, incubation and egg - hatching (June – August); 3. Post – laying, chick – rearing (September - November).

Table 2: Site Comparison for mean fat reserve level fore male and female breeding Cattle four seasons for three sites (Decimally transformed data)

Site	Mbodewa		Jebra		Konduga	
	Male	Female	Male	Female	Male	Female
1	0.222	0.226	0.233	0.244	0.224	0.233
2	0.213	0.201	0.232	0.203	0.214	0.233
3	0.225	0.253	0.230	0.245	0.241	0.235
Mean	0.220	0.227	0.232	0.231	0.227	0.234

LSD (Male) = 0.00160
LSD (Female) = 0.00187
DF= 107; ℓ = 0.05
Stages: 1. Pre-laying and nest – making (March – May; 2. Laying, incubation and egg- hatching (June - August); 3. Post –laying, chick – rearing (September - November).

Table 3: Post – laying nutrient reserve levels in the breeding male and female Cattle egrets for four seasons for three sites (Decimally transformed data). M= Male, F= Female, NS = Not significant

Nutrient	Sex	Mbodewa	Jebra	Konduga	Mean	0.05
Moisture	M	0.16183	0.16172	0.15785	0.16046	NS
	F	0.13561	0.14950	0.15344	0.14619	NS
Protein	M	0.56339	0.55911	0.56683	0.56311	NS
	F	0.56189	0.56317	0.5972	0.56493	NS
Fat	M	0.22339	0.23600	0.24128	0.23356	NS
	F	0.24744	0.24500	0.23456	0.24233	NS
Mineral	M	0.04800	0.0467	0.04811	0.04726	NS
(Ash)	F	0.04567	0.04272	0.04094	0.04311	NS
Mean	M	0.24915	0.25063	0.25351	0.25110	NS
	F	0.24765	0.25010	0.24967	0.24914	NS

LSD (Males) = 0.00015
LSD (Females) = 0.00021
DF = 104; $\ell = 0.05$

Table 4: Protein and energy levels (cal/g) for male and female breeding Cattle egrets for four breeding season for three (3) sites

Protein					Fat		
Sites	Sex	Energy Loss (a)	Energy Gain (b)	Net Energy (a + b)	Energy Loss (c)	Energy Gain (d)	Net Energy (c + d)
Mbodewa	Male	-3.150	2.875	-0.275	-8.242	11.017	2.775
	Female	-5.092	3.042	-2.050	-21.908	46.00	24.092
Jebra	Male	-7.858	0.275	-7.583	-0.225	-2.250	2.475
	Female	-5.700	5.358	-0.342	-36.292	37.642	1.350
Konduga	Male	-7.792	7.483	-0.308	-9.075	24.150	15.075
	Female	-7.233	12.033	4.80	-0.350	2.150	1.800

Males:- LSD (protein) = 1.402, b = 1.358, a + b = 0.503
Males:- LSD (Fat) = 1.759, b = 2.436, a + b = 2.730

Males:- LSD (protein) = 0.973, b = 0.8897, a + b = 0.869
Males:- LSD (Fat) = 2.040, b = 2.226, a + b = 2.568

DISCUSSION

Levels of protein content for both males and females were higher at Konduga than Mbodewa and Jebra sites. This suggests that some of the food reserves could have been utilized during the flight to breeding sites at Mbodewa and Jebra. The distance from rooting (non –breeding) sites at Konduga was within 40 metres radius, which may not require as much energy as that of Jebra and Mbodewa sites where the birds roosted much further away from the breeding sites. They were traversing longer distance from the rooting sites to nesting sites. This confirms the study by Bryant and Tatner (1991) who reported that high energy expenditure was due to sustained working rate by small birds especially those with expensive foraging habits at the same time involved in breeding activities. Other workers found that, for birds to be able to breed, the nutrient reserves should be at a certain threshold (Hohman, 1986; Ankney and Scott, 1980; Thomas and Popko, 1981; Gauthier *et al.*, 1984; Jones, 1990).

According to Thomas and Popko (1981) , females require high levels of protein and fat reserves for the processes of ovarian development and males require some energy reserves for testicular activities (sperm production and copulation), twig collection , nest guarding and foraging. They also found that nutrients such as protein and fat reserves were highest during the breeding period for both males and females. Difference in breeding activities of male and female birds according to Servello and Kirkpatrick (1988), was responsible for the higher nutrient reserves in the females. Protein and fat reserves, however, are reduced in female birds during laying and incubation period (Gauthier *et al.*, 1984), but increased again during post –laying period to provide sources of energy for foraging and maintenance of active metabolism and chick – rearing (Eckert *et al.*, 1991; Harvey, 1971; Krapu, 1981). Udedibie *et al.* (2000), reported direct relationship between feed intake and weight gain in broilers.

The increase in nutrient reserve by females above that of males at post- laying suggests that they have resumed foraging activities fully in order to restore (replace) the depleted reserves during egg-laying and incubation. However, it is the time the males were left to guard the nest content from intruders and enemies, hence leaving them with little time to forage. Replacement of the lost energy by males from twig collection, nest guarding and defence from cockuldry males therefore needed more time, perhaps only after the juveniles had fledges and left the nest.

The significant difference in ash or minerals between males and females per site suggest that the females used up more of the body nutrients than the males during breeding seasons (Oduguwa *et al.*, 2001). The higher energy gain by the females egrets at Mbodewa (46.0cal/g) and Konduga (4.8 cal/g) than the Jebra (0.28 cal/g) may indicate how energy levels are affected by distance travelled.

It can be concluded that distance between foraging and nesting sites can have high influence on the levels of both nutrient and energy utilization in breeding Cattle Egrets. As the demand for nutrient and energy utilization become less after laying eggs, the nutrient reserve (Tables 1 and 2) and

those on energy utilization (Table 4) confirmed the above deductions on body nutrients and energy utilization by breeding Cattle Egrets.

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