

**PRODUCTIVE AND REPRODUCTIVE PERFORMANCE
OF BOER AND KATJANG GOAT
AT FSA FARM**

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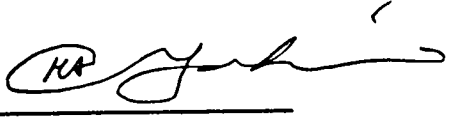
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ABSTRACT

Goat is one of the most important animals in livestock industries. This is because of its ability to produce not only meat as a nutrient sources, but also producing sub-product such as skin and milk. In Malaysia, intensive farming of goat are mainly focusing for meat production. The research was conducted to investigate the productive and reproductive performance of Boer and Katjang goat and to find out the relationship among the productive and reproductive parameters of Boer and Katjang goat. This study was conducted in the goat house at Faculty of Sustainable Agriculture (FSA) from March 2016 until November 2016. Two breeds of goats that available in the farm, Boer and Katjang was used as the experimental animals. The data on productive and reproductive parameter were taken from 42 Boer and 18 Katjang goats which consists of the kids and the adult goat. Among the goats, 18 were males and 42 were females. The results showed that the average milk production (\pm SE) per day for Boer was 277.14 ± 249.20 ml and Katjang was 175.00 ± 89.92 ml mainly affected by the litter size. The average (\pm SE) body weight based on the age for Boer were 13.35 ± 5.11 kg for under 1 year of age, 28.20 ± 7.14 kg for one to two years of age, and 46.84 ± 7.83 kg for above two years of age. The average (\pm SE) body weight based on the age for Katjang were 5.00 ± 1.78 kg for under 1 year of age, 21.75 ± 5.44 kg for one to two years of age, and 30.80 ± 6.92 kg for above two years of age. As for the birth weight of the kids, single birth average weight (\pm SE) was 2.73 ± 0.78 kg and twin average birth weight was 2.31 ± 0.38 kg for Boer. Meanwhile, for the Katjang single, twin, and triplets average birth weight (\pm SE) were 1.33 ± 0.17 kg, 1.83 ± 0.40 kg, and 1.57 ± 0.33 kg respectively. The number of kids born in Boer is 26 which is higher than Katjang, 12. The mortality rate was quite high for both breeds. In Boer, the mortality rate is 42.3% while 75% in Katjang and mainly caused by low birth weight.

ABSTRAK

Kambing adalah salah satu haiwan yang penting dalam industri ternakan. Hal ini kerana kebolehan kambing yang bukan hanya mampu membekalkan daging sebagai sumber nutrien, tetapi juga mengeluarkan produk sampingan seperti kulit dan susu. Di Malaysia, perladangan kambing secara intensif tertumpu khas untuk pengeluaran daging. Kajian ini telah dijalankan untuk mengenal pasti parameter produktif dan pembiakan kambing Boer dan Katjang. Kajian ini telah dijalankan di Fakulti Pertanian Lestari (FPL) pada bulan Mac 2016 sehingga November 2016. Dua baka kambing yang terdapat di ladang, Boer dan Katjang telah diambil sebagai haiwan kajian. Data bagi parameter produktif dan pembiakan telah diambil dari 42 ekor Boer dan 18 ekor Katjang yang terdiri daripada anak kambing dan kambing dewasa. Kambing tersebut terdiri daripada 18 ekor jantan dan 42 ekor betina. Hasil dapatan menunjukkan purata penghasilan susu (\pm SE) bagi baka Boer untuk sehari ialah 277.14 ± 249.20 ml dan bagi baka Katjang ialah 175.00 ± 89.92 ml dipengaruhi oleh jumlah anak. Purata (\pm SE) berat badan bagi Boer berdasarkan peringkat umur ialah 13.35 ± 5.11 kg bagi kategori bawah satu tahun, 28.20 ± 7.14 kg bagi kategori satu tahun hingga dua tahun, dan 46.84 ± 7.83 kg bagi kategori atas dua tahun. Purata (\pm SE) berat badan bagi Katjang berdasarkan peringkat umur ialah 5.00 ± 1.78 kg bagi kategori bawah satu tahun, 21.75 ± 5.44 kg bagi kategori satu hingga dua tahun, dan 30.80 ± 6.92 kg bagi kategori atas dua tahun. Manakala, purata berat (\pm SE) semasa lahir baka Boer untuk kelahiran tunggal ialah 2.73 ± 0.78 kg dan untuk kelahiran kembar ialah 2.31 ± 0.38 kg. Bagi baka Katjang, untuk kelahiran tunggal, kembar dan kembar tiga ialah masing-masing 1.33 ± 0.17 kg, 1.83 ± 0.40 kg, and 1.57 ± 0.33 kg. Jumlah kelahiran Boer ialah sebanyak 26 ekor berbanding Katjang 12 ekor. Kadar kematian anak kambing bagi kedua-dua baka agak tinggi iaitu 42.3% bagi Boer dan 75% bagi Katjang yang disebabkan oleh berat kelahiran yang rendah.

