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CASE REPORT

A case of 4-year-old female sheep-goat hybrid born under natural conditions in Namibia

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Abstract

This article reports a 4-year-old female sheep x goat interspecific hybrid born under natural conditions in Namibia. Repetitive DNA sequencing using microsatellite markers was used to confirm the hybrid. The morphological characteristics of the sheep-goat hybrid had higher parameters in terms of heart girth, height at withers, and trunk length than other animals in the flock. The weight of the hybrid was 74 kg, while the weight of its dam, a goat doe, was 42 kg, and the possible sire, a sheep ram, weighed 51 kg. The hybrid had a long and thick tail and a head resembling a sheep, whereas its skin, horns, and teats were like those of a goat, and its legs were relatively long. The hybrid conceived on two occasions with a buck but aborted at about 4 months into the pregnancy. The hybrid, in terms of body weight and dimensions, was bigger than common goats and sheep found in the rural livestock traditional farming area of the region, possibly indicating hybrid vigour. The hybrid's large size brings hope about the need for more research and breeding and the possibility of cloning such animals using nuclear transfer technology for increased meat production in future. The authors believe this is the first documented report of a sheep-goat hybrid from Namibia, and the third in Africa, that lived normally for a long time to full adulthood and even conceived, even though the conceptus was aborted.

Introduction

Sheep *(Ovis aries)* and goats (*Capra hircus)* belong to the family Bovidae and order Artiodactyla. The two species, *together* with Aoudad (*Ammotragus levia)*, also called barbary sheep and Bharals (*Pseudois nayaur),* also called blue sheep, are the most closely related in the subfamily of Caprinae [1]. Sheep and goats are genetically and taxonomically different and do not readily interbreed. However, occasionally, the isolating mechanisms, that is, biological properties of the individual, which prevent the interbreeding of populations that are actually or potentially sympatric, permit the crossing of different but closely related species, resulting in an interspecific hybrid [2].

Sheep belong to the genus Ovis and have 54 chromosomes, while goats belong to the genus Capra and have 60 chromosomes. The offspring of a sheep–goat pairing, though very rare, is generally stillborn. Despite widespread shared pasturing of goats and sheep, hybrids are very rare, demonstrating the genetic distance between the two species. They are not to be confused with sheep–goat chimaera, which is artificially created by combining the embryos of a goat and sheep.

Interspecific hybridization in mammals occurs rarely in nature [3]. The Equidae family (horses, donkeys and zebras) has the most viable hybrids even though the family has vast chromosomal differences among species and is always sterile [4]. The technique of interspecific hybridization is commonly used in plant breeding to develop new cultivated species with desirable characteristics from two or more existing species. There are very few published reports of such hybrids born out of sheep and goat natural breeding from around the world [5, 6, 7]. This article reports a 4-year-old female sheep X goat hybrid born under natural conditions in Namibia. The hybrid conceived on two occasions with a buck but aborted before completing a full-term pregnancy, and we, therefore, put on record this as a rare case which includes phenotypic and genotypic characteristics.

Case Report

In a village called Onamatanga, situated approximately 720 km from Windhoek in Namibia and 120 km from Outapi, the regional capital of the Omusati region is in the Okahao district of Northern Namibia. In this area and most parts of rural Africa, sheep and goats are generally kept together. The most significant proportion of small stock is goats relative to sheep. The farmer, coincidentally the first author's father, in the same village, had eight sheep (2 males and six females of the Damara breed) and 75 goats of different ages (12 males and 60 females of local breeds). During the day, animals are left to graze/browse freely, and during the night, they are kraaled in one enclosure near the Onamatanga cattle post. Approximately four years ago, a suspected female sheep-goat hybrid was born in that flock, the dam being a doe and the sire believed to be a damara sheep ram from the same flock. Since the dam was a goat, the offspring was noticeably phenotypically different compared to her other offspring born earlier. In addition, this progeny was growing faster and was the biggest in size and weight among all the sheep and goats in the flock. This phenotypically rare characteristic and fast growth made the first author, being a veterinarian, curious, and he examined the animal physically (Figure 1) and endeavoured to establish the parental linkage through DNA to confirm that this was a true sheep x goat hybrid.

