A Review of Some Characteristics, Socio-economic Aspects and Utilization of Zulu Sheep: Implications for Conservation

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Abstract

Zulu sheep are Nguni sheep of Zululand and are adapted to the harsh conditions of KwaZulu-Natal. They are used by rural farmers for economic purposes. Their numbers are declining, indicating a potential extinction threat. Knowledge of their phenotypic and genotypic characteristics is essential for conservation planning. In this review there is a focus on the utilization, socio-economic aspects, phenotypic and genotypic characteristics as well as a proposed breeding programme. A survey has shown that rural farmers in the areas of northern KwaZulu-Natal prefer to keep this breed for its adaptability, resistance to diseases and meat quality. Zulu sheep are small framed multi coloured animals. Mature males weigh up to 38 kg and females up to 32 kg. Based on four morphological traits and live weight, phenotypic diversity between three populations was estimated at 48 %. A genetic diversity between these three populations was estimated at 22%. Live weight of Zulu sheep can be estimated using the heart

girth and wither height measurements. Scrotum circumference of young rams (up to 22 months old) is reliable for estimating the live weight. Animals that were characterized in the studies were grazed extensively and no supplements were provided. There is therefore a potential of weight increase if these animals are reared in a semi-extensive environment. An open nucleus breeding scheme is thus recommended for a sustainable use and conservation of this breed. For more conclusive results larger numbers of phenotypic and genetic characteristics, in larger numbers of Zulu sheep populations, should be investigated.

Key words: Indigenous sheep, extensive farming, body measurements, conservation

Introduction

The ancestral wild stock of both the thin-tailed and fat-tailed sheep is identical (International Livestock Research Institute (ILRI), 2007). From an Asian origin, sheep spread westwards to beyond the Mediterranean, including Europe and Africa (Epstein, 1971). The process of domestication resulted in some morphological and physiological modifications in sheep. For instance, wool replaced the hair coat in colder climates, the tail was lengthened and in some cases became a place of excess fat storage (Devendra and Mcleroy, 1982). Fat-tailed sheep were first realized in Egypt at the beginning of the second millennium AD. The assumption is that they entered Africa (Egypt) on various occasions through both Suez and Babel Mandeb. It is believed that from Egypt the population spread westwards into Lybia, Tunisia and eastern Algeria (ILRI, 2007). The group that entered through Babel Mandeb extended from Ethiopia into the Great Lake region of Uganda, Kenya and Tanzania but did not enter into Congo (Ryder, 1984). Archeologists have reported that a further southward migration from here may have arrived in South Africa (SA) as early as 400 BC (Bester, 2009). However, by 200 AD, the Khoi-Khoi pasturalists arrived at the SA northern borders with early sheep breeds (Plug and Badernhorst, 2001). A second wave of migrators between the third and second centuries AD brought early Iron Age communities into

the eastern parts of the country (Bester, 2009). One group of the Iron Age people came down the east coast to Natal and dispersed further south bringing sheep and cattle with them. These sheep are suspected to be the ancestors of the Nguni breeds (Ramsay *et al.*, 2000). The Nguni sheep of Zululand are called Zulu sheep and the Nguni sheep of Swaziland, Swazi sheep. Zulu sheep are found in the communal areas of KwaZulu-Natal in South Africa, such as Matubatuba, Msinga, and Nkandla. Research flocks were established at the Makhathini Research Station below the Pongolo River Dam and at the University of Zululand (Ramsay *et al*., 2000). Reports indicate that the numbers of sheep of this breed are declining (Ramsay *et al*., 2000; Kruger, 2001)

