Nig. J. Anim. Prod. 2022, 49(1):17-27. https://doi.org/10.51791/njap.v49i1.3396 *Nigerian Journal of Animal Production*

Inheritance of wattle and its relationship with growth and reproductive traits in Red Sokoto goats

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Abstract

There are scarce information on how wattle traits is inherited from parents to offspring and its effect on growth and reproductive trait in Red Sokoto goats. Many production traits are corrected with presence or absence of wattle. The influence of wattle on growth and reproductive traits was evaluated in some other breeds of goats. The present study was carried out to determine how wattle trait is inherited from parents to offspring and its effect on growth and reproductive traits in Red Sokoto goats. Data from 166 Red Sokoto goats consisting of 6 adult bucks and 60 adult does and 100 kids/progenies comprising 47 males and 53 females were used to study the inheritance of wattle and its relationship with some growth and reproductive traits in Red Sokoto goats. The data were collected over a 3 years period (December, 2015 to December, 2018) at the Teaching and Research Farm of the Department of Animal Production Technology, College of Agriculture and Animal Science, Division of Agricultural Colleges, Ahmadu Bello University, Mando Road, Kaduna. 32 progeny had wattle and 35 had none. The mating in which neither of the parents had wattle, all the 33 progeny were without wattle. The mean value for wattle and non-wattle were 3.92 ± 0.540 and 4.08 ± 0.526 respectively and did not differ significantly ($p > 0.05$). Genotypic and gene frequencies were determined using the Hardy-Weinberg principles, $(P + q)^2 = 1$ where p and q are frequency of the dominant and recessive alleles respectively. The appearance of wattle was bilateral in all the cases examined in this study. The gene frequency for the absence of wattle in the 100 Red Sokoto kids in this study was 0.82. The genotypic frequencies were 0.67, 0.30 and 0.03 respectively for homozygous recessive (ww), heterozygous (Ww) and homozygous dominant individuals. Of the 100 Red Sokoto kids examined in this study, 68% had no wattle compared with 32% with wattle giving a ratio of 2:1. The ratio of male: female with wattle was 1.0 : 1.3 respectively. The body size characteristics measured were body weight (Bwt), mating weight (Mwt), kidding weight (Kwt), height-at-withers (HAW), body length (BL), chest girth (CG) and body condition score (BCS). The traits measured on the kids were birth weight, weights at 1,3,6,9 and 12 months respectively. The mean value for body size characteristics were 24.61 ± 0.30kg Bwt, 21.11 ± 0.69kg Mwt, 22.53 ± 0.89kg Kwt, 59.19 ± 0.30cm HAW, 60.05 ± 0.35cm BL, 65.42 ± 0.34cm CG and 3.08 + 0.09 respectively. The mean value of birth weight,, 1, 3, 6, 9 and 12 months weight were 1.85 ± 0.10kg, 4.02 ± 0.03kg, 7.34 ± 0.03kg , 10.31 ± 0.04kg, 12.63 ± 0.03 kg and 14.70 ± 0.08kg respectively. Wattle had significant ($p < 0.05$, $p < 0.01$) effect on birth weight, body weight and measurements at 1,3,6, and 9 months except body length at 9 months, chest girth at 12 month and weight at 12 months ($p>0.05$). This study also revealed that wattled does had higher twinning rate (41.0%) compared to non-wattled does (35%). Kids with wattle had higher body weight and sizes at all age compared to kids without wattle. It is recommended from the outcome of this research that livestock keepers and breeders should breed does and bucks with wattle to produce heavier body weight and sizes kids for increase productivity of

their herds.

Keywords: Wattle, body weight, body measurements, Red sokoto goats

Héritage de l'acacia et sa relation avec les traits de croissance et de reproduction chez les chèvres Red Sokoto

