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COMPARATIVE MULTIVARIATE ANALYSIS OF BODY WEIGHT AND MORPHOMETRIC TRAITS IN THREE STRAINS OF BROILER CHICKENS

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ABSTRACT

This study evaluates the linear body measurements in three strains of broiler chickens; Arbor Acre, Cobb500 and Ross308. Data were collected on body weight and linear body measurements, including body length, chest girth, thigh length, shank length, wing length, and keel length and subjected to statistical analysis to identify the traits that could best describe and discriminate the broiler strains. Cobb 300 exhibited significantly ($P<0.05$) highest body weight (1934.50 g) compared to ArborAcre (1771.85 g) and Ross308 (1771.43 g). Body length and chest girth showed the highest correlations with body weight in Cobb 300 and Ross308 strains while body length is the most significant predictor of body weight for the three strains of broilers. Canonical discriminant analysis revealed that body length and shank circumference were critical for differentiating the three strains. The study highlights the importance of selecting for body size-related traits to improve growth performance in broiler chickens.

1. INTRODUCTION

The poultry industry is one of the fastest-growing agricultural sectors worldwide. The poultry industry is a vital contributor to food security, economic development, and providing affordable and high-quality animal protein. Among poultry types, broiler chickens are of significant economic importance due to their rapid growth rates and efficient feed conversion abilities. As the global demand for poultry products continues to increase, optimizing the performance of broiler strains through precise breeding, management, and selection programs has become increasingly important. Advances in genetics and breeding technologies have led to the development of various commercial broiler strains, including ArborAcre, Cobb500, and Ross308, each with distinct performance characteristics. These strains are bred to maximize traits such as body weight, feed efficiency, and adaptability to different environmental conditions (Abdullah et al., 2010). Nevertheless, it is of great importance to assess their phenotypic and genetic potentials under different management systems to maximize production results (Mendes, 2011).

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These characteristics are not only representative of the genetic ability of broiler strains but also a useful tool for optimization of management. Linear body measurements and weight are essential parameters in poultry research to evaluate growth performance and predict carcass yield (Tyasi et al., 2024). Abstract Linear body measurements are important parameters of growth performance assessment in broilers; they additionally provide estimates of body weight, a vital economic trait in poultry production systems (Yakubu et al., 2009a; Tyasi et al., 2024). However, traditional methods of studying these traits treat them as independent, and as such, are likely to miss out on complex interrelationships. The problem of better separating classes has led to the use of multivariate techniques like Principal Component Analysis (PCA) and Canonical Discriminant Analysis (CDA). Currently available tools help have been developed that combine the exploration and dimensionality reduction, or they tackle the exploration and reductions of key traits and assist with the optimization of selection protocols (Yakubu et al., 2009b. The relationships between these traits have been assessed, attributes contributing the most to the overall performance have been identified and strain classification were done through various multivariate statistical methods e.g PCA, CDA etc (Eyduran et al., 2010; Ikpeme et al., 2016; Ibiwoye and Sola-Ojo, 2021).

PCA allows selection of traits with a large contribution to the overall performance (Mendes, 2011) and identifies the main 55contributing traits to variance in linear body 56measurements, CDA also enables the differentiation of various strains, revealing information on their morphological and genetic diversity (Ogah et al., 2009). These approaches are critical in sub-Saharan Africa where local environmental conditions and management practices have a major impact on broiler performance. Despite the widespread usage of commercial broiler strains, however, there is still limited in-depth comparative assessment of their growth performance and morphological characteristics, especially in semi-arid regions such as Nigeria. Variations in performance indicators, including body weight and related morphometric traits, has been a hindrance to farmers and breeders in identifying the optimal strain for the particular environmental and management conditions (Ajayi et al., 2008). Additionally, the relationships between these traits and their implications for selection and breeding programs have not been fully understood. Despite successful application of PCA and CDA in other contexts, there remains a gap in knowledge of executing these techniques on broiler strains raising them under semi-arid conditions.

By identifying key traits and their interrelationships, the findings can guide breeders and farmers in selecting strains that are best suited for specific environmental and management conditions (Salako, 2006; Mendes, 2009). The results will also contribute to the development of more targeted breeding programs, ultimately enhancing the efficiency and sustainability of broiler production in regions with similar climatic challenges. This study, therefore, was conducted to assess the relationships between body weight and linear body measurements in three strains of broiler chickens with the view of identifying those components that describe body conformation which could be used as a tool for improving growth traits in the three broiler chickens. The results could aid in discriminating and identifying strains of broiler chickens from among the strains of broilers available for commercial production in Nigeria.

