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CHARACTERISTIC COMPOSITION OF GUINEA FOWL (*NUMIDA MELEAGRIS*) EGG

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ABSTRACT

The guinea fowl egg contains 83.3 % edible portion and has a total weight of 35.4 g. The edible portion contains a protein level of 85.5 % with amino acid profile better than that of whole hen's egg. It is a good source of iron, has an amino acid index of 1.52 and predicted protein efficiency ratio of 3.21, total fatty acids of 6.74 g/100 g sample and utilizable energy due to protein of 49.3 %.

KEYWORDS

Numida meleagris, egg edible portion, composition.

INTRODUCTION

The bird thrives under semi-intensive conditions, forages well and requires little attention. It retains many of its wild ancestor's survival characteristics: it grows, reproduces and yields well in both cool and hot conditions; it is relatively disease free; it requires little water or attention; it is almost as easily raised as chickens and turkeys; and it is a most useful all-round farm bird. Guinea fowl also produces substantial numbers of eggs. In Africa, these are often sold hard-boiled in local markets. In the Soviet Union, they are produced in large commercial operations. In France, guinea fowl strains have been developed that not only grow quickly but lay as many as 190 eggs a year[1]. Poultry eggs are eaten in most areas of the world with fewer social taboos associated with them than with pigs and cattle. In Nigeria, of the 50 million poultry population, 40 million (80 %) were indigenous and guinea fowl constituted 4 % of this[2]. This study concerned anatomy, proximate, mineral and amino acids profile of *Numida meleagris* eggs which would give a more comprehensive information on the guinea fowl egg like it is found for whole hen's egg.

MATERIALS AND METHODS:

N. meleagris eggs (10) were purchased in a market in Odo Ayedun-Ekiti, Ekiti State, Nigeria, identified, weighed and measured. The edible portion was removed; oven dried, milled into flour and kept in a freezer, pending analysis. Moisture, fiber, fat and total ash were determined with the method of AOAC[3] while nitrogen was determined by the micro- Kjedahl method[4] with crude protein taken as N x 6.25. The crude fat was converted to total fatty acids by multiplying with a conversion factor of 0.83[5]; and Atwater factors were used to calculate the total energy. The utilizable energy due to protein was also calculated. Minerals were determined from the total ash using the AOAC[3]

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method with the aid of atomic absorption spectrophotometer (Buck Scientific Model – 200A/200) and phosphorus was determined colorimetrically by Spectronic 20 (Gallenkamp, UK) using the phosphovanado methods[3]. All chemicals used were of British Drug House (BDH) analytical grade.

The method of amino acid analysis was by ion-exchange chromatography (IEC)[6] using the Technicon Sequential Multisample Amino Acid Analyzer (TSM) (Technicon Instruments Corporation, New York). The internal standard was norleucine. The period of analysis was 76 min, with gas flow rate of 0.50 ml/min at 60 ^{0}C and the reproducibility was ±3 %. Details of procedure had been given earlier[7]. Tryptophan was not determined.

The essential amino acid scores were determined using the method of FAO/WHO[8]; also using the suggested pre-school child requirement[9] and comparison with whole hen's egg[10].The predicted protein efficiency ratio was determined using the method of Alsmeyer et al.[11] while the amino acid index was determined by the method of Steinke et al[12]. The isoeletric point was calculated by the method of Olaofe and Akintayo[13].

RESULTS AND DISCUSSION

The guinea fowl egg characteristics are shown in Table 1. The edible portion was high with a percentage of 83.3 %. The total egg weight value of 35.4 g was close to the level of 42.0 (guinea fowl), 34.5 g (chicken) eggs[2] and 27.1 g in francolin but lower than in duck (74.9 g) and turkey (70.9 g)[14]. The edible egg in francolin is 21.6 g, 67.3 g in duck and 71.4 g in turkey while the shell weighed as follows (g): 5.68 (francolin), 9.54 (duck) and 8.35 (turkey)[13].