Résumé

Il existe peu d'informations sur la façon dont les traits d'acacia sont hérités des parents à la progéniture et son effet sur la croissance et le trait de reproduction chez les chèvres Red Sokoto. De nombreux traits de production sont corrigés avec la présence ou l'absence d'acacia. L'influence de l'acacia sur la croissance et les traits de reproduction a été évaluée chez certaines autres races de chèvres. La présente étude a été réalisée pour déterminer comment le trait d'acacia est hérité des parents à la progéniture et son effet sur la croissance et les traits de reproduction chez les chèvres Red Sokoto. Les données de 166 chèvres Red Sokoto composées de 6 mâles adultes et 60 femelles adultes et de 100 chevreaux/progénitures comprenant 47 mâles et 53 femelles ont été utilisées pour étudier l'hérédité de l'acacia et sa relation avec certains traits de croissance et de reproduction chez les chèvres Red Sokoto. Les données ont été recueillies sur une période de 3 ans (décembre 2015 à décembre 2018) à la ferme d'enseignement et de recherche du Département de technologie de production animale, Collège d'agriculture et de sciences animales, Division des collèges agricoles, Université Ahmadu Bello, Mando Road , Kaduna. 32 descendants avaient de l'acacia et 35 n'en avaient pas. L'accouplement dans lequel aucun des parents n'avait d'acacia, tous les 33 descendants étaient sans acacia. La valeur moyenne pour l'acacia et le non-acacia était de 3,92 + 0,540 et 4,08 + 0,526 respectivement et ne différait pas significativement (p > 0,05). Les fréquences génotypiques et génétiques ont été déterminées en utilisant les principes de Hardy-Weinberg, (P + q)2 = 1 où p et q sont respectivement la fréquence des allèles dominants et récessifs. L'apparition de l'acacia était bilatérale dans tous les cas examinés dans cette étude. La fréquence du gène pour l'absence d'acacia chez les 100 enfants Red Sokoto de cette étude était de 0,82. Les fréquences génotypiques étaient respectivement de 0,67, 0,30 et 0,03 pour les individus homozygotes récessifs (ww), hétérozygotes (Ww) et homozygotes dominants. Sur les 100 enfants Red Sokoto examinés dans cette étude, 68% n'avaient pas d'acacia contre 32% avec l'acacia donnant un rapport de 2: 1. Le ratio mâle/femelle avec acacia était respectivement de 1,0 : 1,3. Les caractéristiques de taille corporelle mesurées étaient le poids corporel (PsC), le poids d'accouplement (PsA), le poids de mise bas (PMB), la hauteur au garrot (HAG), la longueur corporelle (LC), le tour de poitrine (TP) et le score d'état corporel (SEC). Les traits mesurés sur les chevreaux étaient le poids à la naissance, les poids à 1, 3, 6, 9 et 12 mois respectivement. La valeur moyenne des caractéristiques de taille corporelle était de 24,61 + 0,30 kg PsC, 21,11 + 0,69 kg PsC, 22,53 + 0,89 kg PsA, 59,19 + 0,30 cm SEC, 60,05 + 0,35 cm BL, 65,42 + 0,34 cm CG et 3,08 + 0,09 respectivement. Les valeurs moyennes du poids à la naissance, à 1, 3, 6, 9 et 12 mois étaient respectivement de 1,85 + 0,10 kg, 4,02 + 0,03 kg, 7,34 + 0,03 kg, 10,31 + 0,04 kg, 12,63 + 0,03 kg et 14,70 + 0,08 kg. L'acacia a eu un effet significatif (p < 0,05, p < 0,01) sur le poids à la naissance, le poids corporel et les mensurations à 1, 3, 6 et 9 mois, sauf la longueur du corps à 9 mois, le tour de poitrine à 12 mois et le poids à 12 mois (p >0,05). Cette étude a également révélé que les femelles caronculées avaient un taux de gémellité plus élevé (41,0 %) que les femelles non

caronculées (35 %). Les enfants avec une caroncule avaient un poids corporel et une taille plus élevés à tout âge que les enfants sans caroncule. Il est recommandé, d'après les résultats de cette recherche, que les éleveurs et les éleveurs élèvent des biches et des boucs avec de l'acacia pour produire des chevreaux de poids corporel et de taille plus lourds afin d'augmenter la productivité de leurs troupeaux.

