VOL. 6, NO. 8, AUGUST 2011 ISSN 1990-6145
ARPN Journal of Agricultural and Biological Science


www.arpnjournals.com

RELATIONSHIPS AMONG BODY CONFORMATION, TESTICULAR TRAITS AND SEMEN OUTPUT IN ELECTRO-EJACULATE PUBERTAL KIKO GOAT BUCKS

Chuck Okere[1], Patricia Bradley[1], E. Rick Bridges[2], Olga Bolden-Tiller[1], Durandal Ford[2] and Anthony Paden[1]
[1]Department of Agricultural and Environmental Sciences, Tuskegee University, Tuskegee, AL, USA
[2]School of Veterinary Medicine, Tuskegee University, Tuskegee, AL, USA
E-Mail: chuckokere@yahoo.com

ABSTRACT

The objective of this study was to determine the relationship between body conformation traits: chest girth (CG), height at withers (HTW), body length (BL), body condition scores (BCS), body weight (BWT), scrotal circumference (SC) and semen output in three electro-ejaculated Pubertal Kiko bucks. An electro-ejaculator was used once a week for semen harvest for five consecutive weeks. Upon collection, semen samples were evaluated for ejaculate volume (ml), color, consistency, and mass activity. Mean values for body measurements were 3.06 ± 0.41 (BCS, 1-5), 81.7 ± 4.72 cm (CG), 67.1 ± 4.03 cm (HTW), 69.5 ± 5.56 cm (BL), 40.7 ± 5.01 kg (BTW) and 25.9 ± 2.18 cm (SC). Semen output did not differ throughout the five collection weeks (1.33 ± 0.57 ml, 1.16 ± 1.04 ml, 1.33 ± 0.57 1.50 ± 0.86 ml, and 0.90 ±0.52 ml; $p>0.05$). Also, semen volume did not differ among bucks (1.50 ± 0.5 ml, 1.34 ± 0.93 ml and 0.90 ±0.41 ml; $p>0.05$). CG, BCS were positively correlated with BWT ($r = 0.75$, and 0.69). SC showed positive and moderate correlation with semen volume ($r = 0.31$). However, there were low and negative correlations between BWT, BCS, HTW, CG and semen volume ($r = -0.13$, 0.13, -0.68, and 0.04), indicating that semen output is fairly independent of most body conformation traits. The study has demonstrated that semen can be harvested in sufficient quantity from pubertal Kiko bucks via electro-ejaculation when the use of artificial vagina is inappropriate due to age or training. We recommend that this procedure be incorporated in a breeding soundness examination tool for selecting or culling Kiko sires at an early age.

Keywords: electro-ejaculation, kiko bucks, semen output, body conformation.

INTRODUCTION

According to Spencer (2008), various forms of goat production have existed throughout the world for centuries, in 1992; the United States developed a strong interest in meat goat production. Since then, the meat goat industry has been the fastest growing segment of livestock production in America [1]. Initial interest in meat goat production primarily took place in the Southeast, with Texas and Tennessee leading most states and having the largest goat populations. In Alabama, goats of any breed or crossbreed are eventually slaughtered for human consumption. With the exception of the South African Boer and Kiko goats imported via New Zealand in early 1993, there are no true meat goat breeds in the U.S. However, there are few breeds that stand out as more specialized for meat production. These are the Spanish, Myotonic (Tennessee Fainting Goat), Nubian and Pygmy goats [2].

To make genetic gain in the meat goat industry in Southeast Alabama there is a requirement to determine superior Boer or Kiko sires within the population and increase their use. Establishing which sires are superior requires an understanding of their reproductive abilities [3]. The Kiko Goat was developed in New Zealand by crossing feral goats with dairy goats in the 1980s [4, 5]. The most accurate way to test a sire's genetic worth is to perform breeding soundness evaluation (BSE) and also generate progeny from the animal and compare them with progeny from other animals [6]. BSE predicts the potential fertility of a buck. It is based on an examination that includes tests for physical soundness, testicular size, semen quality, and in some cases, libido/mating ability. The evaluation identifies bucks with poor potential breeding ability to improve herd fertility, and bucks with general suboptimal fertility. The advantages of this evaluation are often self evident. Older bucks are usually the most dominant in a group and will prevent younger bucks from breeding more than a few females. Unfortunately, these dominant animals may not have the best semen or libido. This evaluation can identify dominant bucks with low fertility and prevent significant economic losses that would result from large numbers of open does or a lengthened kidding interval [7].

