Available online at http://www.ijirr.com

International Journal of Information Research and Review
Vol. 2, Issue, 09, pp.1089-1092, September, 2015

OPEN ACCESS JOURNAL

ISSN: 2349-9141

Full Length Research Paper

CROSSBREEDING, DESCRIPTION AND QUALITY ATTRIBUTES OF THREE INDIGENOUS CHICKENS

[1,*]Thobela Louis Tyasi and [2]Masibonge Gxasheka

[1]Department of Animal Genetics, Breeding and Reproduction, College of Animal Science and Technology, Jilin Agricultural University, Changchun, People's Republic of China
[2]Laboratory of Plant Pathology, Department of Plant Protection, Jilin Agricultural University, Changchun, Jilin 130118, China

*Corresponding Author

Received 24th August 2015; Published 30th September 2015

Abstract

The main objective of this review was to find out how much has been done on crossbreeding, description and quality attributes of Ovambo,Potchefstroom Koekoek and Venda chicken breeds. These three chickens are the most available indigenous chicken breeds in South Africa. However, many studies need to be done on these three different indigenous chickens. Thus, crossbreeding, description and quality attributes are essential to be identified on these chickens. Crossbreeding is beneficial for two primary reasons. First, a well-designedcrossbreeding system allows the combination of desirable traits of the breeds involved in the cross while masking some of the disadvantages of the breeds. The second benefit arises from heterosis, which is often referred to as hybrid vigour. It is very important to distinguish the description of the animals that can benefit the breeders to breed for quality attributes such as meat color, pH meter and meat tenderness.

Keywords: Crossbreeding, Heterosis, Ovambo, Potchefstroom Koekoek, Venda, pH meter, meat color, meat tenderness

***To cite this paper**:* Thobela Louis Tyasi and Masibonge Gxasheka, 2015. Crossbreeding, description and quality attributes of three indigenous chickens*, International Journal of Information Research and Review.* Vol. 2, Issue, 09, pp.1089-1092, September, 2015.

INTRODUCTION

Crossbreeding is one of the tools for exploiting genetic variation. Crossbreeding, the mating of two individuals with different breed make-ups is one type of a larger class of mating systems called out-breeding (Saadey *et al*., 2008; Momoh and Nwosu, 2008; Siwendu *et al*., 2012). Out-breeding has the opposite effect of inbreeding and hence results in increased heterozygosity in a population and decreased homozygosity (Razuki *et al*., 2011). A crossbreed or crossbred animal usually refers to an animal with purebred parents of two different breeds, varieties, or populations (Williams *et al*., 2002). The intention is often to create offspring that share the traits of both parent lineages, and producing an animal with hybrid vigour (Saadey *et al*., 2008).Crossbreeding is beneficial for two primary reasons. First, a well-designed cross breeding system allows the combination of desirable traits of the breeds involved in the cross while masking some of the disadvantages of the breeds. The second benefit arises from heterosis, which is often referred to as hybrid vigour. In addition to these primary benefits, crossbreeding also enables the change of a population rapidly with the introduction of new breeds. The purpose of crossbreeding is to produce progeny which are more disease resistant, healthier and hardier (Momoh and Nwosu, 2008).

Crossbreeding benefits

Crossbreeding offers two distinct advantages over pure-breeding: heterosis and breed complementarity. Both are very important to the animal production industry.

Heterosis

Heterosis which is also called hybrid vigour is the superiority of crossbred offspring to their purebred parents. However, mathematically, heterosis is the percentage increase in a specific trait that progeny have over the average performance of their parents. Heterosis is highest for traits that do not respond well to selection, example fitness and reproductive traits, and lowest for traits that respond well to selection, for example carcass and fleece characteristics. According to Fairfull, (1990) heterosis is greater for reproductive traits than for growth traits, however, Lui *et al*. (1995) reported that heterosis is influenced by maternal and direct additive effects but Momoh and Nwosu, (2008) reported that heterosis for growth traits was age dependent. Generating hybrid vigour is one of the most important, if not the most important, reasons for crossbreeding. A lot of research work on chickens has been done in different countries throughout the world. In Egypt, Sabra (1990) established that crossbreds obtained from crossing between local breeds had positive and high magnitude of heterosis for growth traits such as body weight at different ages, while Saadey *et al*. (2008) found that crossbreds obtained from crossing between Sinai (S) and White Leghorn had positive and high heterotic percentage at all ages. Sabri *et al*. (2000) and Iraqi *et al*. (2002) reported that heterosis estimates were generally positive and high for growth traits of crossbreds obtained from crossings between Mandarah and Matrouh chicken strains. Siwendu *et al*. (2012) conducted a study on heterosis of body weight by crossing two indigenous breeds (Venda and Naked neck) with one exotic breed (Ross-308). The heterosis estimates indicated that crossing between the Venda sires and Ross 308 dams as well as between the Venda sires and Naked Neck dams gave the highest heterotic effect for body weight.