Mots-clés: Acacia, poids corporel, mensurations, Chèvres redsokoto

Introduction

In the African continent, the largest goat population exists in Nigeria, Sudan, and Kenya. China, India, Pakistan, Bangladesh, together with Nigeria constitute the top five countries in the world with the largest number of goats (Skapetas and Bampidis, 2016). The world goat's population stands at 921 million goats of which 90% are in developing countries. FAOSTAT, 2011). Nigeria has more than 53.8 million goats (FAOSTAT, 2008). There are three major breeds of goats in Nigeria; Sahel (desert goat), the Red Sokoto and West African Dwarf goats (Oni, 2002). The Red Sokoto goats contribute to 70% of the country's goat population (Osuhor *et al.,* 2002). The Red Sokoto goat is uniformly dark red in colour, horns are present in both sexes, ears are short, medium width ad usually carried horizontally (FAO, 2009, Abubakar *et al.,* 2019).

Body conformation and growth rate of animals are important criteria for selection of breeding animals in meat producing species. The phenotype of an animal for size and conformation is the result of its genetic potential and the influence of environment (Jaforoghi *et al.,* 2010; Akpa *et al.,* 2013).vCross breeding and subsequently the replacement of locally adapted breeds by a narrow range of high-yielding international trans-boundary breeds is becoming an area of concern affecting animal genetic diversity in developing countries (Taberlet *et al.,* 2015). This type of breed replacement without any long-term breeding plan has contributed to severe genetic erosion, including extinction of a number of locally adapted (both within and across) breeds in the last few decades (Boettcher *et al.,* 2010; Philipson *et al.,* 2011). The devastating effect to date are that dilution and in turn disappearance of important adaptive traits (resistance to disease and adaptation to poor nutrition, the gregarious behavior) by poorly, designed cross breeding (Adebabay *et al.,* 2016). These traits would otherwise being very crucial for the survival and management of herds in extensive farming and harsh environment. There are virtually scare information on how the wattle trait is inherited from parents to off-spring and its effect on body weight and conformation traits of their kids in Red sokoto goats. This study was therefore carried out to determine how wattle traits is inherited from parents to offsprings and its effect on body weight and conformation traits of Red Sokoto kids.

Materials and methods

The study was conducted at the Teaching and Research Farm of the Department of Animal Production Technology, College of Agriculture and Animal Science, DAC/ABU, Mando Road, Kaduna. The College is on Longitude 725' – 2641'E ( ). The rainfall in this area varies between 1000cm and 1500mm per annum and rainy season lasts for 150 – 200 days and dry season stars from October to early April. The mean annual temperature was about 34C with hottest months being from March to April (40C) and the coolest period (13C), which were between December and January (NIMET, 2015).

Animals and their management

Forty Red Sokoto does in their first and second parities and four Red Sokoto bucks

aged between 1 to 2 years were randomly selected to constitute the initial stock for this research work, comprising twenty wattled does versus two wattled bucks and two non-wattled bucks versus twenty non-wattled does. The goats were purchased from the Fulani herdsmen that reared them in Kaduna and Kano States. The goats were housed in a well-ventilated pens. They were identified using ear tags and were kept under semi-intensive management system. The animals were released for grazing in batches or groups. The animals were supplemented with maize ofals, cowpea husks and groundnut haulms which gave 87.6% dry matter, 7.9% ash, 17% crude protein, 2.3% ether extract and 12.6% crude fibre. Mineral lick was also provided, water was given and ad-libtum. All the animals were de-wormed and vaccinated at the beginning and during the period of the research. The experiment lasted for thirty-six months (December, 2015-December, 2018).

Mating plan

The does were grouped into four pens; one wattled Red Sokoto buck was mated to ten wattled Red Sokoto does. The other pen contained one non-wattled Red Sokoto buck mated to ten non-wattled Red Sokoto does, the third group ; one non-wattled Red Sokoto buck mated to ten wattled Red Sokoto does and lastly one wattled Red Sokoto buck to ten non-wattled Red Sokoto does. Mating lasted for 30 days. During the mating period, supplementary feeding were provided to the does in the form of groundnut haulm, maize offals, threshed bean pods '*kowa'*. These served as '*flushing*' strategy. The offsprings obtained from the above matings were mated. One wattled buck was mated to ten wattled female offsprings and one non-wattled buck was mated to tens non-wattled females offsprings.

Data collection

Pattern of Inheritance for Wattle

Observation was made on the appearance of wattle on the first and second generation offsprings out of the six breeding groups. The result of the parent mating were observed in the first generation offsprings, while that of the first generation offsprings were observed in the second generation offsprings.

