THE RELATIONSHIP BETWEEN BEHAVIOUR AND MORPHOMETRIC TRAITS IN YOUNG CHICKENS

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INTRODUCTION

- Ethological studies have shown that local and exotic chickens differ in behaviour (anxiety, sociality and cognition).

- Independent studies have shown that local and exotic chickens differ in body weight and size as measured by the length of various body parts, and associated growth rates.

- Chickens has received less attention in relating morphometric traits and behaviour in selection processes.

- Knowledge of correlation between behaviour and mass/size-related (morphometric) traits can lead to the discovery of markers/ predictors of behaviour and enhance understanding of the likely response of behavioural traits to primary selection for morphometric traits.

AIM OF THE STUDY

- The study examines the relationships between behaviour (anxiety, sociality and cognition sub-phenotypes) and physical form (Morphometric measurements) through studies of their correlation.

MATERIALS AND METHODS

- **Experimental site**

  The experiment was carried out at the animal production pavilion of the teaching and research farm, Faculty of Agriculture, University of Ilorin.

- **Animals:** A total of 44 birds consisting of 22 local birds (Yoruba Nigerian Local Chicken) and 22 exotic birds (11 Hubbard Broiler and 11 Isa Brown Layer chickens) were studied. All birds were housed in conventional cages, granted unrestricted access to drinking water and fed *ad libitum* (Broiler feed from Top Feeds, Ilorin .Nigeria) from age 1 – 8 weeks.

- **Mass/size-related (morphometric) traits:** Body weights and lengths of body parts were determined weekly from age 1 – 8 weeks as described previously (Toye *et al*., 2013)

  Morphometric traits measured includes: *Body weight (BW), Body girth (BG), Shank length (SL), Keel length (KL), Wing length (WL), Girth Length Ratio* (GLR) = *Body Girth: Body Length, Body Mass Index (BMI) and Growth rate.*

Behavoural Traits

- Locomotory activity , vocalisation, the time taken to restore visual contact and proximity with con-specifics in the context of exposure to an anxiogenic environment is a reporter of (sub-phenotype of) anxiety, and a and a pro-social and pro-survival behaviour.

Birds was subjected to a battery of ethological tests of fearfulness, anxiety and cognition.

Ethological tests includes:

- **Open Field Test (OFT)** at age 7 days and a repeat test at 48 days.
- **T-Maze test** at 2 weeks age and a repeat test at 7 weeks age.
- **Voluntary Approach Test** at age 4 weeks and a repeat test at age 8 weeks.
- **Forced Approach test** at age 4 weeks and a repeat test at age 8 weeks (Raji and Toye, 2014).

MORHPMETRIC TRAITS MEASURED WEEKLY

Day 1

Wk 8

WK 1
OFT 1

WK 2
T-MAZE 1

WK 4
VAT1
FAT 1

WK 7
OFT 2
T-MAZE 2

WK 8
VAT2
FAT 2

OFT = OPEN FIELD TEST
T-MAZE = T-MAZE TEST
VAT = VOLUNTARY APPROACH TEST
FAT 1 = FORCED APPROACH TEST

STATISTICAL ANALYSIS

Pearson's bivariate correlation: The levels of correlation between behavioural and non-behavioural traits were determined by the use of the Pearson's method (Falconer, 1989) implemented in SPSS 21 (IBM SPSS, 2008).

$$r = Cov\,(X,Y) / \sqrt{(Var\,(X) \bullet Var\,(Y)}$$

Where: r = coefficient of correlation. X= Phenotypic Trait1. Y= Phenotypic trait 2. *Cov* = Covariance. *Var* = Variance.

Absolute Correlation values between 0 and 0.3 (including the range covering 0 and -0.3), 0.3 and 0.7 (including the range covering -0.3 and -0.7) and 0.7 and 1.0 (including the range covering -0.7 and -1.0) were classed as "Low", "Medium" and "High" Correlations respectively.

