

## **Repeatability Estimates of Growth Traits in Arbor Acre Broiler Chickens fed Graded Level of Probiotics enhanced *Moringa oleifera* seed meal diets**

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**Target Audience:** Poultry breeders, Researchers, Geneticist and Poultry Nutritionist

### **Abstract**

*Two hundred (200) Arbor Acre broiler chickens fed four different diets containing 0 (control), 4, 6, and 8% (unconventional) probiotics enhanced Moringa Oleifera seed meal (PEMOSM) were used to estimate repeatability (R) of growth traits during the starter (0-4 weeks) and finisher phases (5-7weeks). The traits considered were body weight, body length, thigh length, drumstick length, shank length, body girth, wing length and keel length. The results showed low to moderate and high R estimates based on the diet fed to chickens and feeding phase (starter and finisher). Moderate to high R (0.47 to 0.99) estimates were obtained for most of the growth traits examined during the starter and finisher phases when the chickens were fed diets containing 0 and 4% PEMOSM, except shank length, thigh length, wing length, body girth and keel length that had low R estimates (0.32 to 0.43) during those period. When the chickens were fed higher levels of PEMOSM, low R estimates (0.30 to 0.47) were obtained for most of the traits except body weight which had 0.62 and 0.52 at 6 and 8% PEMOSM inclusion level during finishers' stage, and keel length with 0.55 at 6% PEMOSM during the starter phase. This findings indicate that nutrition play a major role as an environmental factor that have a significant effect on genetic parameters of chicken and should be taken into consideration when broiler chickens are been considered for genetic improvement.*

**Key words.** Broiler chickens; Growth traits; Repeatability estimates; Nutrition.

### **Description of the Problems**

Today's commercial broiler is the most efficient ever, representing the combined efforts of genetics and improved operational managerial practices, with the most striking growth capability of 70-75g per day occurring in the first week (1). The efficiency in genetic modeling of poultry entails the ability to

predict the bird's growth and development, which allows the prediction of its nutrient requirements (2). It provides an insight into the efficient capability of the chick to digest feed and to cope with environmental and management stresses of which nutrition is one and it is a major factor that determines productivity and

profitability in broiler production because it accounts for 65 -75% of the total cost of production, thus making most farmers to manipulate their diet with unconventional feedstuff to sustain profitability (3).

The concepts, which help the breeder predict future performance records, are repeatability and genetic correlation. Repeatability (R) is used to predict future performance from past or present records. It indicates the consistency with which an individual maintains its ranking in a population with respect to temporarily-repeated character. Repeatability estimates are reliable indications of the correlation between independent measurements in terms of a ratio of the genetic and permanent environmental effect to the total phenotypic variance (4). Poultry breeders have tried to establish the relationships that exist between body weight and physical characteristics (body conformation) such as body length, shank length, thigh length, breast girth and keel length as this information reflects on the overall performance of the broiler birds. It has been established that interrelationships among body measurements can be applied speedily in selection and breeding (5), this will help the breeders to organize the breeding program in order to achieve an optimum combination for maximum economic return.

The effects of diet manipulation and feeding of unconventional feedstuffs on growth traits of chickens when fed diet that is different from their normal diet needs to be investigated because phenotype is as a result of genotype and the environment while nutrition is a key environmental factor that affects the

performance of chickens. Using genetic parameters such as repeatability estimates will enable the breeder to predict the future probable performance when unconventional feedstuffs are being fed to chickens that are meant for genetic evaluation purpose, since repeatability of the growth traits can be used to predict future meat production, thus it can help in determination of the most profitability level when diet manipulations is been practiced and it will also assist in evaluation of the impact of unconventional feedstuff on morphometric traits of chickens as an indices of overall body weight. Therefore, study on the repeatability estimate of growth traits in Arbor Acre broilers fed PEMOSM based diet will provide a useful insight to prediction of the future growth performance when such unconventional diets are fed to chickens.

## **Materials and Method**

### **Experimental Site and Management of Chickens**

This experiment was carried out at the Teaching and Research Farm, Faculty of Agriculture, University of Ilorin, Ilorin, Kwara State. Two hundred day old Arbor Acre broiler Chickens were obtained from Yammfy Farm, Ilemona, Kwara State, Nigeria. On arrival the chicks were weighed, winged tagged and randomly distributed to four different brooding pens labeled according to the diet. Normal diet without Probiotics Enhanced *Moringa Oleifera* Seed Meal (PEMOSM) was regarded as 0% PEMOSM and labeled diet 1, while diets 2,3, and 4 contains PEMOSM at 4, 6, and 8% inclusion level, respectively. All the necessary

medications and vaccinations were given to the chickens accordingly and they were fed *ad libitum* for seven weeks. Measurement of body weight and other body parameters were done on weekly basis throughout the experimental period as described below:

**Body Weight and Linear Measurements**

**Body Weight (BW):** Body weight in gram (g) units' recorded to two decimal places, was taken by use of a sensitive weighing scale (Scout II electronic weighing scale at initial stage and 20kg Camry Emperors weighing scale when the chickens were older and bigger).