The frequency of the recessive gene alleles were estimated using Hardy Weinberg equilibrium (Falconer and Makey, 1996) as shown below.

$$q = \sqrt{\frac{m}{M}}$$

where q = frequency of recessive gene (w)
m = observed number of animals exhibiting the particular recessive traits.
M = total number of animals sampled.
The genotypic frequency were calculated using Hardy-Weinberg equations

$$(p+q)^2 = 1 = p^2 + 2pq + q^2 = 1$$

Where:
p^2 = frequency of the dominant gene
2pq = frequency of heterozygote gene
q^2 = frequency of the recessive gene

Performance characteristics

The following performance characteristics were measured on the parent population; body weight, mating weight, kidding weight, height-at-withers, body length and chest girth. Records of age of the does, body condition score, parity, litter size, abortion rate and sires. The following observations were also made on the kids; birth weight, body weight, height-at-withers, body length, chest girth at 1,36, 9 and 12 months of age. Also, records of kids mortality , date of birth, sex and sires were kept. These were monitored on the first and second generation offsprings. The number of offspring generated in first generation was seventy-three and that of the second generation was twenty-seven giving a total of one hundred progeny.

Body condition score (BCS)

Body Condition Score (BCS) of the does was measured at mating, after kidding and during lactation period every two weeks

using a five point scale as described by Thompson and Meyer (2002) and Aumont *et al.,* (1994). 1 = emaciated, 2 = thin, 3= moderate, 4 = fat, 5 = obese. The does lumbar vertebrate, loin and rump area were palpated, examined then scored. Amount of fat deposited were determined by the use of finger tip pressure was exerted on the backbone, pin bone and hip bone.

Dam traits

Body weight_Doe's weight was measured every two weeks using a portable scale and values recorded in (kg). Mating weight was the doe's weight at mating recorded in (kg), Kidding weight was the doe's weight measured immediately after kidding. Height-at-withers was measured as the distance from the surface of a platform to the withers (cm). Body length was measured as the distance from external occipital protuberance to the base of the tail (cm). Chest girth represented the circumference of the chest (cm) (Akpa *et al.,* 2011)

Abortion rate was the number of abortion per doe and recorded in percentage.

Kids traits

The birth weight of the born kids were taken few hours after birth and values recorded in kg, and also weight at 1,3,6,9 and 12 months respectively. Body measurements of kids were also taken at 1,3,6,9 and 12 months respectively using tape and values recorded in (cm) (Akpa *et al.,* 2011). The date the kids were born was recorded.

The number of kids born per doe, whether single, twins or triplets was recorded as type of birth. This was the sex of the kid, whether male or female; for male was determined by the presence of testes while female was presence of udder while the morality of the kids were recorded and values expressed as percentage.

Statistical data analysis

The data for this study were analysed by the General Linear Model (GLM) procedure of Statistical Analysis (SAS, 2012). The fixed effect include type of birth, sex, effect of dam and month of birth. Significant differences were separated using Duncan's Multiple Range Test (Duncan, 1955).

The parameters measured were estimated using the following model:

$Y_{ijkl} = \mu + P_i + L_j + W_k + K_l + E_{ijkl}$

Y_{ijkl} = any observation

μ = overall mean

P_i = effect of parity of dam

L_j = effect of litter size

W_k = effect of weight of dam

K_l = effect of weight of kids

E_{ijkl} = random error term**Results and discussion**

Inheritance of wattle

The phenotypes of progeny of mating between different combinations of wattled and non-wattled Red Sokoto goats are presented in Table 1, group a, one wattled Red Sokoto buck was mated to 10 wattled Red Sokoto does, the progeny produced were 5 wattled Red Sokoto (males) and 7 wattled Red Sokoto (female) kids, while 4 non-wattled (males) and 6 non-wattled female were also obtained in this group (a pure breeding mating).