Locally adapted or indigenous breeds like the Zulu sheep are usually owned by rural farmers and although they may not yield as much in production as the exotic breeds they represent the lifeline of rural farmers. Such breeds produce a wide range of products, thrive on low forage and require lower levels of health care. Their management is ecologically more sustainable, especially in marginal environments (Kohler-Röllefson, 2000). Many indigenous communities have been forced to abandon their traditional patterns of livestock production because of lack of resources resulting from the encroachment of agriculture, wildlife reserves, or population pressure (Adebambo, 1994). Abandoning of traditional rituals, customs and livelihoods inevitability also result in the loss of distinct breeds. The maintenance of the remaining livestock diversity in communal farming would require activities that can be carried out within the framework of technical cooperation. These would include support for research on indigenous knowledge and capacity building at grassroots and at national level. Le Viet Ly (1994) suggested that the goal for conservation of biodiversity should focus on the diversity between and within indigenous populations of farm animals. Phenotypic and genetic

characterisation of local breeds is a prerequisite for the establishment of a conservation plan.

This article reviews the socio-economic and the cultural values of the farmers on keeping the Zulu sheep breed, some phenotypic variation and the genetic variation within this breed.

Socio-economic and cultural values

The number of sheep owned by individual farmers is lower than that of either goats or cattle. A livestock survey conducted by Nsahlai et al. (2009) in four districts of KwaZulu-Natal (Uthungulu, Mkhanyakude, Zululand and Amajuba) revealed that 156 communal farmers owned a total of 4031 Zulu goats, 2424 Cattle and 433 Zulu sheep. The traditional farmers in KwaZulu-Natal keep the Zulu sheep as a source of protein and for sale when in need of cash. These sheep are also used for payment of penalties in the tribal courts, but none of the farmers use this species for "Lobola" (marital payments) or other cultural ceremonies (Kunene and Fossey, 2006). Various adaptability traits of this breed have been reported by Ramsay et al. (2000) and by the farmers who keep them. These include resistance to diseases, good meat quality and the ability to flourish in the hot and humid climate of KwaZulu-Natal. The system of production in these areas is extensive. The Zulu sheep survive utilizing only locally available feed resources without major supplements, vaccines and dipping (Kunene and Fossey, 2006). It has also been confirmed by Haigh (2008) that this breed has a high tolerance to a variety of internal and external parasites. The breed is also tolerant to tick borne diseases and another

characteristic is its excellent mothering abilities (ILRI, 2007). According to the World Watch list for domestic animal diversity prepared by the FAO (2000), breeds that utilize low-value feeds or survive harsh environments or have tolerance to or resistance against specific diseases, could be beneficial in future. This is because they are often genetically adapted to their environment. Their unique characteristics could be a source of genes needed for improving the health and performance of the commercial breeds (FAO, 2000). According to a survey conducted by Kunene and Fossey (2006) in the rural areas of Umhlathuze, in Northern KwaZulu-Natal, there is no controlled breeding in the traditional farming systems hence lambing is throughout the year. Farmers have observed that Zulu sheep lambs born in spring or summer months are more prone to getting diseases. They have developed certain traditional selection criteria as well as some management practices to improve the production of their herds. Ewes with big udder and rams with large scrotums have been reported by the communal farmers to be more fertile. Although some farmers drench the sheep when they recognise the signs of internal parasites infections with veterinary prescribed medicines, other farmers use plant leaves boiled in water. The widely used plants for drenching are the *Gnidia kraussiana* and the *Clerodendrum glabrum* (Kunene et al., 2003).

During the recent a survey in 2010 by Mavule et al. of the Zulu sheep owners at Nongoma, Msinga, Jozini, Nquthu and Nkandla it was observed that some farmers in some communal areas of Nquthu, Nkandla and Msinga were keeping crosses of Zulu sheep with South African (SA) Merinos. Their flocks are comprised of SA Merinos, crosses of Zulu sheep and SA Merinos and some pure Zulu sheep, especially rams.