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LIST OF SYMBOLS, UNITS, AND ABBREVIATION

%	Percentage
±SE	Standard Error
1 st	First
2 nd	Second
3 rd	Third
4 th	Fourth
BWG	Birth weight gain
cm	centimetre
DVS	Department of Veterinary Services
FSA	Faculty of Sustainable Agriculture
g	gram
H _a	Alternative hypothesis
H _o	Null hypothesis
kg	kilogram
MARDI	Malaysian Agricultural Research and Development Institute
ml	millilitre
MOA	Ministry of Agriculture
SE	Standard error
wt.	Weight



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$$\text{Kid mortality rate (\%)} = \frac{\text{Number of kids died before weaning}}{\text{Total number of kids born}} \times 100\%$$

CHAPTER 1

INTRODUCTION

1.1 Background

The counted population of goats all over the world is 674 million. High number of goats populations found in the developing countries which approximately 94% from that total of goats population. Basically, goat is important in terms of numerically and economically yet promising animal resources in the developing countries especially for the poor people in Asia and Africa (Hussain, 1999).

Livestock industries in Malaysia only contribute less than 10% of value added in agricultural sector. It cannot be denied that the livestock industry itself faces plenty of challenges in the breed supply chain in order to meet the national agricultural development plan. This is because of the continuous imports of ruminants' meat product from India due to free market access policy for the exporters from India. The meat imported from India offers much cheaper price than the meat produced by the local farmers. This policy narrowed the market for the local farmers to promote and markets their products. One of the government strategies for transforming the livestock sector is to increase the ruminant populations. Basically, the livestock sector in Malaysia can be categorized into two main subsector which is non-ruminants that includes poultry and pigs and ruminants that includes cattle, goats, and sheep. The subsector of non-ruminants sector is in a stable stage and contribute up to 94% from the total number of livestock industry (Wan Zahari, 2008). Meanwhile, the ruminant sub-sector only contributing 6% from that total number of livestock industry (Wan Zahari, 2008). From these scenario, we can see that most of the contribution is from non-ruminant sub-sector.



A statistics on goat population in Malaysia from 2006 to 2011 shows an improvement from 349,427 heads on 2006 and 580,271 heads in 2011. On the other hand, the number of live goats imported also increasing from 87,841 to 113,422 from year 2006 to 2011 respectively (MOA, 2011). The population of goat in Malaysia is comprises of the small-framed Katjang goats which originally from Malaysia and the imported goats which have larger frame such as Boer, Savanna and Jamnapari. Because these exotic breeds are imported continuously, indigenous Katjang are in unstable number of population. This is because, there are no realistic and solid plan to conserve the Katjang breed. Besides that, it has been proved that these exotic breeds able to adapt well to Malaysia's environment.

In 2004, Malaysia able to produced 25,920 tonne of beef and 13,200 tonne of goat meat. But, the demand for both beef and goat meat is 129,770 tonne and 16,445 tonne respectively. The following Table 1.1 shows the Malaysia self-sufficiency level for beef and goat meat from year 2000 to 2010. There is some improvement in term of self-sufficiency level but there is slight declination on consumption per capita.