2. MATERIALS AND METHODS

Study location and Experimental birds

The location for the study was Livestock Teaching and Research Farm of the Department of Animal Science, Federal University Dutsin-Ma, Katsina State of Nigeria. Dutsin-Ma lies within Latitude 12°27’ N and Longitude 7°29’ E (Rotimi and Ati, 2020).

A total of one hundred and forty-three (143) commercial broiler chickens, including three strains; Arbor Acre (54), Cobb500 (40) and Ross308 (49) were included in this study. They were managed in a deep litter system. Commercial feed and drinking water were supplied to birds *ad libitum.* The three broiler chickens were subjected to the same management system from day old. All the necessary routine management were administered appropriately (MVM, 2016).

Data collection

At seven weeks of age, individual data on body weight (BW) and linear body measurements were obtained from the three commercial strains of broiler chickens. The linear measurements taken included:

Body Length (BL): Measured from the tip of the beak to the base of the tail.
Chest Girth (CG): Circumference of the chest around the keel and back.
Thigh Length (TL) – Distance between the hip joint and knee joint.
Shank Length (SL) – The straight portion of leg between the knee joint and the hock joint).
Shank Circumference (SC) - Circumference of the shank at the thickest point.
WL: Wing Length, the length from the shoulder joint to the tip of the longest primary feather
Keel Length (KL): Length of the keel bone.

The live Wt. (g) of individual bird was assessed using a sensitive weighing scale while linear body measurements were measured using a simple tape rule measuring in cm. Measurements were performed following standard procedures to maintain consistency and minimize the error (Isaac et al., 2022; Rotimi, 2024). All measurements were accomplished in triplicate to maximize reliability. The choice of these measurements was based on the previous knowledge of their association with growth traits and their use as predictors of body weight

Statistical Analysis

All data were analyzed using Analysis of Variance (ANOVA) procedures of the SPSS statistical package (IBM SPSS, version 20) to test the effect of strain on body weight and linear body measurements.

Model adopted is as presented below:

$Y_{ij} = \mu + S_i + e_{ij}$

Where:
Y_{ij} = Measurement for individual birds,
μ = Overall mean,
S_i = Effect of the ith strain (ArborAcre, Cobb300, Ross308),
e_{ij} = Random error.

This analysis was applied to identify significant differences in growth traits among strains, providing insights into their genetic potential and suitability for different production systems.

Phenotypic Correlation Analysis:
Phenotypic correlation analysis was applied to quantify relationships between body weight and linear body measurements. Strong correlations validated the use of linear measurements as proxies for body weight, simplifying selection and management processes in breeding programs.

Principal Component Analysis (PCA):
Principal component analysis (PCA) procedures were used to reduce dimensionality and identify traits contributing most to variance within and between strains. Multicollinearity occurs when two or more variables measure virtually the same thing and this can lead to unreliable results from multiple regression analysis (Shahin and Hassan, 2000; Rotimi et al., 2023). The multicollinearity among the variables can be reduced by adopting principal component analysis (PCA) procedures (Everitt et al., 2001; Jolliffe, 2002).

Principal Components:
The new variables obtained by projecting the original variables onto the eigenvectors (Rotimi et al., 2024).
PC = X*V
Where;
PC = the matrix of principal components.
X = the data matrix,
V = the matrix of the eigenvectors
Explained Variance:
The explained variance (EV) is the proportion of variance explained by each principal component.
$EV = (\lambda_i/\sum\lambda_j)*100$
Where;
EV = Explained variance
λ_i = the eigenvalue corresponding to the i^{th} principal component,
$\sum\lambda_j$ = the sum of all eigenvalues.
Orthogonality:
The principal components are orthogonal to each other, meaning that their covariance is zero.
$Cov(PC_i, PC_j) = 0$ for $i \neq j$

Data set validity for PCA analysis was evaluated using Kaiser-Meyer-Olkin and Bartlett's sphericity tests. Eigenvalue values ≥1.000 were used to select the number of components to retain.