Breed complimentarily

Breed complementarity is the other major advantage of crossbreeding which relates to the fact that there are no perfect breeds, and that each breed possesses certain strengths and weaknesses. In a systematic crossbreeding program, breed resources are combined to balance the positive and negative aspects of each breed in the cross. According to Thomas (2006), mating Poly-pay ewes to Suffolk rams is such an example. This cross takes advantage of the reproductive efficiency and moderate maintenance costs of Poly-pay ewes while producing Suffolk-sired lambs to meet market requirements for fast-growing, heavy muscled lambs. Crossing a Boer buckwith a dairy doe would be another example of breed complementarity. Boer goats are known for their outstanding body conformation and carcass quality, while dairy does such as Saanen produce more milk than Boer goats. Razuki *et al*. (2011) conducted a breed complementarity study by crossing the Iraq brown, White Leghorn and New Hampshire chickens. This study was conducted to improve egg production and egg weight traits. White Leghorn and New Hampshire are exotic breeds which are recommended for egg production, the Iraq brown is an indigenous breed which is adapted to harsh conditions.

Description of three indigenous chicken breeds

The general description of the chicken breeds that were used in the study is provided below

Ovambo

The breed (Figure 1) originates from the northern part of Namibia and Ovambo-land.They are dark coloured (Grobbelaar *et al*., 2010). Ovambo are very aggressive and have been known to catch and eat mice as well as young rats. They can also fly and roost on the top of trees to avoid predators (Grobbelaar, 2008).

Figure 1. Ovambo chickens (hen at the back and cock in foreground).

The breed and performance information of the Ovambo chickens, Ramsey, *et al*. (2000) is depicted in Table 1.

Age	Cook	Hen
Average mass at 16 weeks	1.74kg	1.32kg
Average mass at 20 weeks	2.16kg	1.54kg
Sexual maturity		143days
Average egg weight		52.5g

Potchefstroom Koekoek

This breed (Figure 2) was bred during the 1950's by a researcher called Marais at the Potchefstroom Agricultural College, North West province of South Africa (Grobbelaar,*et al*., 2010).The breed was developed from three breeds, namely Black Australorp, Barred Plymouth Rock and White Leghorn. They have a barred colour pattern which is where the name "Koekoek" comes from. Few studies have been done on this breed.Makhafola *et al*. (2012) reported that the breed is suitable for meat production. The breed and performance information for the Potchefstroom Koekoek, Ramsey*, et al*. (2000) is depicted in Table 2.

Figure 2. Potchefstroom Koekoek chickens (cock at the back and hen in the foreground)

Venda

Venda (Figure 3) described in 1979 by a veterinarian, Dr Naas Coetzee. The Venda breed is a lightweight breed that can easily fly into trees to roost for the night or just to escape from ground predators.

Table 2. Breed and performance information of the Potchefstroom Koekoek

Age	Cook	Hen
Average mass at 16 weeks	1.84kg	1.40kg
Average mass at 20 weeks	2.40kg	1.70kg
Sexual maturity		130days
Average egg weight		55.5g

Figure 3. Venda chickens (cock at the back and hen in the foreground)

Table 3.: Breed and performance information of the Venda

Age	Cook	Hen
Average mass at 16 weeks	1.57kg	1.24kg
Average mass at 20 weeks	2.01kg	1.40kg
Sexual maturity		143days
Average egg weight		52.7g

This breed is well adapted to hightemperatures and to scavenge for food. They eat anything from grass seeds, house scraps, and insects and even hunt small rodents. This breed is well suited to be used in rural areas for egg production and to hatch their own chickens. The breed and performance information for the Venda, Ramsey, *et al.* (2000) is depicted in Table 3.

Chicken quality attributes

Meat quality is a function of tenderness, pH, colour, juiciness, flavour and nutritive value (Muchenje *et al*., 2009). The present study focussed only on pH, colour and tenderness. Meat quality attributes such as pH and colour affect consumption (Simela, 2005). According to Deiss *et al.,* (2009) different chicken breeds perform differently in these attributes.