Table 1.1 Malaysia self-sufficiency level for beef and goat meat

Year	2000	2003	2004	2010
Self-sufficiency level				
Beef	15.8	19	20	28
Goat meat	6	8	8	10
Consumption per capita				
Beef	4.8	5.2	5.7	4.8
Goat meat	0.6	0.6	0.79	0.7

Source: Wan Zahari, 2008

Sabah is a net importer of meat, live animals and animal feed and it can be said that meat is one of the important part of the local diet in Sabah. The most popular consumed meat in Sabah includes meat from cattle, swine, and poultry. The current situation in Sabah shows that areas such as Kota Belud, Kinarut, Keningau, Sandakan and Tawau have a high density of farmers producing cattle, buffalo, poultry, swine, and dairy products. Based on the poll that conducted by the Sabah state government on 2012, there are a least 47,779 head of goat in Sabah. From that total, Sabah only able to achieved 23.66% of self-sufficiency rate (Government of State of Sabah, 2012). The current situation of food security in Sabah is a reflection of three main factors. These factors includes short of local production to meet increasing demand due to rapid growth

in populations, imports dependency for all parts of the food production chain, and relatively low income levels that can be seen clearly in rural areas that reducing affordability of food.

In 2009, Department of Veterinary Services has established *in-situ* conservation facilities supported by *ex-situ* conservation by maintaining the semen and embryo bank at the National Institute of Veterinary Biodiversity in Jerantut, Pahang (DVS, 2014). But, in order to manage any development work generally in Malaysia and especially in Sabah, the goat productive and reproductive traits should be identified and recorded. This is to obtain maximum performance of the goat to achieve optimum food self-sufficiency rate. Aside from that, knowledge on productive and reproductive performance of animals able to contribute improving strategies for achieving the total self-sufficiency rate in Malaysia generally and Sabah specially. Thus, by using the Boer and Katjang goats at Faculty of Sustainable Agriculture (FSA) as the experimental animal, the current productive and reproductive performance of these two breeds can be obtained.

1.2 Justification

A large number of Boer goat has been imported to this country because of their product quality and ability to adapt. A native breed which is Katjang should not be left out in order to conserve and later improves their population number. Envisaging the momentum of this thesis research, it is basically aimed for evaluating the potential of both Katjang and Boer goat. Hence, it is proposed to study the productive and reproductive performance of Boer and Katjang goat which specified at FSA goat farm.

1.3 Objectives

The objectives of this research are:

1. To investigate the productive and reproductive parameters of Boer and Katjang goat at FSA farm.
2. To find out the relationship among productive and reproductive parameters of Boer and Katjang goat at FSA farm.

1.4 Hypothesis

H_0 = There is no significant difference among productive and reproductive parameter in Katjang and Boer goat at FSA farm.

H_a = There is a significant difference among productive and reproductive parameter in Katjang and Boer goat at FSA farm.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

There were several researches have been carried out worldwide which have the importance with productive and reproductive performance of the goats. The related researches works carried out from various countries are reviewed in this chapter.

2.2 History and Origin of Katjang and Boer Goat

2.2.1 History and Origin of Katjang Goat

Katjang goat (*Capra aegagrus*) is the only indigenous breed of goat in Malaysia. This Katjang goat resembles the Black Bengal goat of India and Bangladesh. Because of its resemblance with Black Bengal breed, Katjang is hypothesized originated from Bengal which now known as India and Bangladesh. Some theories said that the Indian traders from Bengal brought in the Black Bengal though the Penang Port which back then known as the Northern Port of Malaya. Thus, from these reasons there are possibility that the Katjang breed has inherited the coat colour of the Black Bengal because of closed breeding. Both Malaysia and Indonesia claimed Katjang as their indigenous breed (Sutama and Budiarsana, 2009).

The Katjang goat also known as "Kacang" goat by the locals which is referred to as "bean" and "pea". This is because it resembles the characteristics of broad bean since its body is compact and meaty (Abdul Razak, 1988). The Katjang breed also can be found in Indonesia, Thailand, and Philippines. Some theories believes that Katjang is originated from Indonesia (Abdul Razak, 1988). But, there is no through study been

done related to the populations and distributions of Katjang goat. Hence, Katjang populations can only be found in some parts of Malaysia thus it is seen at risky condition.