Among the reasons given by the farmers was that it was an effort to improve the Zulu breed for meat production because the SA Merino is a large-frame breed. Although farmers at Nquthu and Nkandla used to own pure Zulu sheep they were also advised in 1980 to produce wool, consequently there was no particular use of Zulu sheep at that time. However the farmers were left with higher veterinary expenses and the yearly shearing of animals whereas the wool project called "Zinkunzini Wool Farmers" is no longer in existence after collapsing in 1997. Pure Zulu sheep shear their coats naturally. Haigh (2008) indicated that the agricultural extension officers have unintentionally promoted perceptions among the rural farmers that the modern breeds are superior to the Zulu sheep. However 90 % of the sheep farmers interviewed owning the crossbreds have indicated that they would like to revert to pure Zulu sheep because of the expense incurred in buying medicines and vaccines for dipping and drenching of their flocks. Some farmers in these three areas have bought Zulu rams for this purpose.

Phenotypic characteristics

Zulu sheep are multicoloured and have a coat of either wool or hair (Kruger, 2001). The dominant colours are brown and a brown-and-white colour combination. Brown or dark brown adult sheep are born as black lambs and the colour gradually changes to brown or dark brown as the lambs grow. Although there are four groups of ear length sizes (mouse ears, small, medium and large) within a population, the large ear (9 to 14 cm) seems to be the most common among this breed (Kunene et al., 2007). It has been alleged by Haigh (2008) that the mouse ears may be a protection measure against picking up ticks. There is a poor relationship between ear length type and the live weight (LW), heart girth (HG) or wither height (WH). Ramsay *et al*. (2000) has described this breed as small to medium. The least square means for birth weights of males and

females are 2.5 ± 0.53 kg and 2.1 ± 0.36 kg, respectively. The weights for mature Zulu sheep under the extensive management environments (31.8 ± 0.43 kg and 37. 7 ± 0.72 kg for females and males, respectively (Kunene et al., 2007) are below those of other indigenous sheep breeds such as the Dorper, which are also reported to tolerate the poor grazing conditions (Cloete et al., 2000). Maiden Dorper ewes are reported to have a live weight of 39 kg at 213 days (Cloete et al., 2000) while Schoeman et al., (1993) have reported live weight of 50.8 kg for the Dorper ewes at 248 days.

The LW and HG of Zulu sheep are less affected by seasonal changes in some areas of KwaZulu-Natal as compared to other factors like location or sex (Kunene et al., 2007). These authors found the LW and HG to be similar ($P > 0.05$) for summer and autumn (wet season) and again in winter and spring (dry season). Small differences of 2.58 kg and 3.90 cm, respectively were reported by the authors (Kunene et al., 2007) between the wet and the dry season. Furthermore, results of a study conducted on forage behaviour of Nguni sheep by Nyamukanza et al. (2010) in northern KwaZulu-Natal, demonstrated that the Zulu sheep do not lose weight between seasons, because they increase forage time and bite size in the dry season. The sheep were observed to spend 65.7 % grazing in the late dry season compared to 58.1 % in the early wet season.

The inter-population phenotypic diversity obtained from LW, LBM and some morphological traits computed from three populations (University of Zululand, Makhathini Research Station and KwaMthethwa community) was larger (48.26 %) than the intra-population diversity among the Zulu sheep. The intra-population phenotypic diversity on LW, HG and WH was low (8.85 – 11.26 %) (Kunene et al., 2009b). The larger phenotypic diversity between populations may indicate that an improvement may be obtained by selection and breeding if a large number of populations are used for selection. This was verified in the report by Mavule et al. (2010) who

showed a range of 37 kg to 48 kg for weights of mature rams in six areas of kwaZulu-Natal (Jozini, Msinga, Nquthu, Nongoma, Matubatuba, Eshowe).