Stepwise Regression Analysis
Stepwise Regression Analysis was used to develop models for predicting body weight from linear body measurements. Sequential inclusion of variables based on significance and contribution to the model's explanatory power was followed.

Canonical Discriminant Analysis (CDA)
Stepwise canonical discriminant analysis was conducted. The general model of the linear discriminant function was given in the expression;
$Y = a + D_1X_1 + D_2L_2 + \ldots + D_iL_i$
Where;
Y = Discriminant z score of discriminant function,
a = Intercept
D = Discriminant coefficient for a quantitative trait
X = Quantitative trait

Wilks' Lambda
This was evaluated as the proportion of the total variance in the discriminant scores not explained by differences among the strains. The value ranges between 0 and 1. Values close to 0 indicate that group means are different.

3. RESULTS AND DISCUSSION

In Table 1, results show that Cobb 300 attained significantly ($P<0.05$) higher body weight (1934.50±55.73) than ArborAcre and Ross308 (1771.85±39.28 and 1771.43±45.27 respectively), indicating a superior growth potential in Cobb 300. This aligns with existing studies where genetic variations influence growth traits (Udeh and Ogbu, 2011). This result is higher than report of Udeh and Ogbu (2011), who reported that Abor Acre and Ross308 had significantly higher body weight than Marshall (1.88 kg, 1.81 kg and 1.65 kg for ArborAcre and Ross308 and Cobb 300 respectively) at 7 weeks. The average bodyweight of 1,771.85 g, 1,771.43 g and 1,934.50 g recorded for ArborAcre, Cobb 300 and Ross308 respectively at 7 weeks of age were similar with the reports of other authors; Abdullah et al., (2010), 1,801 g for Ross308 broilers at 7 weeks of age, Udeh and Ogbu (2011), 1.88 kg, 1.81 kg and 1.65 kg for Arbor Acre and Ross308 and Marshall at 8 weeks respectively. The comparable weights of Arbor Acre and Ross308 suggest similar genetic potential under the experimental conditions. This finding is essential for breeders aiming to optimize growth traits through genetic selection. Results also revealed that Ross308 broiler strain recorded significantly ($P<0.05$) superior BL (29.17±0.30) than Arbor Acre and Cobb 300 (28.13±0.30 and 28.01±0.25 respectively).

The correlations between body weight and linear body measurements were highly significant across strains, as revealed in Table 2. Results show that the correlations relationships between body weight and all linear body measurements were positive and highly significant ($P<0.01$) in the three broiler strains, this underscores the predictive ability of these traits. Chest girth (CG) exhibited the strongest correlation with body weight in Cobb 300 (r = 0.923) and Ross308 (r = 0.930), while keel length had the highest correlation in Arbor Acre (r = 0.744). These positive and significant relationships reinforced the hypothesis that specific body measurements can serve as reliable proxies for estimating body weight (Ajayi et al., 2008; Rotimi et al., 2023). Such data are vital for simplifying field measurements in breeding programs.

In Table 3, the Kaiser-Meyer-Olkin Measure (KMO) measure of data sampling adequacy computed for the three broiler strains (0.853, 0.954 and 0.946 for ArborAcre, Cobb 300 and Ross308, respectively) confirmed that the sample size was sufficient (KMO>0.60) for factor analysis (Kaiser, 1960). Udeh and Ogbu (2011) obtained lower KMO values of 0.60, 0.62 and 0.67 for Arbor Acre, Marshal and Ross308 respectively. Bartlett test of sphericity was also significant, ArborAcre (289.205), Marshal (4424.102) and Ross308 (5258.305), confirming the adequacy of the data (Eyduran et al., 2010). Communalities observed in this work were adequately high, 0.628 to 0.899 in Arbor Acre, 0.853 to 0.960 in Cobb 300, and 0.901 to 0.967 in Ross308 broilers respectively (Table 4). Values obtained in this study were higher than the report of Udeh and Ogbu (2011) in broiler strains at 8th week old. This difference may be due to the age variation. Other researchers also observed high communalities in; three Nigerian local chickens (Ikpeme et al., 2016), indigenous Nigerian chickens (Yakubu et al., 2009), two commercial meat-type chickens (Amao, 2017).