Table 1

Guinea fowl egg characteristics (mean ± SD)

Parameter	Value
Total weight (g)	35.4±2.33
Length (cm)	5.0±0.34
Breadth (cm)	3.9±0.35
Shell (g)	5.9±1.11
% shell	16.7
Edible portion (g)	29.5
% edible portion	83.3

Table 2 contains the proximate composition of guinea fowl eggs. Both the protein and fat were high with low carbohydrate. The ash level of 1.24 g/100 g was close to the level of 1.23 g/100 g in both chicken and guinea fowl as well as 1.24 g/100 g in duck eggs[2]. The level of 1.24 g/100 g ash in the present report shows that ash content of guinea fowl egg would likely have higher levels of minerals than some of the eggs cited. The low level of carbohydrate is positively comparable to the level of the 0.59-1.03 g/100 g in the eggs cited above[2]. The fat level was lower than the literature report of (g/100g): 13.4 (duck), 11.9 (turkey), 11.7 (guinea fowl) and 11.5 (chicken)[2]; and correspondingly their values of total fatty acids were higher. The calculated metabolizable energy of 1769 kJ/100 g (1.77 MJ/100 g) showed the sample to be a source of

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concentrated energy. This result is close to the values of 1.67-1.70 MJ/100 g in vegetables and 1.3-1.6 MJ/100 g in cereals[15].

Table 2

Guinea fowl egg (edible portion) proximate composition (dry weight) (g/100 g)

Parameter	Value
Total ash	1.24
Moisture content	4.21
Crude protein	85.5
Crude fat	8.12
Crude fiber	ND[a]
Carbohydrate	0.90
Total fatty acids	6.74
Energy (kJ/100 g)	1769

[a]*ND = not detected.*

Table 3 shows the various energy levels as contributed by protein, fat and carbohydrate. The protein carried 82.2 % of this distribution leading to high level of utilizable energy due to protein (UEDP %) for the sample to be 49.3 % (assuming 60 % utilization). This is far more than enough to prevent protein energy malnutrition.

Table 4 shows the guinea fowl egg mineral composition. The most concentrated mineral was iron and followed by phosphorus. The calcium/phosphorus ratio was very low and diets rich in these two minerals should be eaten with egg to maintain a good balance. The phosphorus level in the present study was low compared to the egg literature level of 207 mg/100 g[16] but the magnesium level of 13.6 mg/100 g was close to the literature level of 11 mg/100 g in whole, raw eggs[16].

Table 3

Energy values as contributed by protein, fat and carbohydrate in guinea fowl egg

Parameter	Value
Total energy	1769
Proportion of total energy due to protein (PEP %)	1454 (82.2)
Proportion of total energy due to fat (PEF %)	300 (17.0)
Proportion of total energy due to carbohydrate (PEC %)	15.3 (0.86)
Utilizable energy due to protein (UEDP %)	49.3

Table 4

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Guinea fowl egg (edible portion) mineral composition (dry weight) (mg/100 g)

Parameter	Value
Sodium	18.0
Potassium	13.6
Calcium	3.68
Magnesium	10.8
Zinc	2.88
Iron	56.6
Manganese	ND
Copper	ND
Chromium	ND
Phosphorus	35.5

The amino acid profile of the guinea fowl is shown in Table 5. Virtually all the amino acids were high in value. The amino acid profile in the guinea fowl was compared with the amino acid of the whole hen's egg[10]. Result showed that all the essential amino acids as well as many of the non-essential amino acids were much more concentrated in the guinea fowl egg than the whole hen's egg. Whole hen's egg amino acids were only better concentrated in the following (mg/g): Asp (107), Ser (44), Cys (18), Ile (56) and Val (75) and these differences were very marginal (Table 5). This means that the guinea fowl egg protein have higher and better levels of amino acids than the whole hen's egg. The essential (and non-essential) amino acids scores are also in Table 5. All the essential amino acid scores were greater than 1.0 except Val (0.88) and Ile (0.99) under the whole hen's egg comparison with Phe + Tyr having the highest score of 1.67 and Met + Cys being the lowest with 1.13 under the provisional amino acid scoring pattern whilst Ile (1.98) and Lys (1.19) were highest and lowest respectively under the pre-school child comparison. Only the essential amino acids with whole hen's egg scores might be necessary for correction to bring all the essential amino acids (EAA) to the expected allowance. Therefore, in order to fulfill the day's needs for the EAA in guinea fowl, 100/88 or 1.44 times as much guinea fowl protein would have to be consumed when it serves as the sole protein in the diet[17].