2.2.2 Characteristics of Katjang



Figure 2.2.2 Katjang goat

Due to the early importations and restricted number of breeds and types and result of inbreeding, the goats in Malaysia become more uniform and black in colour over the years. Katjang goat is a meat type goat which the morphologies character includes of a thin, black or brown coloured coat with white patches. The average height of male and female Katjang is 65 cm and 55 cm (Abdul Razak, 1988). On the other hand, the mature weight is 25 kg for male and 20 kg for female. Basically, the average daily weight a Katjang goat able to gain per day is 55 gram. Meanwhile, the milk production per day range from 500 to 750 ml. The Katjang horn shape is crescent. Figure 2.2.2 shows a picture of Katjang with a brown colour coat and crescent horn shape.

Katjang goats is known with their ability to adapt and adjusted with their environment within short period of time. Aside from that, they also able to tolerant with heat and diseases in hot-humid climate. Unfortunately, due to preference for a larger sized body the Katjang tends to be crossed with other imported breeds to meet the market needs. Hence, the Katjang goat populations went through genetic erosion.

2.2.3 History and Origin of Boer Goat

Boer goat (*Capra hircus*) is well-known all over the world and desired for its meat production. The name Boer is obtained from the Dutch word "boer" which means farmer (Abdul Rashid, 2008). Boer has an excellent body confirmation, fast growing rate and good carcass quality. Indeed, because of that reasons Boer able to gained recognition worldwide. Based on studies conducted previously, Boer is found able to improve productive performance of plenty indigenous breeds through cross breeding.

Boer is originated from South Africa. The Boer breed is said existed through breeding processes between the indigenous breed of Africa and imported breed from India, Netherlands and Europe which brought by the trader back then (Abdul Rashid, 2008). The production of Boer systematically started by the European farmers in 1959. The main aim is to introduce Boer as high potentials meat producer (Abdul Rashid, 2008). Boer is first introduced to Malaysia when Malaysian Agricultural Research and Development Institute (MARDI) brought the Boer in 1999.

The first type of Boer is the ordinary Boer goat. It is defined as animals with good meat conformation, short hair and varies in colour patterns. Next is the long hair Boer goats. This type of Boer have heavy coats and course meats. The polled Boer goats are hornless and have less desirable body conformation. On the other hand, the indigenous Boer goats have a long legs and varies in terms of conformation and colour patterns. The improved Boer goats are the main line selected for breeding purposes.

The standards for breeds was established in 1959 when the South African Boer Goat Breeders' Association is formed. This standards are uses by various breeders association from Australia, Canada, New Zealand and Unites States of America (Abdul Rashid, 2008). The parameters acquired for judging the breed includes conformation, head, neck and forequarters, barrel, hindquarters, legs, skin and coverings, sexual organs, size, colouring, tail, general appearances and types, and fertility.

2.2.4 Characteristics of Boer

Basically, the head conformation includes shape of nose, jaw, horn, ear, and eyes colour. The nose of Boer is said resembling the Romans meanwhile the jaws is built firmly with occlusion of the maxillary and perfect mandibular (Abdul Rashid, 2008). The ear of the Boer resembles the Nubian's which is long and pendulous ears. Their eyes colour is brown while their horn is hard and in a balance position. Figure 2.2.4 is a Boer with a white colour coat with brown and long pendulous ear at FSA farm.