The communalities obtained in this study ranged from 0.628 to 0.967 across the three strains of broilers, this is higher than the values (0.204 to 0.764) obtained by Ibiwoye and Sola-Ojo (2021) across four strains of broilers but similar with the observations of Mendes (2011) who recorded ranges of 0.78 to 0.98.

Two principal components (PCs) were extracted for ArborAcre broiler strain with eigenvalues of 4.358 for PC1 and 1.172 for PC2. The two PCs extracted accounted for 78.996% of the total variance, with 62.257% and 16.739% accented by PC1 and PC2 respectively. PC1 loaded highly on BL (0.937), CG (0.658), TL (0.935), SL (0.866) and KL (0.685). the loadings indicate the correlations between the components and the variables. This factor can be termed body size factor as it encompasses the measurements related to broilers overall size, implying that this factor can be used in breeding programme to select breeding stock with desirable body size and can be used as marker associated with body size. Other researchers also applied PCA procedures; Udeh and Ogbu (2011) extracted two PCs in Arbor Acre, three PCs in Cobb 300 and two PCs in Ross308 broiler chickens while Ibiwoye and Sola-Ojo (2021) extracted six PCs for Hubbard and Ross308 strains, three PCs in Marshall, explaining 59.46%, in Hubbard about 58.67%, in Ross308 about 55.52%, of the total variance. PC2 in ArborAcre, orthogonal to PC1, was heavily loaded on SC (0.0895) and WL (0.781).

However, one principal component (PC) was extracted in Cobb 300 and Ross308 broilers. This signifies high correlation among variables with limited variability in the data, thereby resulting to the single factor explaining majority of the variance. In Cobb 300 broilers, the PC loading ranged from 0.923 in SL to 0.980 in CG, while in Ross308 the PC loadings ranged from 0.949 in SC to 0.983 in BL. This implies simplified breeding programme as focus can be on a single trait. However, this can lead to loss of information as other important factors may be ignored. The PCA revealed distinct variance structures across strains. The streamlined variance in Cobb 300 and Ross308 implies a focus on fewer traits during selection. However, this may risk overlooking genetic diversity, which could be critical under varying environmental conditions.

Table 5 shows the results of the analysis of the stepwise regression models in the three strains of broilers. This study also sought to assess how body weight can be predicted from linear body measurements using stepwise regression in three strains of broilers. In ArborAcre broilers, two models were retained for the stepwise regression. Models retained KL and BL and accounted for 62.3% ($P<0.01$) of the total variation in the body weight. On the other hand, three models were extracted in the stepwise regression analysis on Cobb 300 broilers, retaining more linear body measurements in the optimum model, which indicated that more linear body measurements in Cobb 300 broilers were highly significant ($P<0.01$) in estimating body weight. The model had CG, BL and SL accounting for about 86.3% of total variances in the body weight. In Ross308 broiler chickens, four models were retained. The optimum model accounted for about 87.5% of the total variations in the body weight, containing CG, BL, SL and TL. The stepwise regression analysis involving the pooled data set retained three models with the optimum model accounting for about 60.00% of the total variances in body weight of the three strains of broiler chickens, with BL, TL and SC retained in the model.

These results simply show that BL represents a common growth parameter, whereas other traits such as CG and TL provide strain-specific information. This validates that strategy will need to be selected dependent upon strain and breeding goal. Strain is highly significant for the four traits, as is body weight (BW) and more often muscle and fat related traits were retained in the stepwise regressions analysis for three strains of broiler chickens, but body length (BL) is also an important indicator of growth and development in the broiler strains as seen from the results in Fig. The presence of this variable in the models indicates it is an important predictor of body weight. This trend further confirms that breeding for BL can be applied for enhancing growth and development of three broiler strains.

Results Canonical discriminant functions Table 6 presents the summary of canonical discriminant functions. Function 1 accounted for 53.2% 288 of total variation and function 2 accounted for 46.86% of total variation. The average canonical correlations (0.542 and 0.518 in functions 1 and 2 respectively) and significant Wilk's Lambda (0.516 and 0.731 in functions 1 and 2 respectively) indicate that the canonical analysis can detect linkages between the variables.