In domesticated animal species semen collection for artificial breeding reasons is usually collected from animals trained to ejaculate into an artificial vagina (AV), manual stimulation of the accessory sex glands, manual stimulation of the penis, intravaginal condom and intravaginal collection post-coitus [8, 9]. Electro-ejaculation (EE) method is used to collect semen from bucks, bulls and rams for artificial insemination when the bull, buck or ram is extremely slow in serving the AV or physically incapable of mounting a dummy [10, 11]. Electro-ejaculation involves the stimulation by electrical current of emission, erection and ejaculation. Emission of semen from the ampullae and vasa deferentia into the pelvic urethra is a sympathetic response controlled by contraction of smooth muscle in response to stimulation of the lumbar sympathetic nerves which form the hypogastric nerve. Electro-ejaculation remains the preferred method of

collection in pubertal and or incapacited bucks [12, 13]. In addition, EE does not require training of AI sires [14]. It has been shown that semen of acceptable quality could be harvested by EE from small ruminants [15, 16, 17, and 18]. [19 and 20] observed that EE is the best option for collection in valuable bucks/sires, which are incapable of natural service because of age or injury. Electro-ejaculation is an aversive experience but the level of aversion is by probably influenced the probe type used and the restraint involved [21]. Body and testicular development has been well studied in Boer bucks [22]. This type Information on meat goat bucks is generally scarce and particularly with Kiko bucks. Since no systematic studies are available on physical and reproductive development in Kiko bucks, therefore, this study was designed to determine relationship of body weight, scrotal circumference, and semen output in order to develop standards for selection of meat goat bucks. Therefore, this project was designed to determine the relationship between body conformation traits: chest girth (CG), height at withers (HTW), body length (BL), body condition scores (BCS), body weight (BWT) and scrotal circumference (SC) to semen output in three electro-ejaculated Pubertal Kiko bucks.

MATERIALS AND METHODS

Three pubertal Kiko bucks (age from 8-12 months) were utilized. Animals were housed at the Tuskegee University Caprine Research Unit, Tuskegee, Alabama, U.S.A. They were fed once a day a high concentrates diet. Tuskegee University Animal Use and Care Committee approved the protocol for this study. Bucks were fed of a constant supply of hay and complete mineral supplement and fresh water were always available. The body weight of the bucks was recorded using a scale, body condition score (BCS) was evaluated subjectively (ranging from 1 = emaciated to 5 = obese) and scrotal circumference was measured using a tape at the broadest part of the scrotum. Shoulder width (SW) was determined with the aid of a tape measure, as the horizontal distance between the processes on the left shoulder and those of the right shoulder blade. Chest girth (CG) was measured with the aid of a measuring tape around the chest, just behind the front legs; body length (BL) was measured from the sternum to the aitch bone and hip width (HW) was measured using a plastic measuring tape, while height at wither (HTW) was measured vertically from thoracic vertebrae to the ground using a metal ruler. An electro-ejaculator (Pulsator IV Auto Adjust ™ Lane MFG Inc. Denver, CO) was used for semen harvest once a week for five consecutive weeks. Upon collection, semen samples were evaluated for ejaculate volume (ml), color, consistency, and mass activity. Descriptive statistics (*Statistix* 7, 2000, Analytical Software, Tallahassee, FL) was performed on the data to determined differences in selected body conformation, testicular and semen quality traits. Also, data was subjected to analysis of variance using the GLM procedures of *Statistix 7.0* (2000), correlation coefficients (r) were established between various body, testicular parameters and semen traits.

RESULTS AND DISCUSSIONS

Electro-ejaculation involves the stimulation by electrical current of emission, erection and ejaculation [23]. Electro-ejaculation is the only way to obtain semen from a wide range of captive species. These animals are sedated or anaesthetized before electro-ejaculation for safety and handling reasons. Semen collection and storage is an important to in controlled breeding programs of many endangered species [13]. In domesticated animals semen collection for artificial breeding reasons is usually collected from animals trained to ejaculate into an artificial vagina. In general our experience with an electro-ejaculator in Kiko bucks has been the same as reported in the literature for bucks, rams and bulls. The semen appeared physically thinner, but this may be due to failure to judge the ejaculation point, allowing seminal fluid to remain in the collection tube and dilute the sample.