To increase the carcass yield of this breed a genetic improvement of live weight is required. The participation of the farmers in such a scheme can be adversely affected by the lack of scales (balances) required to measure the live weight. Weighing scales are expensive and farmers in rural communities may not be able to afford them (Hassan and Ciroma, 1990; Slippers *et al.*, 2000; Thiruvenkadan, 2005). Therefore the estimation of live weight from simpler and more easily measurable variables such as wither height (WH) and heart girth (HG) would be of an advantage. The weight of Zulu sheep can be estimated using the combination of both wither height and heart girth or by the heart girth alone. The scrotum circumference has proved to be a reliable estimator of the LW of young rams up to 28 months old (Kunene et al., 2009a). The following equations have been reported by Kunene et al. (2009a) to be the best estimators of live weight for Zulu sheep from three different localities of KwaZulu-Natal:

1. Young sheep with milk set of teeth: $LW = -21.4 + 0.40HG + 0.28WH$, $R^2 = 0.73$
2. Male sheep with one pair of incisors : $LW = -56.80 + 0.63HG + 0.63WH$, $R^2 = 0.73$
3. Non-pregnant females with one pair of incisors: $LW = -35.5 + 0.52\ HG + 0.40WH$, $R^2 = 0.64$
4. Rams with two pairs of incisors: $LW = -49.70 + 0.53HG + 0.65WH$, $R^2 = 0.81$
5. Ewes with two pairs of incisors: $LW = -38.00 + 0.55HG + 0.40WH$, $R^2 = 0.54$
6. Males with three and four pairs of incisors $LW = -56.20 + 0.54HG + 0.80WH$, $R^2 = 0.54$
7. Non- pregnant females with three and four pairs of incisors: $LW = -35 + 0.66HG + 0.25WH$, $R^2 = 0.54$

The following equations have been computed using the scrotum circumference (SC):

1. Young ram rams with milk set of teeth $LW = -1.01 + 1.08SC$, $R^2 = 0.78$

2. Young rams with one pair of incisors LW = -9.66 + 1.53 SC, $R^2 = 0.61$

Genetic Characterisation

Zulu sheep have been found to be genetically closer to the Swazi sheep. A genetic distance of 0.182 using microsatellite markers was observed between the two breeds (Buduram, 2004) where the two breeds formed a cluster. The author attributed this finding to the lack of geographical barriers to isolate these two breeds and the possibility of a common ancestry. The Zulu, the Swazi and the Pedi sheep are all grouped as Nguni sheep (Kruger, 2001), however the above author reported a relatively further genetic distance of 0.492 between the Zulu and the Pedi. A similar trend of results was reported by Hlophe (2010) when using RAPD markers; the Swazi and the Zulu breeds formed a cluster. Whilst genetic distance was 0.0430 between the Zulu and the Swazi breeds, it was found to be 0.0822 between the Zulu and the Pedi sheep. The authors attributed this to geographic separation and genetic selection over the past 200 years. Sufficient genetic and morphological data could be useful to establish such relationships. When using the RAPD markers, Kunene et al. (2009b) observed that the inter-population genetic diversity among three Zulu sheep populations was higher (21.91 %) than the range of 5.17- 11.04 % within the populations. A high genetic similarity in a population may be attributable to close breeding and small population size (Kantanen et al., 1999). Genetic diversity of sheep breeds needs to be constantly monitored because of breed substitution, indiscriminate crossbreeding and decline of population sizes of some breeds (FAO, 2007). Genetic variation within a breed is important in genetic improvement programs (Ali et al., 2009). Reduction in genetic diversity of indigenous genetic resources reduces the chances that may be available in a breed to respond to changes in environment and disease patterns.

Conclusion

In conclusion the Zulu sheep are a local genetic resource of KwaZulu-Natal which require minimum inputs and are a source of cash and protein for the rural farmers in these areas. Even a small improvement in terms of supplements in dry season might produce considerable changes in the use of simple traits like live weight and hardiness. The work that has been done so far indicate that a Zulu sheep breeding scheme programme based on the rural farming system should be considered as a means of conserving the breed. In that way, the farmers' participation may be attained. More populations still need to be characterized before such a programme can be implemented. The use of microsatellite and mitochondrial DNA markers on a large number of populations is recommended to establish the variation and the unique genetic attributes of the Zulu sheep breed.

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