Table 5

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Guinea fowl edible egg amino acid (mg/g crude protein) and its scores

Amino acid	Concentration	Scores based on		
		Whole hen's egg	Provisional scoring pattern	Pre-school child requirement
Lysine*	69.1	1.11	1.26	1.19
Histidine*	26.2	1.09		1.38
Arginine*	65.5	1.07		
Aspartic acid	89.9	0.84		
Threonine*	52.0	1.02	1.30	1.53
Serine	38.0	0.48		
Glutamic acid	16.0	0.13		
Proline	50.8	1.34		
Glycine	66.8	2.23		
Alanine	57.7	1.07		
Valine*	65.8	0.88	1.32	1.88
Cystine	5.5	0.31		
Methionine*	33.9	1.06	1.13	1.58
Isoleucine*	55.5	0.99	1.39	1.98
Leucine*	91.0	1.10	1.30	1.38
Tyrosine	42.9	1.07		
Phenylalanine*	57.0	1.12	1.67	1.59
Total	nd[a]	-	1.35	1.47

**Essential amino acid, [a]nd = not determined*

Table 6 contains the summary of some essential parameters of guinea fowl egg amino acids. The total amino acids content was 1028 mg/g crude protein (cp) of which non-essential amino acids was 529 mg/g cp and the essential amino acids 499 mg/g cp. Neutral, acidic and basic amino acids are 60.0, 24.3 and 15.6 % respectively. The FAO/WHO/UNU (1985)[9] standards for pre-school children (2-5 years) are (mg/g cp): Leu (66), Ile (28), Lys (58), Met + Cys (25), His (19) and total (339); based on this

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information the guinea fowl egg would provide more than enough of the essential amino acids (Table 5). The % Cys/TSAA level of 14.0 was low like many animal proteins.

The predicted protein efficiency ratio (P-PER) was 3.21 which is close to the maximum of just over 4 for a well physiologically utilized protein[18]. The essential amino acid index (EAAI) was 1.52; the amino acid index can be useful as a rapid tool to evaluate food formulations for protein quality[19]. The EAAI of guinea fowl was better than the value of 1.26 and amino acid score of 1.04 reported for defatted soy flour[20]. The Leu/Ile ratio was low and so the leucine concentration could not lead to concentration antagonism[21]. The isoelectric point (pI) calculation from amino acids would assist in the production of the protein isolate of an organic product. The P-PER, EAAI, Leu/Ile and pI values were all close between the guinea fowl egg and whole hen's egg. The coefficient of variation (CV %) for all the parameters in Table 6 were determined. The CV % result in % Cys/TSAA was high at 73.1 showing the high difference in the two values.

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Table 6

Summary of some essential parameters of guinea fowl egg amino acid profile (mg/g crude protein)

Parameter	Guinea fowl	Domestic fowl (hen)	CV %
Predicted protein efficiency ratio (P-PER)	3.21	2.88	7.66
Leu/Ile ratio	1.64	1.48	7.25
Leu-Ile %	39.0	32.5	12.9
Isoelectric point (pI)	5.93	5.64	3.54
Essential amino acid index (EAAI)	1.54	1.55	0.46
Acidic amino acid (AAA)	250	227	6.82
% AAA	24.3	22.7	4.81
Basic amino acid (BAA)	161	147	6.43
% BAA	15.6	14.7	6.43
Aromatic amino acid (ArAA)	126	133	4.20
% ArAA	12.3	13.3	3.82
Neutral amino acid (NAA)	617	625	0.91
% NAA	60.0	50.0	16.8
Sulphur amino acid (SAA)	39.4	91	56.0
% SAA	3.83	9.11	57.7
% Cys/SAA	14.0	44	73.1
Total amino acid (TAA)	1028	999	2.02
Essential amino acid (EAA) -with Histidine	499	510	1.54
-without Histidine	473	486	1.92
% EAA (with Histidine)	48.6	51.1	3.55
% EAA (without Histidine)	46.0	48.6	3.89
Non–essential amino acid (NEAA)	529	489	5.56
% NEAA	51.4	48.9	3.52

CONCLUSION

Guinea fowl (*Numida meleagris*) was found to be high in UEDP to prevent PEM, high in Fe to prevent anaemia; it was better than whole hen's egg in size, ash, 11 of 17 (64.7 %) amino acids, seven of nine (77.8 %) EAA and P-PER; it satisfied all the provisional EAA scoring patterns and the EAA for pre- school child (2-5 years old). From these results guinea fowl eggs production should be encouraged and taken as one of choice eggs.

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