The present study is the first, to the best of our knowledge, which illustrate the relationship of body weight, scrotal circumference, and semen output in Kiko bucks. These standards can be used for selection and culling of Kiko bucks maintained even in different regions of the country for breeding programs to eliminate the problem of infertility and could be help in minimizing the age at puberty. Mean values for body measurements were 3.06 ± 0.41 (BCS, 1-5), 81.7 ± 4.72 cm (CG), 67.1 ± 4.03 cm (HTW), 69.5 ± 5.56 cm (BL), 40.7 ± 5.01 kg (BTW) and 25.9 ± 2.18 cm (SC) (Table-1). Semen volume did not differ among bucks (1.50 ± 0.5 ml, 1.34 ± 0.93 ml and 0.90 ±0.41 ml; $p>0.05$), indicating that the response of bucks to electro-ejaculation in terms of semen output were similar (Table-2). Also, similar semen output did not differ throughout the five collection weeks (1.33 ± 0.57 ml, 1.16 ± 1.04 ml, 1.33 ± 0.57 1.50 ± 0.86 ml, and 0.90 ±0.52 ml; $p>0.05$) (Table-3). CG, BCS were positively correlated with BWT (r = 0.75, and 0.69) and SC showed positive and moderate correlation with semen volume (r = 0.31) (Table-4). Scrotal circumference is a simple repeatable method of measurement of testicular size which is highly correlated with testicular weight, semen quality, and with fertility [24, 25]. This finding is consistent with the earlier work in Holstein bulls (r = 0.96) [26], Wagyu bulls (r = 0.94) [27] and buffalo bulls (r = 0.99). Also, scrotal circumference (SC) and sperm motility and morphology are the traits most closely correlated with the fertility of bulls. Moreover, measuring SC is particularly important in examination of yearling bulls, and it is highly correlated with sperm production and semen quality [7].

It appears that the body weight is lower in Kiko bucks as compared to Boer [22], at the corresponding ages. These differences could be due to genetics, feeding management, and selection. There were low and negative correlations between BWT, BCS, HTW, CG and semen volume (r = -0.13, 0.13, -0.68, and 0.04) indicating that semen output is fairly independent of body conformation traits. Early sperm collections from young bulls are often

substandard in terms of semen volume, sperm concentration, motility or morphology [28]. However, some improvement in semen quality occurs with advancing age. The bucks were able to ejaculate after reaching 3-5 volts of electrical stimulation. Ejaculate volume of semen collected by electro-ejaculation was within the normal range for goat bucks [29, 15, and 17]. The apparatus has proven highly useful in the diagnosis of cases of failure to protrude the penis.

Semen output represents one of the most important step to predict potential fertility in sires, and according to the Society of Theriogenology Guidelines (1993), it accounts for 60% of the final scoring in breeding classification [30]. Although electro-ejaculation is extremely valuable as a method of collecting semen it should not be considered as a replacement for the artificial vagina wherever this may be used. The value of an electro-ejaculator as an emergency aid is now well established. Livestock breeders should consider this as an apparatus to aid in infertility diagnosis in large animals. It may also prove very useful for evaluation of range bucks immediately prior to the breeding season. The fact that electro-ejaculated semen has a conception rate as good as that obtained by other collection methods have been demonstrated by [9].

Table-1. Descriptive statistics for body, testicular parameters and semen output in electro-ejaculated pubertal kiko bucks.

Item	Means ±SD	Minimum	Maximum
Body weight, kg	40.7 ± 5.01	39.00	48.0
Body condition scores (1 - 5)	3.06 ± 0.41	2.00	4.00
Chest girth, cm	81.7 ± 4.72	74.00	89.00
Height at withers, cm	67.1 ± 4.03	61.0	79.0
Body length, cm	69.5 ± 5.56	62.0	79.0
Scrotal circumference, cm	25.9 ± 2.18	23.00	30.00
Hip width, cm	51.8 ± 7.11	38.00	63.00
Shoulder with, cm	25.9 ± 2.18	35.00	58.00
Semen volume, ml	1.24 ± 0.66	0.5	2.00

Table-2. Descriptive statistics for individual bucks for body, testicular parameters and semen output following electro-ejaculation (Means ±SD).