**Body Length (BL):** Body length was taken as the nostril to pygostyle distance measured in centimeter (cm) units when a tape measure is stretched from a bird's nasal opening, along its neck, and along its back, to the tip of its pygostyle.

**Body Girth (BG):** Body girth was taken as the distance in centimeter (cm) units covered when a tape measure is looped round the region of the breast, taking care to run the tape under (rather than over) the wing.

**Shank Length (SL):** The shank length was taken as the distance in centimeters (cm) between the foot pad and the hock joint, measured by use of a set of Venire callipers.

**Thigh Length (TL):** Thigh length was taken as the distance between the tip of the tarsus and the ball joint, measured in centimeter (cm) units by use of a tape measure.

**Wing Length (WL):** Wing length was taken as the distance from the humerus-coracoid junction to the distal tip of the phalange digits, and was measured in centimeter (cm) units by use of a tape measure.

### Statistical Analysis

The average value for individual measurement was calculated from the raw data obtained for each treatment of birds within the same age group. The analysis of variance (ANOVA) was computed using Excel 2007 computer package. From the ANOVA Table, the expected mean square were obtained from the actual mean squares which were used to calculate the variance due to individual ( $\delta^2w$ ) and the error ( $\delta^2e$ ) using the method of Becker (1984), it was from the variances obtained that the Repeatability (R) was estimated using the expression below:

$$R = \frac{\delta^2w}{\delta^2w + \delta^2e}$$

$\delta^2w$  = Individual variance component

$\delta^2e$  = Error

$(\delta^2w + \delta^2e)$  = Total Phenotypic variance.

### Results and Discussion

The estimated variance components and repeatability (R) estimates of body weight and linear body measurements in Arbor acre broilers fed control diet with 0% PEMOSM during the starter phase (0-4 weeks) were as shown in Table 1. Low to medium repeatability estimate that ranged from 0.41 to 0.57 were obtained for growth traits measured for Arbor Acre broiler chickens fed normal diet during the starter phase (0-4 weeks), with drumstick length having the highest value (0.57), and the thigh length having the least value (0.41). High repeatability was estimated for body weight and other growth traits measured when the Arbor acre broilers were fed control diet (0% PEMOSM) at finishers' stage (5-7 weeks), it ranged from 0.63 in Wing length to 0.99 in Thigh length (Table 2).

**Table 1: Repeatability estimates of growth traits in Arbor acre broiler chickens fed 0% PEMOSM at starter phase (0-4weeks).**

GROWTH TRAITS	$\sigma_i^2$	$\sigma_e^2$	R
Body weight (g)	8654.087	6639.539	0.56
Body Length (cm)	2.3946	1.860	0.56
Thigh Length (cm)	0.7186	1.016	0.41
Drumstick Length (cm)	0.0469	0.035	0.57
Shank Length (cm)	0.1177	0.154	0.43
Body Girth (cm)	3.6246	3.408	0.51
Wing Length (cm)	0.5774	0.729	0.43
Keel Length (cm)	0.4144	0.331	0.55

**Table 2: Repeatability Estimates of growth traits in Arbor acre broiler chickens fed 0% PEMOSM at Finisher phase (5-7weeks).**

GROWTH TRAITS	$\sigma_i^2$	$\sigma_e^2$	R
Body weight (g)	7783.69	2205.50	0.78
Body Length (cm)	4.3848	2.256	0.66
Thigh Length (cm)	2.4330	0.032	0.99
Drumstick Length (cm)	0.2259	0.024	0.89
Shank Length (cm)	0.0571	0.101	0.85
Body Girth (cm)	1.9927	0.072	0.91
Wing Length (cm)	0.8848	0.516	0.63
Keel Length (cm)	1.6993	1.420	0.92

The estimate of repeatability for Arbor Acre broilers fed 4% PEMOSM at starter phase as shown in Table 3 ranged from low to medium with the body weight, body length, thigh length and drumstick length having a moderate repeatability (0.47 to 0.56), while other parts measured had low repeatability

(0.32 to 0.41). At finisher stage, the Repeatability estimates obtained for chickens was low for wing length, moderate for Keel length (0.43), and high for body girth and body length (0.65), body weight and shank length (0.74), thigh length 0.79, and highest (0.84) for drumstick length (Table 4).