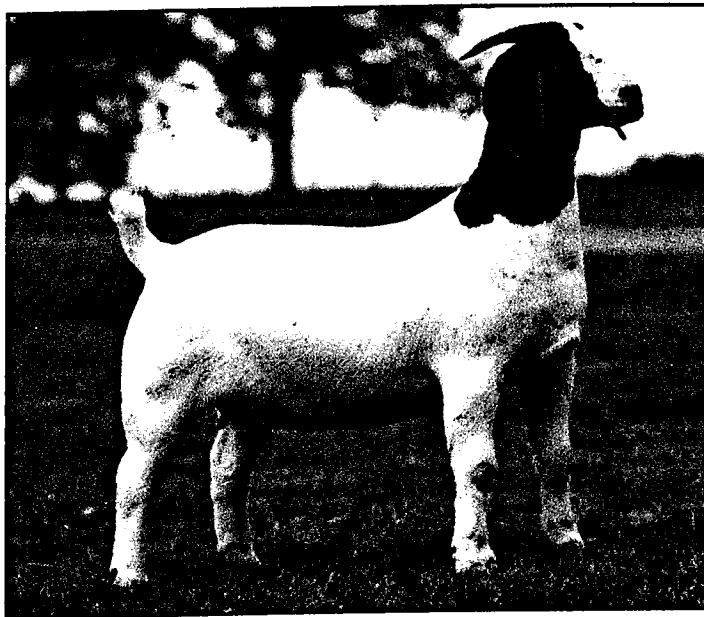


Figure 2.2.4 Boer with long and pendulous ear and balanced horn position

The body of Boer is in a fine compositions if it is round and long. The ribs is balanced and meaty. The back of Boer is straight, wide, and balanced (Abdul Rashid, 2008). The length of neck should be balance with a wide chest. The shoulder should have good composition of meat. The length legs is balanced with the body size. The skins around the chest and neck is looks folded. The hip of the goat should have a good compositions of meat down to the thigh areas. Usually, the hip is wide and balanced (Abdul Rashid, 2008).

For culling process, there are some guidelines provided based on the body conformation of Boer. The goat should be culled when its forehead is hollowed, straight and flat horn, the jawlines is drawing out, and blue colour eyes instead of brown (Abdul Rashid, 2008). The Boer is not favourable when their neck is either too long or too short

with weak and imbalanced shoulder conformation. If the back of body is too curvy and imbalanced the goat should be culled out. Lastly, a flat and tilted hip is not favourable.

2.3 Productive Performance

2.3.1 Milk Production

Milk production mainly affected by species of animals, breed and genetic potentials, parity, length of lactation, weaning period, diseases, seasonal conditions, feed supply and management system. Milk production in Boer and Katjang goats is generally count as adequate in terms for earing multiple kids. But, there is a small difference in growth rate at weaning between single and multiple births.

Since they are a meat purpose goat breed, they have a shorter lactation length compared to dairy breeds. Apparently, the milk solids are higher in meat breeds compared to other breeds. The milk production of Boer during the first 12 weeks of lactation ranged from 1.5 to 2.5 kg per day in Boer goats as shown in Table 2.3.1. It is also found that the fat content in Boer milk is twice than that in dairy goats. However, in recent study the milk yield ranged from 1.91 kg to 2.32 kg per day during the first 8 weeks of lactation. The variations in milk production in Boer is due to the litter size and lactation number. Meanwhile, the Katjang only able to produce around 500 to 750ml of milk per day (Abdul Razak, 1988). The milk is considered insufficient since Katjang is known for its prolificacy and always give birth to twins and triplets.

Table 2.3.1 Mean daily milk production and milk composition during first 12 weeks of lactation of Boer goat does

Age of does	Litter size	Milk yield kg/day	Milk composition			
			% Protein	% Fat	% Total solids	% Lactose
2	Singles	1.5	4.5	7.5	17.3	4.7
2	Twins	1.9	4.4	7.0	16.8	4.7
2	Triplets	2.3	4.2	6.4	15.8	4.6
4	Singles	1.8	4.5	7.7	17.9	4.9
4	Twins	1.9	4.3	7.4	17.1	4.8
6	Singles	2.1	4.4	9.4	19.2	4.7
6	Twins	2.2	4.1	8.1	17.4	4.7
6	Triplets	2.5	3.9	7.6	17.0	4.7

Source: Raats et al., 1983

2.3.2 Body weight

Generally, the birth weight of Boer kids ranges from 3 kg to 4 kg. Usually, the male will be weigh 0.5 kg heavier than female. Kids at weaning can weigh from 20 to 25 kg, depending on weaning methods and age (Lu and Potchoiba, 1988). When the goat reached 7 month of age, bucks weight may range from 40 kg to 50 kg and does weight will range from 45 kg to 65 kg. Once the goats has reached maturity, their mature weight will be range from 90 kg to 130 kg and 80 kg to 100 kg for bucks and does respectively. But, the body weight measurement can be varies due to genetics influences, nutrition, health and disease, breeding age and method, and the system of management.