Item	Buck # 35	Buck # 37	Buck # 9633
Body weight, kg	35.1 ± 2.8	41.7 ± 3.26	45.1 ± 1.86
Body condition scores (1 - 5)	2.8 ± 0.4	3.3 ± 0.4	3.10 ± 0.2
Chest girth, cm	76.7 ± 2.03	82.3 ± 2.84	86.8 ± 1.02
Height at withers, cm	65.3 ± 2.7	64.5 ± 1.3	71.6 ± 3.3
Body length, cm	67.5 ± 5.08	68.5 ± 6.6	72.6 ± 4.0
Scrotal circumference, cm	24.8 ± 2.03	26.9 ± 1.27	25.9 ± 2.54
Hip width, cm	49.2 ± 6.1	49.7 ± 8.1	56.3 ± 6.3
Shoulder with, cm	47.2 ± 2.7	47.2 ± 7.18	54.3 ± 4.8
Semen volume, ml	1.5 ± 0.50	1.34 ± 0.9	0.90 ± 0.4

Table-3. Effects of week and bucks on body, testicular parameters and semen output following electro-ejaculation.

Item	P-values*	
	Collection week	Buck
Body weight, kg	0.0048	0.0001
Body condition scores (1 - 5)	0.1652	0.1114
Height at withers, cm	0.1291	0.0016
Body length, cm		
Scrotal circumference, cm	0.0063	0.0731
Semen volume, ml	0.8901	0.4664

*Significant if P< 0.05

Table-4. Correlation coefficients (r) among body, testicular parameters and semen output following electro-ejaculation of kiko bucks.

	BCS	BWT	BL	CG	HTW	SC
BWT	0.6972					
BL	0.4603	0.3790				
CG	0.8486	0.7597	0.4417			
HTW	-0.4856	-0.1738	0.2896	-0.3203		
SC	-0.1019	-0.5377	-0.2174	-0.0790	-0.5508	
VOL	0.1388	-0.1304	-0.7780	0.0464	0.6381	0.3179

CONCLUSIONS

a) The present study is the first, to the best of our knowledge, which illustrate the relationship of body weight, scrotal circumference, and semen quality in Kiko bucks.
b) The study has demonstrated that semen can be harvested in sufficient quantity from pubertal bucks via electro-ejaculation when the use of artificial vagina is inappropriate due to age or training.
c) These standards for relationship of body conformation or testicular traits to semen output in Kiko meat goat bucks can be used for selection and culling of Kiko bucks maintained even in different countries for breeding programs to eliminate the problem of infertility and could be help in minimizing the age at puberty.
d) We recommend that these results be incorporated in a breeding soundness examination tool for selecting or culling Kiko breeding sires at an early age.

REFERENCES

[1] Solaiman S. 2007, August. Assessment of the meat goat industry and future outlook for U.S. small farms. Tuskegee University.

[2] Luginbuhl J. M. 1998. Breeds of Goats for Meat Goat Production and Production traits. http://www.cals.ncsu.edu/an_sci/extension/animal/meatgoat/MGBreed.htm.

[3] D. Ford, C. Okere and O. Bolden - Tiller. 2009. Libido Test Scores, Body Conformation and Testicular Traits in Boer and Kiko Goat Bucks. Journal of Agricultural and Biological Sciences. 4(5): 1-8.

[4] Batten G. J. 1987. A New Meat Goat Breed: Proceedings of the IV International Conference on Goats. 2: 1330, Brasilia, Brazil.

[5] Newman S.A.N., Paterson D.J. 1997. Potential to improve goat production in New Zealand through the introduction of Boer genetics. J. Anim. Sci. 75 (Suppl. 1), 13.

[6] Ott RS. 1986. Breeding soundness examination of bulls. In: Morrow DM (Ed). Current Therapy in theriogenology. WB Saunders, Philadelphia. pp. 125-136.

[7] Brito L. F. C., Silva A. E. D. F., Rodrigues L. H., Vieira F. V., Deragon L. A. G. and Kastelic J. P. 2002. Effect of age and genetic group on characteristics of scrotum, testes and testicular vascular cones, and on sperm production and semen quality in AI bulls in Brazil. Theriogenology. 58: 1175-1186.

[8] Martin ICA. Semen collection and evaluation. In: Morrow, DA (Ed). Current Therapy in Theriogenology. WB Saunders, Philadelphia. pp. 880-884.

[9] Austin J. W., R. B. Leidy, G. M. Krise and E. W. Hupp. 1986. Normal values for semen collected from Spanish goats by two methods. J. Applied Physiol. 24: 369-372.

[10] Memon M. A., K. N. Bretzlaff and R. S. Ott. 1986. Comparison of semen collection techniques in goats. Theriogenology. 26: 823-827.