In group b, 1 non-wattled Red Sokoto buck was mated to 10 non – wattled Red Sokoto does; the offspring obtained from this pure breeding mating were all non-wattled (10 males and 11 females) progeny. In group c, mating between 1 non-wattled Red Sokoto buck and 10 wattled Red Sokoto does (cross breeding) produced 5 wattled (males) and 3 watled (females) progeny and 6 non-wattled (males) and 5 non-wattled (females) progeny. The mating of 1 wattled buck to 10 non wattled Red Sokoto does in group d produced 2 wattled (males) and 4 wattled (females) offspring and 5 non-wattled (males) and 4 non-wattled (females). A total of 73 offspring (35 males and 38 females) were obtained in this parent mating of wattled and non-wattled Red Sokoto goats. The phenotype of progeny from mating of F_1 generation between

wattleD and non-wattled Red Sokoto goats are presented in Table 2. In group 1, 1 wattled Red Sokoto buck was mated to 10 wattled Red Sokoto does, the offspring produced were 4 wattled (males) and 6 wattled (female) Red Sokoto kids and three non-wattled males and two non-wattled females. The progeny obtained in mating between one non-wattled Red Sokoto buck and 10 non-watled Red Sokoto does (Group II) were 12 all non-wattled Red Sokoto goats (5 males and 7 females).

Table 1: Phenotype of progeny from mating between different combinations of wattled and non wattled Red Sokoto goats

Sire Phenotype	Gen.	Dam Phe.	Gen.	Progeny Phe.	M	F	Total
M		**F**					
a) 1 WT	Ww	10WT	Ww	WT	5	7	12
				NWT	4	6	10
b) 1 NWT	Ww	10 Nwt	Ww	All - NWT	8	9	17
c) 1 NWT	Ww	10 WT	Ww	WT	5	3	8
				NWT	6	5	11
d) 1 WT	Ww	10NWT	Ww	WT	2	4	6
				NWT	5	4	9
TOTAL					**35 :**	**38**	**73**

Phe: Phenotype, Gen=genotype, WT= wattled, NWT= non wattled , M= male , F= female

Table 2: Phenotype of Progeny from matings between wattled and non -wattled Red Sokoto goats of F_1 generation.

Group	Sire Phenotype (M)	Gen.	Dam Phe. (F)	Gen.	Progeny Phe.	M	F	Total
I	1 WT	Ww	10WT	Ww	WT	4	6	10
				Ww	NWT	3	2	5
II	1 NWT	ww	10 Nwt	ww	All - NWT	5	7	12
	TOTAL					**12**	**15**	**27**

*Phe: Phenotype; Gen=genotype; WT= wattled; NWT= non wattled; M= male; F= female

The mating between wattled buck to wattled does in this study produced wattled and non-wattled progenies. This indicated that the parents were heterozygotes for wattle appearance. Mating between wattled buck and non-wattled does; and between non-wattled buck and wattled does in this study produced wattled and non-wattled progenies. This was in agreement with the reports that inheritance of wattle is controlled by autosomal dominant gene; (Gasu *et al.,* 1970, Lauvergene *et al.,* (1987) and Reber *et al.,* (2015). The within mating of non-wattled bucks and non-watled does in this study produced all non-wattled progenies. This indicated that the parents might be pure breeding lines. This was in agreement with the reports of Hermiz *et al.,* (2016) in Shami goats, Osinowo *et al.* (1990) in Yankasa Sheep and Gasu *et al.* (1970)in Sardinian breed of sheep. , Russel (2002) reported that crosses that always produced progenies with the same parental phenotype must have been between homozygous recessive or dominant.The effect of wattled and non-wattled Red Sokoto goats on reproductive traits are shown in Table 3. The percentage of SB for wattle and non wattled were 49%and 46% respectively. The TW for wattled and non-wattled does were 41% and 35% respectively. The percentage Kmt for wattled and non-wattled in this study were 32 % and 37% respectively. The Abrt for

wattled and non-wattled does were 11% and 7% respectively. The type of birth, single and twins obtained in this study were comparable with the results of other studies (Akpa *et al.,* 2010) who recorded 44% for single birth and 40.5% for twins. The result is also comparable to the values recorded by FAO (2009) in Niger Republic traditional system which indicated 56.1% for single, and 40.9% for twins. The result in this study was comparable to the findings of Amoah *et al.,* (1996) who reported the most frequent litter size was twins (48.2%), followed by single (34.6%) together constitute 82.8% of the birth.

Table 3: Effect of wattle and non-wattle Red Sokoto goats on some reproductive traits.