**Table 3: Repeatability Estimates of growth traits in Arbor acre broiler chickens fed 4% PEMOSM at starter phase (0-4weeks).**

GROWTH TRAITS	$\sigma_i^2$	$\sigma_e^2$	R
Body weight (g)	9212.65	7274.54	0.55
Body Length (cm)	2.4337	2.703	0.47
Thigh Length (cm)	5.5397	7.755	0.56
Drumstick Length (cm)	0.0275	0.027	0.50
Shank Length (cm)	0.0623	0.091	0.41
Body Girth (cm)	1.9927	2.731	0.42
Wing Length (cm)	0.5774	0.729	0.43
Keel Length (cm)	0.4917	0.988	0.32

**Table 4: Repeatability Estimates of growth traits in Arbor acre broiler chickens fed 4% PEMOSM at finisher phase (5-7weeks).**

GROWTH TRAITS	$\sigma_i^2$	$\sigma_e^2$	R
Body weight (g)	6680.00	2244.01	0.74
Body Length (cm)	1.6176	0.881	0.65
Thigh Length (cm)	0.1191	0.030	0.79
Drumstick Length (cm)	0.1491	0.022	0.84
Shank Length (cm)	0.3789	0.1310	0.74
Body Girth (cm)	3.2390	1.7270	0.65
Wing Length (cm)	0.5774	0.729	0.43
Keel Length (cm)	0.4144	0.331	0.52

When the Arbor acre broilers chickens were fed 6% PEMOSM at starter phase, the R obtained was moderate for keel length (0.55) and thigh length (0.45), and low for other traits measured (0.32 to 0.42) as shown in Table 5. At finishers stage (5-7 weeks) low R estimates were obtained for all the traits measured except the body weight with an R estimates of 0.62 (Table 6).

When the chickens were fed 8 % PEMOSM at starter phase, the Repeatability estimates were low and it ranged from 0.30 to 43 for keel length, body length, body weight, shank length and body girth, while those of thigh length and drumstick length were 0.45 and 0.47, respectively (Table 7), at finishers stage ( 5-7 weeks) low R estimates were obtained for body length, keel length, shank length, wing length and body girth (0.32, 0.34, 0.38, 0.39 and 0.43) while moderate R estimates were obtained for thigh length 0.45, drumstick length, 0.47 and body weight 0.52 (Table 8).

The repeatability estimates of the growth traits measured varied according to the age of the chickens with respect to the feeding phase (Starter and Finisher). R estimates obtained for most of the traits observed at starter phase were low and moderates except that of body weight that was moderate and high irrespective of the diet type. Low R estimates were obtained for most of the growth traits except body weight that was high at 6 and 8% when the chickens were at finisher stage. The occurrence of low estimates of R for growth traits when the birds were fed higher inclusion level of PEMOSM reflects the relative importance of permanent effect of the unfavorable environmental factors with respects to nutrition compared to when the birds were fed normal diet or a lower inclusion of PEMOSM in their diet, this findings is in line with the submission of (8), where the author stated that low repeatability estimates could be as a result of permanent effect of the unfavorable

**Table 5: Repeatability Estimates of growth traits in Arbor acre broiler chickens fed 6% PEMOSM at starter phase (0-4weeks).**

GROWTH TRAITS	$\sigma^2$	$\sigma_e^2$	R
Body weight (g)	5.5397	7.775	0.42
Body Length (cm)	1.7018	2.5180	0.40
Thigh Length (cm)	0.0532	0.3054	0.45
Drumstick Length (cm)	0.0119	0.0250	0.32
Shank Length (cm)	0.0260	0.0420	0.38
Body Girth(cm)	0.5774	0.7290	0.43
Wing Length (cm)	0.1289	0.1990	0.39
Keel Length (cm)	0.0414	0.3310	0.55

**Table 6: Repeatability Estimates of growth traits in Arbor acre broiler chickens fed 6% PEMOSM at finishers phase (5-7weeks).**

GROWTH TRAITS	$\sigma^2$	$\sigma_e^2$	R
Body weight (g)	460.806	736.846	0.62
Body Length (cm)	0.4917	0.9880	0.32
Thigh Length (cm)	0.0731	2.0250	0.34
Drumstick Length (cm)	0.4542	0.5030	0.47
Shank Length (cm)	0.0260	0.0420	0.38
Body Girth (cm)	0.5774	0.7290	0.43
Wing Length (cm)	0.1289	0.1990	0.39
Keel Length (cm)	0.6916	1.2070	0.36