[11] Wulster-Radcliffe M. C. M. A. Williams J. N. Stellflug and G. S. lewis. 2001. Technical note: Artificial vagina vs. a vaginal collection vial for collecting semen from rams. J. Anim. Sci. 79: 2964-2967.

[12] Mattner P. E. and Voglmayr. 1962. A comparison of ram semen collected by artificial vagina and by electroejaculator. Aust. J. Exp. Agric. Anim. Husb. 2: 78-88.

[13] Palmer C. W. 2005. Welfare aspects of theriogenology: Investigating alternatives to electro ejaculation of bulls. Theriogenology. 64: 469-479.

[14] Belibaski S and S. Kouimtzis. 2000. Sexual activity and body and testis growth in prepubertal ram lambs of Fries land, Chios, Karagouniki and Serres dairy sheep in Greece. Small Rumin. Res. 37: 109 -113.

[15] Sundaraman M. N. J. Kalatharan and M. J. Edwin. 2007. Attempts to achieve semen collection from incapacitated Boer bucks by electro-ejaculation. Asian Journal of Animal and Veterinary Advances. 2(4): 244-246.

[16] Oyeyemi M. O., Akusu M. O. and Ola-Davis O. E. 2001. Effects of successive ejaculation on the spermiogram of West African Dwarf goats. Isr. Vet. Med. Assoc. J. 56: 1-5.

[17] Al-Ghalban M. A. M. J. Tabbaa and R. T. Kridii. 2004. Factors affecting semen characteristics and scrotal circumference in Damascus bucks. Small Ruminant Research. 53: 141 -149.

[18] Kridii R. T. A. Y. Abdullah and M. M. Shiker. 2006. Sexual performance and reproductive characteristics of young adult Awassi, Charollais and Romanov rams. Sheep and Goat Research Journal. 21: 12-16.

[19] Marco-Jimenez F. S. Puchades J. Gadea J. S. Vicente and M. P. Viudes-de Castro. 2005. Effect of semen collection method on pre-and post-thaw Guirra ram spermatozoa. Theriogennology. 64: 1756 -1765.

[20] Carter P. D. Hamilton. PA, Duffy J. H. 1990. Electro ejaculation in goats. Australian Veterinary Journal. 67: 91-93.

[21] Houpt K. A. 1991. Domestic Animal Behaviour. Iowa State University Press, Ames. p. 119.

[22] Keith L. C. Okere S. Solaiman and O. Bolden-Tiller. 2009. Accuracy of Predicting Body Weights from Body Conformation and Testicular Morphormetery in Pubertal Boer Goats. Res. J. Anim. Sci. 3(2): 26-31.

[23] Ball L. 1986. Electro ejaculation. In: Klemm WR (Ed). Applied Electronics for Veterinary Medicine and Animal Physiology. pp. 395-441.

[24] Waldner C. L., Kennedy R. I. and Palmer C.W. 2010. A description of the findings from bull breeding soundness evaluations and their association with pregnancy outcomes in a study of western Canadian beef herds. Theriogenology. 74(5): 871-883.

[25] Kastelic J. P., Cook R. B., Pierson R. A. and Coulter G. H. 2001. Relationships among scrotal and testicular characteristics, sperm production, and seminal quality in 129 beef bulls. Canadian Journal of Veterinary Research. 65: 111-115.

[26] Coulter G. H. and Foote R. H. 1977. Relationship of body weight to testicular size and consistency in growing Holstein bulls. Journal of Animal Science. 44: 1076-1079.

[27] Silva-Mena C. 1997. Peripubertal traits of Brahman bulls in Yucatan. Theriogenology. 48: 675-685.

[28] Devkota B., Koseki T., Matsui M., Sasaki M., Kaneko E., Miyamoto A., Montoya C. A. and Miyake Y. I. 2008. Relationships among age, body weight, scrotal circumference, semen quality and peripheral testosterone and estradiol concentrations

in pubertal and post pubertal Holstein bulls. Journal of Veterinary Medicine Science. 70: 119-121.

[29]Okere C. Chiboka O. and Monstma G. 1986. Effects of Frequent Ejaculations of West African Dwarf Goats on Semen Characteristics. Anim. Repro. Sci. 11(4): 249-258.

[30]Chenoweth P. J., Hopkins F. M., Spitzer J. C. and Larsen R. E. 1993. Guidelines for using the bull breeding soundness evaluation form. Theriogenology handbook. Hastings: Society for Theriogenology. p. B-10.