		Reproductive Traits			
Does	**N**	**SB (%)**	**TW (%)**	**Kmt (%)**	**Abrt (%)**
i) Wattled	30	49	41.0	32	11
ii) Non wattled	30	46	35	37	7

SB= single birth, TW= twin birth, Kmt= Kid mortality, Abrt= Abortion rate

The relatively higher values of single birth and twinning rate by wattled does compared to non –wattled does in this study was in agreement with the findings of Hermiz *et al.,* (2016) in Shami goats and Shongjia *et al.,* (1992) in Saanen does, who reported higher prolificacy and litter size in wattled does. It was also in agreement with the findings of Gasu *et al.,* (1970) who reported higher lambing rate in ewes with wattle. The percentage kids mortality recorded in this study was within the range reported by Abubakar (2009) in the same bred. It was lower than the value reported by Awemu *et al.* (1999), who reported 38%. The value of kid mortality obtained in this study was comparable to records obtained in other breeds of goats such as Zaraibi and Damascus goats 31 and 35% respectively (Shrestha and Fahmy, 2007). The lower value of kids mortality recorded by wattled does was in line with the findings of Odubote (1994) that varied expression of wattled traits may represent some adaptive mechanism related to adaptation and survival in different ecological zone in Nigeria. The relatively fewer abortion rate recorded by non-wattled does compared to wattled does in this study was in agreement with the findings of Osiowo *et al*. (1990) in Yankasa ewes, non-wattled ewes had fewer apparent abortions. It might be probably due to the absence of autosomal dominant gene for wattle which is associated with higher prolificacy (pregnant with multiple birth) and higher milk production. It is worth mentioning that in dairy goats under an adequate plane of nutrition, the incidence of abortion is higher in mature than primaparous does (Engeland *et al.,* 1998; Husain *et al.,* 1996; Mellado *et al.,* 2006).

Effect of wattle on body weight and body measurements at 1, 3, 6, 9 and 12 months of age in Red Sokoto goats are presented in Table 4. There was significant ($p< 0.01$) effect of wattle on birth weight and body weight at 1, 3, 6 and 9 months. Wattle appearance also significantly ($p < 0.01$) affected body measurements (HAW, BL and CG) at 1, 3 6 and 9 months of age in this study. However, there was non significant ($P > 0.05$) effect of wattle condition on BL_9, WT_{12} and CG_{12} in this study. The significant effect of wattle on body weight and body measurements of Red Sokoto goats revealed that wattle is an adaptive feature that influence better performance. These significant effects of wattle on body weight and body measurements in this study confirmed the findings of Adedeji *et al* (2012)in WAD bucks. It was also in agreement with the report of Hermiz *et al* (2016) in Shami goats that wattle significantly affected birth weight, body

Table 4: Effect of Inheritance of wattled and non -wattled on birth weight, body weight, and body measurements at birth, 1, 3, 6, 9 and 12 months of age in Red Sokoto goats

Trait(s)		Mean values			
	N	Wattled	Non wattled	SEM	LOS
BW(kg)	100	1.85[a]	1.65[b]	0.02	**
One month weight	100	4.38[a]	3.81[b]	0.009	**
HAW_1 (cm)	100	34.17[a]	32.74[b]	0.11	**
BL_1 (cm)	100	34.12[a]	31.91[b]	0.11	**
CG_1(cm)	100	36.81[a]	34.20[b]	0.30	**
Three months weight	100	7.63[a]	7.14[b]	0.03	**
HAW_3(cm)	100	40.28[a]	36.93[b]	0.19	**
BL_3(cm)	100	41.29[a]	36.02[a]	0.25	**
CG_3 (cm)	100	44.64[a]	39.05[b]	0.30	**
Six months weight	100	10.61[a]	10.10[b]	0.05	*
HAW_6 (cm)	100	44.95[a]	41.88[b]	0.17	*
BL_6(cm)	100	45.99[a]	41.56[b]	0.30	**
CG_6(cm)	100	49.34[a]	44.23[b]	0.30	*
Nine months weight	100	12.71[a]	12.53[b]	0.04	*
HAW_9(cm)	100	50.01[a]	49.30[a]	0.30	**
BL_9(cm)	100	50.90	50.04	0.20	ns
CG_9 (cm)	100	54.30[a]	53.43[b]	0.20	**
Twelve months weight	100	14.71	14.70	0.13	ns
HAW_{12}(cm)	100	53.00[a]	52.63[b]	0.18	**
BL_{12}(cm)	100	53.03[a]	52.81[b]	0.13	**
CG_{12}(cm)	100	56.76	55.89	0.18	ns