**Table 7: Repeatability Estimates of growth traits in Arbor acre broiler chickens fed 8% PEMOSM at starter phase (5-7weeks).**

GROWTH TRAITS	$\sigma_i^2$	$\sigma_e^2$	R
Body weight (g)	660.1321	1160.475	0.36
Body Length (cm)	0.4917	0.9880	0.32
Thigh Length (cm)	0.0532	0.3054	0.45
Drumstick Length (cm)	0.4542	0.5030	0.47
Shank Length (cm)	0.0260	0.0420	0.38
Body Girth (cm)	0.5774	0.7290	0.43
Wing Length (cm)	0.1289	0.1990	0.39
Keel Length (cm)	0.7057	10.639	0.30

**Table 8: Repeatability Estimates of growth traits in Arbor acre broiler chickens fed 8% PEMOSM at finisher phase (5-7weeks).**

GROWTH TRAITS	$\sigma_i^2$	$\sigma_e^2$	R
Body weight (g)	1326.05	1236.00	0.52
Body Length (cm)	0.4917	0.988	0.32
Thigh Length (cm)	0.0532	0.3054	0.45
Drumstick Length (cm)	0.4542	0.5030	0.47
Shank Length (cm)	0.026	0.0420	0.38
Body Girth (cm)	0.5774	0.7290	0.43
Wing Length (cm)	0.1289	0.1990	0.39
Keel Length (cm)	0.0731	2.0250	0.34

climatic conditions, infectious disease and substandard level of management of the chickens. The low magnitude of the Repeatability estimates obtained when higher levels of PEMOSM were fed indicates that it would take several records to achieve better genetics gain when broilers that are fed higher level of such unconventional diet are being used for selection and breeding work thus, the use of chickens that are not fed with normal broiler diets or fed with lower inclusion of level of manipulated diet should not be encouraged, especially if the broilers chickens are meant for breeding and selection purpose owing to large influence the diet will have on the chickens as an environmental variables. Low R estimates obtained when they were fed 6 and 8% PEMOSM at older ages is an indication of stronger dietary effect on repeatability estimates.

High repeatability estimates were obtained for the growth traits when the chickens were older (at finishers' stage) and when the Arbor acre broiler chickens

were fed 0 and 4% PEMOSM. High R estimates obtained for body weight in this study corresponds with earlier report of (10) where high R estimates were reported for body weight in four strains of broiler chickens at age 2, 4 and 6 weeks of life. Moderate to high R estimates obtained for Arbor acre broiler chickens when they were fed the control diet (0%) and 4% PEMOSM corroborate the findings of 9; 10; 11 and 12 that morphometric trait in broiler chickens exhibit high repeatability estimates. The high estimates of repeatability recorded at starter phase when Arbor Acre broiler chickens were fed 0 and 4% PEMOSM implied that the performance of growth traits observed in the chickens when they were fed normal and slightly manipulated diet will be repeated in future and the broiler birds could be selected at starter phase when they were been fed control diet or diet with 4% PEMOSM during which period they had moderate to high R, because the magnitude of repeatability estimate

gives an indication of the extent to which selection will affect subsequent flock performance at any stage according to (5). The high R estimates recorded for the growth traits at early stages when the chickens were fed normal diet also indicate large influence of additive genes on body weight as stated by (13), and it was also reported that such would enable a breeder to realize a high expected genetic response from selection (14). This study showed that poultry breeders should always take into consideration the underlying environmental factor when designing programme meant for improvement of the existing poultry stock, and broiler chickens should be fed normal or slightly manipulated diet during such programme. Selection for body weight of broiler chickens can be done using their corresponding morphometric traits as indices for overall body weight under known environmental conditions especially when it is desired to alter the growth traits of the chickens so as to achieve greater economic value.

### Conclusions and Applications

1. Nutrition have effect on Repeatability estimates of growth traits in broiler chickens at early and later feeding phase
2. Moderate to high Repeatability estimates were obtained for growth traits in Arbor Acre broiler chickens fed normal broiler diet at starter and finishers phase.
3. Low Repeatability estimates were obtained for Arbor Acre broiler fed 6 to 8% PEMOSM supplemented diet at starter and finisher phase.
4. Arbor Acre broiler chickens placed on higher level of unconventional feedstuff like PEMOSM should not be considered for selection work because higher manipulations of diet with unconventional feed ingredient play a significant role as a major environmental stress, thus leading to a low repeatability estimates compared to those fed normal diet.

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