The pH of meat

As soon as the animal is slaughtered, muscles are converted to meat due to a number of metabolic and structural processes that occur immediately *post-mortem*. These changes that occur in the muscle *post-mortem* can be measured by the levelof pH and temperature (Deiss *et al.,* 2009). Muscle glycogen can be metabolised through anaerobic glycolysis and generate lactate which accumulates in the muscles and in turn lowers intracellular pH. This occurs until it reaches ultimate pH (pHu) of about5.4-5.7 (Dyubele *et al*., 2010). However, the increase or decrease in pH in chicken meat depends on levels of glycogen and lactic acid in the muscle (Zhang *et al.,* 2010). Ultimate pH (pH 24 hours post mortem) below 5.0 leads to tougher muscles (Yu *et al*., 2009). This is due to the formation of bonds between the myosin head and actin resulting in the occurrence of rigor mortis and the rate at which meat is cooled mainly affects pHu (Muchenje *et al*., 2009). Showering animals before slaughter reduces acidosis which can lead to higher pH although in chickens this seems to be different (Dyubele *et al*., 2010).

Meat color

The color of meat is an important physical property that is usually used as an indicator of the quality of the meat by consumers (Muchenje *et al.,* 2009). Color of meat is defined in terms of Hunter colorimetric co-ordinates with L*, a* and b* values (Kannan *et al*., 2003). Lightness (L*) of meat, indicates the lightness of the meat and it ranges from 0 (all light absorbed) to 100 (all light reflected). Co-ordinate a* is the redness of meat and ranges from -60 (green) to + 60 (red); and b* ranges from -60 (blue) to +60 (yellow) (Simela, 2005). Dark meat shows that animals were exposed to situations that exhausted glycogen levels (Kannan *et al.* (2003). According to Qiao *et al.,* (2001) Changes in L* is a good measure of sample lightness-darkness relative to consumers view with minimal interference from product thickness and background colour. Very wide differences exist in L* among commercial sources of chickens, andhigh values are indicative of pale-soft-exudative (PSE) muscle (Lesiow *et al*., 2005). Increasing L* relates to increasing moisture, glycogen, iron, ash, and certain fatty acid ratios (Qiao *et al*., 2001).

Meat tenderness

Tenderness refers to the physical and chemical interaction of meat in the mouth, any feel of non-tactile sensation, the ease of mastication that is determined by the amount of residue that remains in the teeth (Simela, 2005). Consumers prefer meat that is tender (Muchenje *et al*., 2008) with desirable flavor and less connective tissue (Muchenje *et al*., 2009). Age of the animal, muscle type and size of the muscle fibre, post mortem, sarcomere length, proteolysis, distribution of intramuscular fat, pre-slaughter stress, cold shortening, cooking time and method and storage period including aging determine tenderness (Strydom *et al*., 2010).

Conclusion

The study has shown the importance of considering the crossbreeding effects such as estimates of heterotic effect and breed complimentarily before planning any crossbreeding program. It is also concluded that different indigenous chickens have diverse description and the quality of indigenous chicken meat might be related to its composition.

REFERENCES

Deiss, V, Temple, D., Ligout, S., Racine, C., Bouix, J., Terlouw, C. and Boissy, A. 2009. Can emotional reactivity predict stress responses at slaughter in sheep? Appl. *Anim. Behav. Sci.,* 119:193-202.

Dyubele, N. L., Muchenje, V., Nkukwana, T. T. and Chimonyo, M. 2010. Consumer sensory characteristics of broiler and indigenous chicken meat: a South African example. Food Qual. Pref., 21: 815-819.

Fairfull, R. W. 1990. Heterosis.in: Poultry breeding and genetics. R.D. crawford, Ed. elsevier, amsterdam, the Netherlands, pp. 913-933.

Grobbelaar, J.A.N. 2008. Egg production potentials of four indigenous chicken breeds in South Africa.Pretoria, Tshwane University of Technology. (M.Tech. Thesis).

Grobbelaar, J.A.N., Sutherland, B. and Molalakgotla, N.M. 2010. Egg production potentials of certain indigenous chicken breeds from South Africa. Anim. *Genetic Res.,* 46: 25-32.

Iraq, M. M., Hanafi, M. S., Khalil, M. H., El-labban, A. F. M. and Ell-Sisy, M. 2002.Genetic evaluation of growth traits in crossbreeding experiment involving two local strains of chickens using multi-trait animal model. Lives. *Res. Rural. Devel*., 14:1-7.