*p < 0.05, ** p <0.01, BW = Birth weight, HAW=Height at withers, BL=body length, CG=Chest girth, ns=non significant

Table 5: Effect of parity on wattle and body conformation characteristics of lactating Red Sokoto goats

Parity	N	WT	Bwt(kg)	Mwt(kg)	Kwt(kg)	HAW(cm)	BL(cm)	CG(cm)	BCS
1	12	2.00[a]	20.47[c]	11.75[c]	19.50[b]	52.29[d]	54.40[b]	62.21[e]	3.21[b]
2	10	1.80[ab]	18.30[a]	16.80[c]	17.40[b]	56.23[c]	53.72[b]	60.21[a]	2.72[ab]
3	14	1.11[c]	22.09[c]	19.44[bc]	21.28[ab]	58.94[b]	60.75[a]	65.21[b]	2.96[ab]
4	8	1.50[c]	25.66[b]	22.54[ab]	23.08[ab]	60.23[ab]	61.15[a]	66.32[ab]	3.36[a]
5	16	1.25[bc]	27.47[a]	24.63[a]	27.06[a]	61.49[a]	63.13[a]	68.61[a]	3.10[a]
LOS		*	**	**	*	**	**	**	**
S.E.M		0.04	0.26	0.28	0.41	0.32	0.34	0.36	0.12

*p< 0.05, ** p<0.01, WT= wattle, Bwt=body weight, Mwt=mating weight, Kwt=kidding weight, HAW=height-at-withers, BL=body length, CG=chest girth, BCS=body condition score, LOS = Level of significance, S.E.M= Standard error mean.

weight at 1,3and 6 months of age. It was also in agreement with the findings of Daure *et al* (2013) that wattle had significant effect on birth weight, one and three months weight in Yankasa lambs. Ozoje (2002) observed positive association of wattle with tail length and neck circumference in WAD goats. The findings in this study were also in agreement with the report of Ozoje and Kadri (2001), that wattle gene significantly influenced body length, heart girth, height-at-withers in WAD sheep.

Body conformation characteristics

The effect of parity on wattle and body size characteristics are presented in Table 5. Parity significantly ($p < 0.01$) affected Bwt, Mwt, HAW, BL and CG. The effect of parity was also significant ($p < 0.05$) on WT, Kwt and BCS. WT appeared to decrease with

increasing parity of the does up to the Parity 5. Parity significantly affected body size characteristics in the present study. Bwt, Mwt, Kwt, BL, CG, and BCS increased with increasing parity of the does from parity 1 up to 4th parity. These were in agreement with the reports of Abubakar *et al.* (2014), Akpa *et al.* (2011) in the same breed and in sheep; Abubakar *et al.* (2017), Jafarogi *et al.* (2010) who observed that parity of the dam significantly affected Bwt, HAW, BL, CG, Mwt, Kwt. These values increased with increasing parity of the dam. Growth is a complex biological process that is induced by differential development rates of body tissues. The external body measurement of the body have been used to estimate the development of the skeleton and/or soft tissues. Suleiman *et al.,* (1990) reported that body length and height-at-withers were skeletal measurements that were less variable than body weight. It is therefore expected that increase in parity of the does would lead to other physiological development of body tissues and organs.

Conclusion

It was concluded that the inheritance of wattle in Red Sokoto goats is controlled by an autosomal dominant gene (W) and from the ratio of males to females progeny that were examined in this study, the inheritance was not related to sex. The wattled does produced higher twinning rate compared to non-wattled does.

It was concluded that the kids with wattle had higher body weight and sizes at all ages examined (at birth, 1,3,6,9 and 12 months) than non-wattled kids.

Recommendation

It is recommended from the outcome of this research that livestock keepers and breeders should breed does and bucks with wattle produce heavier body weight and sizes kids, which ultimately increase the overall productivity of their flock.

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Received: 9th November, 2021
Accepted: 8th February, 2022