This result imply that the canonical variates are moderately correlated with the dependent variables and that the canonical variates can be used to discriminate between the three broiler strains. The discriminant analysis effectively classified strains, with 65.7% accuracy in original cases and 62.9% after cross-validation. Function 1, explaining 53.2% of the variation, was more effective than Function 2. These results highlight the morphological distinctness of the strains, with some overlap indicating shared genetic heritage, while SC and BL were critical for strain differentiation, confirming their importance in morphological and genetic characterization. Table 7 presents the classification results based on discriminant analysis. The results revealed that 57.4%, 57.5% and 73.5% of ArborAcre, Cobb 300 and Ross308 were correctly classified, after Ross308-validation. The discriminant analysis reveals that 65.7% of original grouped cases were correctly classified while it was 62.9% after cross-validation. The discriminant analysis presents the percentage of strains of broiler correctly classified showing the morphological distinctness between the samples, while the percentage of misclassification indicates the degree of inter-mingling among the three strains.

4. CONCLUSION

The positive and significant phenotypic correlations obtained in this study indicate that body weight can be reliably predicted using these traits. PCA revealed that body size-related traits accounted for majority of the variance in the Arbor Acre strain, while simpler models were found for the Cobb 300 and Ross308 strains. Stepwise regression confirmed that body length was a key predictor of body weight in all strains, while the canonical discriminant analysis demonstrated that body length and shank circumference could be used to effectively distinguish between the strains. These findings suggest that body length and chest girth could serve as important markers for growth selection in breeding programme for broiler chickens.

5. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interest regarding the publication of this article.

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Table 1. Mean (±SE) of body weight (g) and linear body measurements (cm) of three strains of broiler chicken

Strain	N	BW	BL	CG	TL	SL	SC	WL	KL
		*	*	NS	NS	*	*	NS	NS
ArborAcre	54.00	1771.85±39.28^{b}	28.13±0.30^{b}	30.40±0.36	16.84±0.18	6.88±0.09^{a}	4.98±0.06^{b}	20.43±0.23	14.16±0.14
Cobb 300	40.00	1934.50±55.73^{a}	28.01±0.25^{b}	30.18±0.33	16.82±0.31	6.61±0.09^{b}	5.24±0.08^{a}	19.81±0.25	13.90±0.13
Ross308	49.00	1771.43±45.27^{b}	29.17±0.30^{a}	30.96±0.29	16.31±0.16	6.73±0.06^{ab}	5.32±0.06^{a}	20.21±0.16	14.09±0.08
Overall	143.00	1817.20±27.04	28.45±0.17	30.53±0.19	16.66±0.12	6.75±0.05	5.17±0.04	20.18±0.12	14.06±0.07

BW = body weight, BL= body length, CG = chest girth, SL=shank length, TL = thigh length, SL = shank length, SC = shank circumference, WL = wing length, KL = keel length, N = number of observations. ^{a,b,c}Means in the same column with different superscripts are significantly different (P<0.05).

Table 2. Phenotypic correlation coefficient of body weight (g) and linear body measurements (cm) for three strains of broiler chickens

Strain		BW	BL	CG	TL	SL	SC	WL
ArborAcre	BL	0.691**	1					
	CG	0.612**	0.617**	1				
	TL	0.727**	0.869**	0.598**	1			
	SL	0.735**	0.766**	0.637**	0.837**	1		
	SC	0.339**	0.142	0.392**	0.247	0.328*	1	
	WL	0.397**	0.355**	0.489**	0.379**	0.470**	0.518**	1
	KL	0.744**	0.631**	0.602**	0.728**	0.726**	0.505**	0.592**
Cobb 300	BL	0.914**	1					
	CG	0.923**	0.964**	1				
	TL	0.874**	0.931**	0.926**	1			
	SL	0.854**	0.870**	0.887**	0.862**	1		
	SC	0.867**	0.916**	0.937**	0.900**	0.891**	1	
	WL	0.877**	0.932**	0.926**	0.911**	0.840**	0.893**	1
	KL	0.874**	0.935**	0.935**	0.905**	0.855**	0.906**	0.903**
Ross308	BL	0.926**	1					
	CG	0.930**	0.976**	1				
	TL	0.876**	0.950**	0.942**	1			
	SL	0.891**	0.933**	0.931**	0.909**	1		
	SC	0.862**	0.910**	0.922**	0.903**	0.913**	1	
	WL	0.889**	0.950**	0.937**	0.938**	0.897**	0.890**	1
	KL	0.895**	0.941**	0.946**	0.931**	0.914**	0.896**	0.920**

BW = body weight, BL= body length, CG = chest girth, SL=shank length, TL = thigh length, SL = shank length, SC = shank circumference, WL = wing length, KL = keel length, **Correlation is significant (P<0.01), *Correlation is significant (P<0.05).