A detailed physical examination was conducted on the hybrid, the dam of the hybrid and the suspected sire. Workers had seen the ram mounting the doe, but they did not report it and did not remember which ram out of two may have sired the offspring. The first author took the images, and they include the hybrid, the dam, and the sibling of the hybrid in the flock. Two blood samples were collected from the hybrid animal and submitted to the Veterinary Genetics Laboratory (VGL), Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa, to confirm whether the animal in question was a hybrid (Sheep X Goat). DNA reference numbers provided by the VGL were SH800117 and SH800118. The VGL used DNA profiling using microsatellite markers to confirm the hybrid but was unable to perform the chromosome analysis. This DNA profile technique is commonly used for studying relatedness and parentage. DNA profiling was done using a sheep test panel of 15 microsatellite markers and the amelogenin sex marker and a goat test panel of 12 microsatellite markers and the amelogenin sex marker.

Fig 1. First author examining the hybrid physically and in readiness to collect the blood

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Findings and Discussion

The sheep-goat hybrid had higher parameters in terms of heart girth, height at withers and trunk length compared to other animals in the flock (Fig 1, C, Fig 2). The weight of the sheep-goat hybrid was 74 kg, while the weight of its dam (goat) was 42 kg, and none of the rams weighed more than 51 kg as indicated in Table 1. Its sibling born earlier from the same dam was of a non-descript type, short, and weighed only 32 kg (Fig 1, B). This shows that the weight of the hybrid at 4 years of age was significantly higher than that of the dam, and the sire of the hybrid clearly indicates hybrid vigour. The hybrid had a long and thick tail and head resembling a sheep, whereas the coat, horns, and teats were like those of a goat; the legs were relatively long, and the overall body size was larger. The hybrid was highly active and dominant in the flock.

The DNA profile obtained from this animal (DNA Ref SH1800117) had a combination of alleles at specific loci that occur either only in sheep or only in goats, which provides sufficient evidence that the animal has both sheep and goat genetic material and can, therefore, be considered a hybrid of ordinary domestic sheep and common domestic goat. The hybrid was confirmed as a female on physical examination. Detection of sheep-goat inter-species hybridization by using microsatellite markers is one of the many reliable established methods [8, 9]. Sheep have 54 chromosomes, while goats have 60 chromosomes. Because of this difference in the number of chromosomes, their offspring rarely survive to birth and are usually aborted. Even those that do make it to birth seldom live long. However, those reported by Marki and Osterhoff (5) from South Africa, Stewart-Scott et al. (6), from New Zealand and Mine et al. [7] from Botswana, and the present case thrived very well to adulthood. In our case, the hybrid became pregnant but unfortunately aborted twice at an estimated gestation of about 4 months. The foetus was well developed, showing hairs, and this had not been reported in the literature previously. The hybrid, in terms of body weight and dimensions, was bigger than common goats and sheep found in the rural livestock traditional farming area of the region, indicating the effect of hybrid vigour. Most sheep and goat breeds in southern Africa are small to medium-sized, as suggested by Devendra and McLeroy [10]. By virtue of its weight and body dimensions, the hybrid was comparable to large breeds of goats, such as Jamnapari and Boer goats [11].

Sheep and goats are kept as sources of protein, quality meat, milk and a quick source of cash income in developing countries [12]. Due to their small size compared to cattle, they are often owned by women and slaughtered more frequently to provide meat for home consumption with little or no need for refrigeration. Their adaptive features, such as feeding behaviour, disease and heat tolerance, and short gestation period, enable them to effectively cope with the stressful nature of the vast marginal lands of semi-arid countries of this region and rural public needs [14, 15]. Therefore, their role in food security in developing countries cannot be overemphasized. Causes of variation in adult body weight are numerous and include nutrition and genotype-environment interaction. Although the hybrid was raised under the Namibian traditional farming management system characterized by low nutrition, dry area, and poor rainfall, its large size and survival encourage further research into the breeding and the possibility of cloning such animals using nuclear transfer technology for increased meat production in future. Mine et al [7] in his work found the sheep x goat hybrid at the age of 5 years weighing 93 kg which is quite exceptional as compared to the present case that weighed 74 kg at 4 years of age almost under the same traditional farming conditions in a dry harsh area. The heavier weight obtained by the Mine et al [7] case could be attributed to it being a male and being castrated at 10 months of age, while the hybrid, in this case, was female, conceived twice and carried the foetus up to 4 months but aborted, which might have negatively affected further weight gain. A similar report of a hybrid birth from a sheep and goat occurred in Brazil [13]. Although Africa has the second highest number of goats and sheep after China, and the most goats and sheep in Africa are concentrated in Nigeria, Sudan and Ethiopia [14], none of the above countries has reported such a hybrid, while co-grazing of sheep and goats has been practiced throughout history and is commonplace around the world. [15]. It is also interesting to note that such hybrids have been reported from the southern African region, namely Namibia, Botswana and South Africa. However, the one from South Africa failed the chromosome test though phenotypically looked like a sheep-goat hybrid. In both the above cases in Namibia and Botswana, hybrids were observed by scientists with knowledge of genetics and breeding at their farms. In the opinion of the authors, it is possible to have more such cases in this region. Farming practices in which the mingling of sheep and goats occurs and where the climate might favour such interspecific breeding may produce more of these hybrids but remain unreported, and many of these may be slaughtered for meat due to being sterile. The authors believe this is the first documented report of a sheep-goat hybrid from Namibia, and the third in Africa, that lived normally for a long time to full adulthood and even conceived, even though the conceptus was aborted.