Kannan, G., Kouakou, B., Terrill, T. H. and Gelaye, S. 2003. Endocrine, blood metabolite, and meat quality changes in goats as influenced by short-term, pre- slaughter stress. *J. Anim. Sci*., 81: 1499-1507.

Lui, A, Nishimura, T. and Takahashi, K. 1995. Relationship between structural properties of intramuscular connective tissue and toughness of various chicken skeletal muscles. *Meat Sci.,* 43: 43-49.

Makhafola, M. B., Umesiobi, D. O., Mphaphathi, M. L., Masenya, M. B. and Nedambale, T. L. 2012. Characterization of sperm cell motility rate of southern african indigenous cockerel semen following analysis by sperm class analyzer. *J. Anim. Sci. Dvan.,* 2: 416-424.

Momoh, O.M. and Nwosu, C.C. 2008. Genetic evaluation of growth traits in crosses between two ecotypes of nigerian local chicken. *Lives.Res. Rural dev*., 20: 580-690.

Muchenje, V., Dzama, K., Chimonyo, M., Raats, J. G. and Strydom, P. E. 2008. Meat quality of nguni, bonsmara and aberdeen angus steers raised on natural pasture in the eastern cape, south africa. Meat Sci., 79: 20-28.

Muchenje, V., Dzama, K., Chimonyo, M., Strydom, P. E. and Raats, J. G. 2009.Relationship between pre-slaughter stress responsiveness and beef quality in three cattle breeds. *Meat Sci.,* 81: 653-657.

Qiao, M, Fletcher, D. L. Northcutt, J. K. andSmith, D. P. 2001. The relationship between raw broiler breast colour and composition. *Poultry Sci.*, 81:422-427.

Ramsey, K, Harris, L. and Kotze, A. 2000.Landrace breeds: south africa's indigenous and locally adapted developed farm animals. ed. ramsey, harris andkotzé. Farm.Animal conservation trust, Pretoria.

Razuki, W. M., Mukhlis, S. A., Jasim F. H. and Hamad, R. F. 2011.Productive performance of four commercial broiler genotypes reared under high ambient temperatures. *Inter. J. Poultry Sci*., 10: 87- 92.

Saadey, S.M, Galal, A. Zaky, H. I. and Zein El-Dein, A. 2008.Diallel crossing analysis for body weights and egg production traits of two native egyptian and two exotic chicken breeds. *Inter. J. Poultry Sci*., 7: 64-71.

Sabra, Z. E. A. M. 1990. Estimation of heterosis and combining abilities for some economic traits in chickens. M. Sc., thesis, faculty of agriculture, Zagazig University, banha branch, egypt.

Sabri, H. M., Khattab, M. S. and Abdel-Ghany, A. M. 2000. Genetic analysis for body weight traits of a diallel crossing involving Rhode Island Red, White leghorn,Fayoumi and Dandarawi chickens. Ann. *Agri. Sci. Moshtoho*r., 38:1869-1883.

Simela, L. 2005. Meat characteristics and acceptability of chevon from South African indigenous goats. University of Pretoria, South Africa.

Siwendu, N.A., Norris, D., Ng'ambi, J.W., Shimelis, H.A. and Benyi, K. 2012. Heterotic and combining ability for body weight in a diallel cross of three chicken genotypes. Trop. Anim. Health Prod., 20:23-25.

Strydom, P. E., Naude, P. T., Smith, M. F., Scholtz, M. M. and Van Wyk, J. B. 2000.Characteristics of village african cattle breeds in relation to meat quality traits. *Meat Sci.,* 55: 79-88.

Thomas, L. 2006. Practical crossbreeding for improved livelihoods in developing countries: the farm africa goat project. Liv. *Sci.,* 136:38-44.

Williams, S.M., Price, S.E. and Siegel, P.B. 2002. Heterosis of growth and reproductive traits in fowl. *Poultry Sci*., 81: 1109-1112.

Yu, J., Tang, S., Bao, E., Zhang, M., Hao, Q. and Yue, Z. 2009. The effect of transportation on the expression of heat shock proteins and meat quality of m. longissimus dorsi in pigs. Meat Sci.*, 83:* 474-478.

Zhang, M., Xin, L., Bao, E., Hartung, J. and Yue, Z. 2010. Variation in the expression of hsp27, αb-crystallin mrna and protein in the heart and liver of pigs exposed to different transport times. Res. *Vet. Sci.,* 90: 432-438.

****