RESULTS AND DISCUSSION

- A total of 160 directly measured and derived traits were examined, of which 44 were behavioural traits derived from ethological tests and the remaining 116 traits were Mass/size-related (morphometric) traits measured from age 1 to age 8 weeks.
- Low, Moderate and High inter-trait correlations were observed in 83%, 16% and 1% of cases.
- By contrast, in the 6730 unique Behavioural *vs.* Behavioural plus Morphometric *vs.* Morphometric trait correlations (termed “Self *vs.* Self” correlations), Low, Moderate and High inter-trait correlations were observed in 18%, 26% and 56% of cases respectively.

Maximum Positive and Negative Correlation between Classes of 4 Ethological Tests (representing 44 traits) and 116 Morphometric Traits (Body Weight, Length of Body Parts, Growth Rate and associated traits).

Behaviour		Maximum coefficient (r) of correlation with Morphometric traits	
Test	**Class**	**+ve**	**-ve**
OFT	Latency	0.73	-0.46
	Time_Ambul	0.45	-0.75
	Time_Rest	0.75	-0.45
	Squares_Crossed	0.28	-0.55
	Distress_Calls	0.51	-0.62
T-Maze	Latency	0.74	-0.59
	Time_Needed	0.45	-0.53
	Time_Spent	0.45	-0.38
VAT	Latency	0.34	-0.38
FAT	Latency	0.36	-0.36

Positive Correlation

- Behavioural traits showed Moderate(Medium) or greater positive correlation to at least one of the 116 body weight, lengths of body parts and associated growth rate, GLR and BMI traits examined.
- Behavioural trait classes were highly positively correlated with one or more body weight, lengths of body parts and associated GLR and BMI traits includes Latency in the T-Maze Test, Latency in the OFT, and amount of time spent resting in the OFT.
- Highest positive coefficients of correlations ($r \geq 0.7$, High Positive Correlation) between behavioural and non-behavioural traits correspond to a link between Latency to cross the first square in an Open Field Test (which embodies anxiety and locomotory components) at age 7 weeks and Body size (BW, BL, SL, WL, BG).
- High positive correlation ($r \geq 0.7$) was observed between Time resting in an OFT at age 48 days on the one hand, and body size (BW, BG, GLR, BMI).

Negative Correlation

- Every one of the 10 behavioural trait classes showed low or greater negative correlation to at least one of the 116 body weight, lengths of body parts and associated growth rate, GLR and BMI traits examined.
- Of the 10 behavioural trait classes examined, only the time spent ambulating in an OFT showed high negative correlation ($r > -0.7$) with one or more of the 116 morphometric traits (body weight, length of body parts, growth rate and associated GLR and BMI) .
- Each of the 9 other behavioural trait classes exhibited Moderate (medium) level correlation to one or more of the 116 morphometric traits examined.
- Further examination of the data showed that High negative coefficients of correlation occured between Time ambulating in an Open Field Test (Behavioural traits)at age 6 weeks on the one hand and body weight, body shape and fatness indices (Morphometric traits) including BW, BG. GLR and BMI.

- Equally, the morphometric traits that were highly negatively correlated to behavioural traits in the present study point to an inverse relationship between early growth and activity as measured by time ambulating in an OFT.
- The similarity of the relationship between anxiety and body size in humans and chickens may suggest shared underlying mechanisms, and suggests that knowledge may be shared across species in efforts to unravel the genetic architecture of the link between body size and behaviour.

CONCLUSION AND RECOMENDATION

- These data point to the potential utility of morphometric traits as heurictic/surrogate markers for behavioural traits in poultry breeding and management.
- The absence of high correlation between Markers of Pro-Social Behaviour/Cognition (time needed to find con-specifics, time spent with con-specifics and vocalisation/number of calls) and any of morphometric traits examined here suggests a greater complexity of determination of the latter beyond the scope of the former examined here.
- The absence of high correlation between Markers of Pro-Social Behaviour/Cognition (time needed to find con-specifics, time spent with con-specifics and vocalisation/number of calls) and any of morphometric traits examined here suggests a greater complexity of determination of the latter beyond the scope of the former examined here.
- Further studies will partition the genotype and environmental influences on the high correlation between behaviour and morphometric traits reported here, and will define the underlying molecular basis of the former.

THANK YOU

FOR

LISTENING