According to research conducted by MARDI, the body weight performance of Boer is much higher when compared with indigenous breed, Katjang (Abdul Rashid, 2008). Table 2.3.2 shows the birth weight performance of Boer based on research conducted by MARDI. In case of Katjang goat, the body weight also affected significantly by the sex of animals. Generally, the male goats will be heavier than the females by 1.0 to 20%. The differences between the sexes may range from 0.1 kg to 1.4 kg or more in some cases. The birth weight of Katjang is between 1.2 kg to 2.5 kg. Meanwhile, the mature weight of male and female Katjang is around 20 kg to 25 kg (Abdul Razak, 1988). The mature weight of the Katjang is almost the same as Boer at three to four months of age (Abdul Rashid, 2008).

Table 2.3.2 Birth weight performance of Boer goat

Sex	Male	Female
Birth weight (kg)	3.0 to 5.0	2.5 to 4.0
3 months of age weight (kg)	15 to 27	12 to 19
Mature weight (More than 2 years, kg)	65 to 90	45 to 65

Source: Abdul Rashid, 2008

2.3.3 Birth Weight of Kids

The measurement of growth is the basic recording system for performance. It cannot be denied that the birth weight is one of the important economic traits which may influence the kid growth and survivability rates. Basically, the birth weight is affected by sex, litter size, type of birth, parity, dam weight, breed of dam, breed of sire, and plane of nutrition during the last two months of pregnancy.

The birth weight of Boer kids usually range from 2.5 to 5.0 kg. In usual circumstances, the male will weigh heavier by around 0.5 kg. The range birth weight for male is 3.0 kg to 5.0 kg while the female is 2.5 kg to 4.0 kg (Abdul Rashid, 2008). The male and female single local goats of Malaysia were recorded having birth weights of 1.7 and 1.4 kg respectively and the male and female multiple birth kids weigh 1.6 to 1.4 kg respectively.

2.4 Reproductive Performance

The reproductive performance can be measure both in male and females. In females, the reproductive performance can be measured based on few parameters such as conception rate, post-partum heat period, gestation length, age at first kidding, litter size, kid mortality rate, non-return rate, and pregnancy rate. In this research, we are focusing more on the litter size and kid mortality rate only due to some limitations in the faculty. In term of males, their basic reproductive parameter can be measured through the circumference of the testis.

The reproductive performance of the breeding females might be the most important factor that will influenced the herd or flock productivity. This is because all forms of output such as milk, meat and wool are depending on females. Besides that, female reproductive performance are the determinant of output which varies most between flocks within a population. It can be said that reproductive performance is often the determinant of output which is most susceptible to improvement. This can be simply done by using management practices already used by some in the farming community. The collected data on reproductive performance can help to identify the factor causing poor reproductive performance.