Table 3. Kaiser-Meyer-Olkin (KMO) and Bartlett's Tests

Tests		ArborAcre	Cobb 300	Ross308
KMO		0.853	0.954	0.946
Bartlett's Test of Sphericity	Approx. Chi-Square	289.205	4424.102	5258.305
	Df	21	21	21
	Sig.	0.000	0.000	0.000

Table 4. Variance contributions of the linear body measurements (cm) of the three strains of broiler chickens

Traits	ArborAcre			Cobb 300		Ross308	
	PC1	PC2	Communalities	PC1	Communalities	PC1	Communalities
Body length	**0.937**	0.061	0.882	**0.976**	0.952	**0.983**	0.967
Chest girth	**0.658**	0.441	0.628	**0.980**	0.960	**0.982**	0.965
Thigh length	**0.935**	0.157	0.899	**0.959**	0.919	**0.970**	0.941
Shank length	**0.866**	0.292	0.835	**0.923**	0.853	**0.959**	0.919
Shank circumference	0.057	**0.895**	0.804	**0.960**	0.921	**0.949**	0.901
Wing length	0.299	**0.781**	0.700	**0.955**	0.911	**0.964**	0.930
Keel length	**0.685**	**0.559**	0.782	**0.959**	0.921	**0.967**	0.934
Eigenvalues	4.358	1.172	-	6.438	-	6.558	-
Variance (%)	62.257	16.739	-	91.965	-	93.681	-
Cumulative variance	-	78.996	-	91.965	-	93.681	-

Table 5. Stepwise regression equations in the three strains of broilers

Strain	**Model**	**Equation**	**Adjusted R^2**	**Variance Inflation factor Values**			
				KL	**BL**	**-**	**-**
ArborAcre	1	-5.634 +29.599KL	0.546	1.000	-	-	-
	2	-63.829 +20.366KL +8.458BL	0.623	1.660	1.660	-	-
Cobb 300				**CG**	**BL**	**SL**	**-**
	1	-965.738 +84.390CG	0.852	1.000	-	-	-
	2	-1109.882 +54.292CG +36.740 BL	0.859	14.301	14.301	-	-
	3	-1253.068 +45.348CG +33.535BL +77.562SL	0.863	16.530	14.507	4.744	-
Ross308				**CG**	**BL**	**SL**	**TL**
	1	-818.436 +75.624CG	0.864	1.000	-	-	-
	2	-957.977 +44.818CG +37.145BL	0.871	21.235	21.235	-	-
	3	-1034.004 +40.362CG +30.837BL +60.206SL	0.873	22.756	23.435	8.294	-
	4	-986.329 +43.561CG +39.212BL +69.337SL -26.862TL	0.875	23.503	27.126	8.476	11.073
Overall				**BL**	**TL**	**SC**	**-**
	1	-1162.137 +104.710BL	0.441	1.000	-	-	-
	2	-1963.380 +79.532BL +91.117TL	0.584	1.178	1.178	-	-
	3	-2083.799 +68.320BL +83.029TL +111.055SC	0.600	1.462	1.252	1.472	-

BL= body length, CG = chest girth, SL=shank length, TL = thigh length, SL = shank length, SC = shank circumference, KL = keel length

Table 6. Discriminant analysis for classification of the three strains of broiler chickens

Test	Category	Strain	Predicted Group Membership			Total
			Abor Acre	Cobb 300	Ross308	
Original	Count	Abor Acre	31	11	12	54
		Cobb 300	7	26	7	40
		Ross308	6	6	37	49
	%	Abor Acre	57.4	20.4	22.2	100.0
		Cobb 300	17.5	65.0	17.5	100.0
		Ross308	12.2	12.2	75.5	100.0
Cross-validated[b]	Count	Abor Acre	31	11	12	54
		Cobb 300	9	23	8	40
		Ross308	6	7	36	49
	%	Abor Acre	57.4	20.4	22.2	100.0
		Cobb 300	22.5	57.5	20.0	100.0
		Ross308	12.2	14.3	73.5	100.0