

ABG -04

ABG -04 Principal Component Analysis of Morphological Traits of Donkeys in Northwest Nigeria

P.A. John, A.O. Iyola-Tunji, G.N. Akpa, S.P. Balami, R.O. Okeke and B.V. Iriso

¹Department of Animal Science, Ahmadu Bello University, Zaria; ²National Agricultural Extension and Research Liaison Services, Ahmadu Bello University, Zaria.

Corresponding author: P.A John; E-mail: johnpaulapagu@gmail.com

Abstract

Seven hundred (700) donkeys were sampled in this study that was aimed at generating new latent factors from morphological traits of donkeys in North West Nigeria. Data were collected on hair type, coat colour, skin type, coat colour pattern, tail shape, eye colour and head profile using visual observations of the donkeys. The data were subjected to principal component analysis through dimension reduction functions with varimax rotation using IBM® SPSS®. Tail shape (0.51), head profile (0.72) and hair type (0.81) were the traits that contributed significantly to the component in PC1; coat colour (0.81) and coat colour pattern (0.72) in PC2 while eye colour (0.89) was the only trait that loaded in PC3. Tail shape, head profile and hair type (PC1) accounted for 30.1% of the total variation of morphological traits of donkeys in North West Nigeria. Any of these three traits should be used to further classify the donkey populations in North West Nigeria.

Keywords: Donkey, coat colour, morphological traits

Introduction

Delgado *et al.* (2001) stated that knowledge of variation in the morphological traits is the first step in characterization of local genetic resources. Morphological characters provide useful information used to detect genetic relationships of strains in different domesticated animal species (Herrera *et al.*, 1996). According to the FAO (2009), the global strategy involves identifying and understanding the unique genetic resources in a particular region and developing the proper use of the diversity (Franklin, 1997). There are four major strains of donkeys in Nigeria which are clearly identified by their coat colours. They are namely Auraki (Red), Fari (White), Duni (Black) and Idabari (Brown) (Blench *et al.*, 1990). There is however need to explore other means of classification of donkeys other than through their coat colours.

This study was therefore aimed at generating new latent factors from morphological traits of donkeys in North West Nigeria.

Materials and Methods

Seven hundred (700) donkeys were sampled for this study which was carried out in the North West Nigeria. All the States in North West Nigeria were selected for the study because of existence of high population of donkeys. Morphological data were collected on hair type, coat colour, skin type, coat colour pattern, tail shape, eye colour and head profile using visual observation.

The data obtained were subjected to principal component analysis through dimension reduction functions with varimax rotation using IBM® SPSS® Version 21 (SPSS, 2012).

Results and Discussion

The principal components analysis of morphological traits of donkeys are revealed in Table 1. This shows the share of total variance, factor loading and eigen value of principal components of morphological traits of Nigerian donkeys. The result from PC showed that three components were extracted from the original seven morphological traits of donkeys. PC1 accounted for 30.1% of within sample variation with loadings for tail shape, head profile, hair type and skin type. The trait loadings in PC 2 were coat colour and coat colour pattern. In PC 3, the trait loadings was eye colour. Tail shape (0.51), head profile (0.72), hair type (0.81) and skin type (-0.75) were the traits that contributed significantly to the component clusters in PC1, coat colour (0.81) and coat colour pattern (0.72) in PC2 and eye colour (0.89) in PC3. The result of this study is similar to that of Predrag *et al.* (2015) who reported that morphological similarities as indicated by clustering between Balkan donkeys and Albanian donkeys could be attributed to closed geographic proximity and the overlap of their habitat.

However, comparison of selected morphological traits of donkeys in Albania revealed significant differences among the Albanian donkey population (Papa and Kume, 2012) and Catalanian donkey breed (Folch and Jordana, 1997). The differences observed among morphological traits in donkeys of North West Nigeria might be because of the strains differences or geographical distribution. This imposes the need for molecular

characterization of the donkey strains to get insight in their molecular genetic diversity. Manly (1994) demonstrated that morphological variables that have the highest correlation among themselves are good raw materials for multivariate analysis. Coat colour pattern had the highest cluster while hair type and head profile also formed another cluster. This implies that donkeys could be differentiated using these two cluster groups.

Table 1: Principal components cluster analysis of morphological traits of donkeys

Traits	Principal components			Communality
	PC1	PC2	PC3	
Coat colour	-0.15	0.81	-0.02	30.11
Skin type	-0.75	-0.16	0.12	48.88
Coat colour pattern	-0.23	0.72	-0.36	62.94
Tail shape	0.51	0.09	0.08	75.04
Eye colour	0.16	0.33	0.89	84.69
Head profile	0.72	-0.02	-0.13	93.50
Hair type	0.81	0.09	-0.10	100.00
Eigen value	2.11	1.31	0.98	
Eigen percent	30.1	18.8	14.1	

PC = Principal component.

Figures 1a and b showed the principal component distributions and biplot of morphological traits of donkeys. In component 1 about 30.1% form component 1 while 18.8% form component 2. Variation due to component 1 was the highest (30.1%) in relation to the total variations of morphological traits of donkeys in North West Nigeria. Figure 1a-b shows the scatter diagram for variables of morphological traits among donkeys in North West Nigeria. Far and distant relationships were observed between skin type and head profile as well as coat colour pattern and eye colour while close relationships were observed between hair type and coat colour. The closer the distribution of morphological traits among themselves, the closer their relationships and the further or distant the traits, the more distant is the relationships among the morphological traits of donkeys.