REFERENCES

- Abdul Rashid, B. 2008. Ciri-ciri Kambing Boer. Penternakan Untuk Usahawan. Malaysia: MARDI 2008
- Abdul Razak, A. 1988. Baka-baka Kambing. Penternakan Kambing. Malaysia: Percetakan Dewan Bahasa dan Pustaka 1988
- Alexandre, G., Aumont, G., Mainaud, J.C., Fleury, and J., Naves, M. 1999. Productive Performances of Guadeloupean Creole Goats During the Suckling Period. *Small Ruminant Research*. **34**: 155-160
- Banergee, G.C. 1989. *A Text Book of Animal Husbandry*. 7th edition. Oxford and IBH publishing Company India.
- Campbell, Q.P. 1984. The Development of a Meat Producing Goat in South Africa. In: *Proceeding of Second World Congress on Sheep and Beef Cattle Breeding*. 1984. Republic of South Africa.
- Charles, A.B. 1985. Factors Affecting the Growths of Sheep and Goats in Africa. In: *Proceedings of a Conference on Small Ruminants in African Agriculture*. 1985. International Livestock Centre for Africa, Addis, Ethiopia
- Department of Veterinary Services. 2014. List of Applied Research: Animal Genetic Resources in Malaysia.
- Donkin, E.F., and Boyazoglu, P. 2004. Diseases and Mortality of Goat kids in a South African milk goat herd. *South African Journal of Animal Science*. **34**: 220-223
- Erasmus, J. A. 2000. Adaptation to Various Environments and Resistance to Disease of the Improved Boer Goat. *Small Ruminants Research*. **36**: 179-187
- Falik, S.K., Bakht, B.K., Sadaqat, H.H., Barque, A.R., Ghulam, M.D., and Iqbal, M. 1991. Comparative Study of Factors Contributing to the Mortality in Lambs and Kids. *Pakistan Journal of Agricultural Sciences* **28(1)**: 16-20
- Government of State of Sabah. 2012. Strategic Environmental Assessment (SEA) on Food Security in Sabah
- Hailu, D., Mieso, G., Nigatu, A., Fufa, D., and Gamadac, D. 2006. The Effect of Environmental Factors on Pre-weaning Survival Rate of Borana and Arsi-Bale kids. *Small Ruminant Research*. **66**: 291-294
- Hussain, S.S. 1999. Sustainable Genetic Improvement of Economic Traits of Black Bengal Goats through Selective and Cross Breeding. *BAU Res. Prog.* **10**: 72-80
- Lehloanya, K.C., Greyling, J.P.C., and Schwalbach, L.M.J. 2005. Reproductive Performance of South African Indigenous Goats Following Oestrus Synchronisation and Artificial Insemination. *Small Ruminant Research*. **57**: 115-120
- Lu, C.D., and Potchoiba M.J. 1988. Milk Feeding and Weaning of Goat Kids. *Small Ruminant Research* **2**: 105-112
- Ministry of Agriculture and Agro-based Industry Malaysia (MOA). 2011. Agrofood Statistics 2011
- Mohmad Mustafa. 2008. Pengurusan Kesihatan. Penternakan Untuk Usahawan. Malaysia: MARDI 2008
- Morand-Fehr, P., and Sauvart, D. 1980. Composition and Yield of Goat Milk as Affected by Nutritional Manipulation. *Journal of Dairy Science* **63(10)**: 1671-1680
- Raats, J.G., Wike, P.I., and Du Toit, J.E.J. 1983. The Effect of Age and Litter Size on Milk Production Boer Goat Ewes. *South African Journal of Animal Science* **13(4)**: 240-243

- Raji, A.Y., and Njidda, A.A. 2014. Gonadal and extra-gonadal sperms reserves of the Red Sokoto goats fed *Moringa oleifera* supplemented diets. *International Journal of Agricultural Bioscience*. **3(2)**: 61-64
- Sahlu, T., and Goetsch, A. 1998. Feeding the Pregnant and Milking Doe. In: *Proceedings 13th Annual Goat Field Day*. 1998. Langston University, Langston, Oklahoma
- Shelton, M. 1978. Reproduction and breeding of goats. *Journal Dairy Science*. **61**: 994–1010
- Song, H. B., Jo, I. H., and Sol, H. S. 2006. Reproductive Performance of Korean Native Goats Under Natural and Intensive Conditions. *Small Ruminants Research*. **65**: 284-287
- Sutama, I.K. and Budiarsana, I.G.M. 2009. Jenis Kambing. Panduan Lengkap Kambing dan Domba. Indonesia: Penebar Swadaya 2009
- Thomas, P.C., and Rook, J.A.F., 1983. Milk Production, Nutritional Physiology of Farm Animals. New York: Longman Group Ltd. 1983
- Wan Zahari, M. 2008. Industri Penternakan Ruminan di Malaysia. Penternakan Boer Untuk Usahawan. Malaysia: MARDI 2008