Table 1. Prominent phenotypic characteristics of sheep x goat hybrid compared with goat and sheep and other body measurements of the hybrid

Parameters	Normal Goats	Normal Sheep	Sheep Goat Hybrid (Study Animal)
Tail Carriage	Upward	Download	Downward (fig 2)
Tail Length	Short, Curved, Upwards	Long, Thick, Elongated	Long, Thick, Elongated (fig 2)
Body Coat	Hairs	Wool	Hairs (fig 2)
Horns	Curved Backward	Spiral	Curved, Backwards Long (fig 1)
Beard	Present or absent	Absent	Absent (fig 1)
Trunk length cm	-	-	70
Teat Length cm	-	-	4.5
Height at Withers cm	-	-	115
Heart Girth cm	-	-	80
Body Weight kg	-	-	74

Fig 2 A, the dam, B . the elder sibling to the sheep-goat hybrid C .

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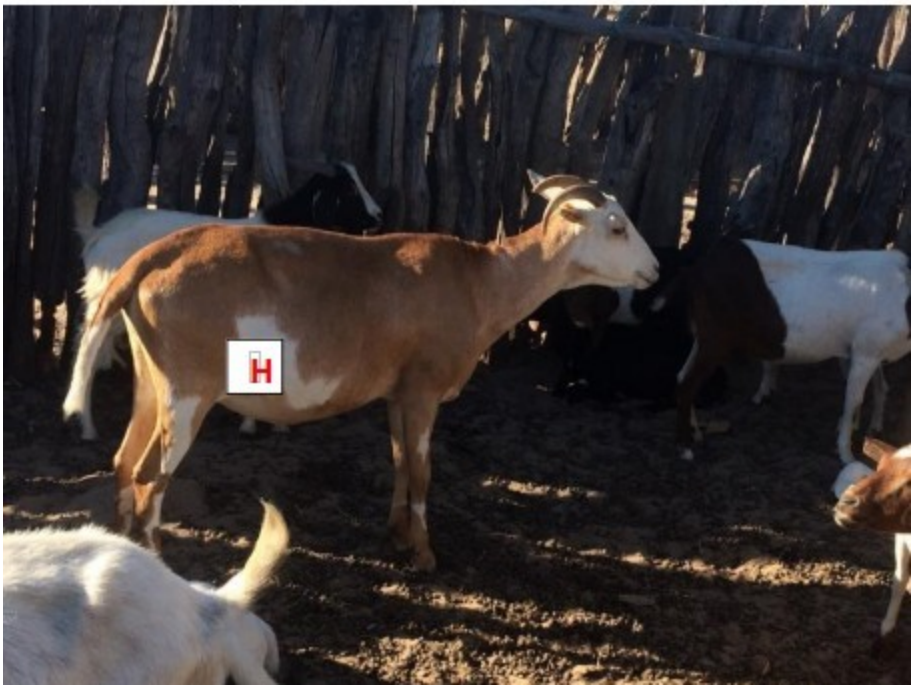

Fig 3 shows the female Sheep-goat hybrid (letter H) with its tail length, tail carriage and long horns.

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