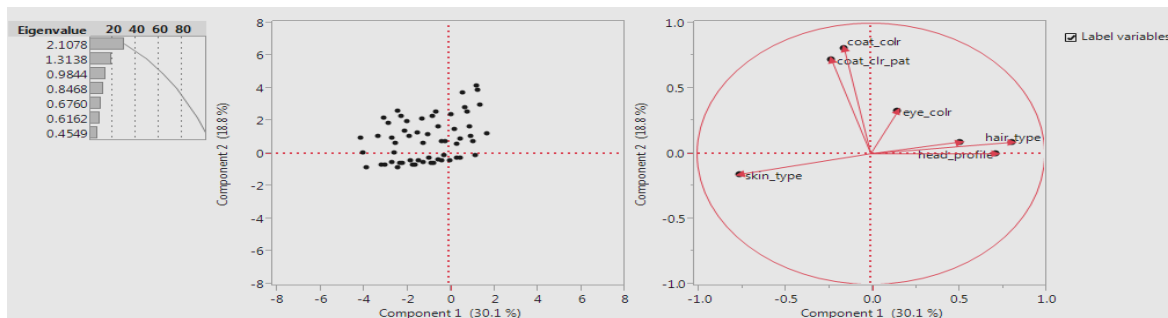


Fig.1a: Principal component distribution of morphological traits of donkeys

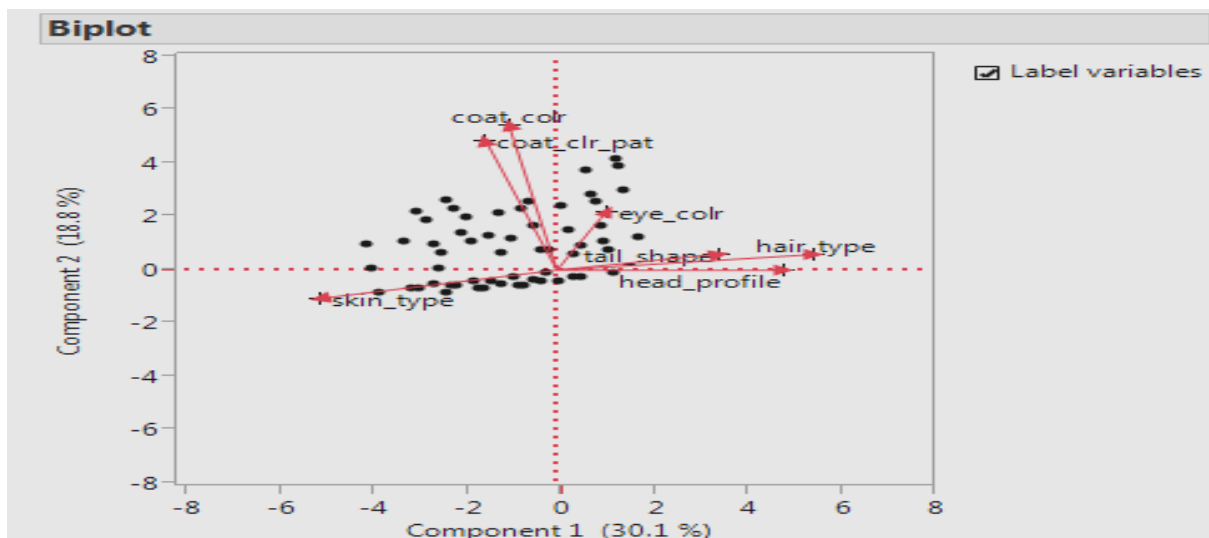


Fig. 1b: Biplot of morphological traits of donkeys

Conclusion and Recommendation

Tail shape, head profile and hair type (PC1) accounted for 30.1% of the total variation of morphological traits of donkeys in North West Nigeria. Any of these three traits should be used to further classify the donkey populations in North West Nigeria.

References

- Blench, R., De Jode, A. and Gherzi, E. (1990). Donkeys in Nigeria: history, distribution, and productivity. In: Starkey, P. and Fielding, D. (Eds), Donkeys, People and Development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ATNESA) ACP-EU Technical Center For Agricultural and Rural Cooperation (CTA), Wageningen, The Netherlands. pp 24-32.
- Delgado, J.V., Barba, C., Camacho, M.E., Sereno, F.T.P.S., Martinez, A and Vega – Pla, J.L., (2001). Livestock characterization in Spain. *Agriculture*, 29: 7-18.
- Folch, P. and Jordana, J. (1997). Characterization, reference ranges and the influence of gender on morphological parameters of the endangered Catalan donkey breed. *Journal of Equine Veterinary Science*, 17(2): 102-111.
- Food and Agricultural Organization of the United Nation (2009). Preparation of national strategies and action plans for animal genetic resources. Animal Production and Health Guideline No. 2 Rome. Retrieved on 15th February, 2015 from <http://www.fao.org/decrep/012/i0770e00.htm>
- Franklin, I.R. (1997). The utilization of genetic variation. *Proceeding for Association of Advancement of Animal Breeding and Genetics*, 12: 39-47.
- Herrera, M., Roder, E., Grutierrez, M.J., Peria, F and Roder, J.M. (1996). Application of multifactorial Discriminant Analysis in the morphostructural differentiation on Andalusian Caprine Breeds. *Small Ruminant Research*, 22: 39-47.
- Manly, B.J. (1994). *Multivariate Statistical Methods: A primer*. Chapman and Hall, London/ New York.
- Papa, L. and Kume, K. (2012). The result of identification and characterization of the donkey population in Albania. *Agricultural Forest*, 58:125-134.
- Predrag, S., Nada, L., Ivica, R. and Ante, I., (2015). Morphological biochemical and hematological characterization of endangered Balkan donkey breed. *Reseach article, Acta Veterinaria-Beograd*, 65(1): 125-136.
- SPSS (2012). Statistical Package for Social Sciences. International Business Machines Corporation, USA.