



***SUPPLEMENTATION OF COCKLE SHELLS-DERIVED CALCIUM FOR
MAINTANING SERUM CALCIUM LEVEL IN PREGNANT AND
LACTATING JAMNAPARI AND BOER GOATS***

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MAINTAINING APPROPRIATE SERUM CALCIUM LEVEL IN PREGNANT
AND LACTATING JAMNAPARI AND BOER GOATS**

By

HUSNA FASIAH BINTI MOHD YUSOFF

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfilment of the Requirements for the Degree of Master of Science**

June 2016

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Abstract of thesis presented to Senate of Universiti Putra Malaysia in fulfilment of the requirement of the Degree of Master of Science

SUPPLEMENTATION OF COCKLE SHELLS-DERIVED CALCIUM FOR MAINTAINING APPROPRIATE SERUM CALCIUM LEVEL IN PREGNANT AND LACTATING JAMNAPARI AND BOER GOATS

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June 2016

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The optimum nutrition, minerals and better care of pregnant and lactating does are very important. One of the most important mineral in the diet is calcium. Calcium supplements used in this study come from cockle (*Anadara granosa*) shells. This is because shells are very similar to bones and in form of CaCO_3 that can provide the strong basis for the calcium potential source. Blood and feed samples were taken to evaluate the level of calcium in diet and serum calcium level in goats, respectively. The observation in this study was first looking at the feed analysis and followed by calcium serum concentration analysis. Feed analysis was used to analyze the calcium content in feed provided by the farmer. Then the research proceeds with blood analysis. Samples were collected before and after supplementation of calcium in order to identify the calcium level in goat's blood. A total of 45 goats were chosen in this study. Calcium is an essential mineral to have in the diet as it builds strong bones and sometimes we may not be aware of. Deficiency of calcium can cause reproductive problems. This is because calcium is very important for smooth muscle function. This study is very important to highlight the influence of pregnancy and lactation on the calcium concentration in goats' blood serum. Most of the feed given by the farmer contain less calcium level compared to the calcium level suggested by the previous from other other researchers. Thus, it is important for the goats to consume enough calcium in order to maintain adequate blood and bone calcium levels. Independent t-test was used to compare serum calcium concentration in mmol/L. Result were expressed as mean \pm standard error mean (SEM). A probability of $p < 0.05$ was considered significant for the statistical test. There was a statistically significant difference between groups as determined by t-test for post-delivery stage. A test revealed that the changes between with and without supplementation were statistically significantly at $p < 0.05$, whereas, significant difference occurred between mid-trimester and late-gestation stages in Jamnapari goats. However from overall results from the tables shows no significant different happened among all other stages. Finally, it seems that most of the feed types were shown a lower calcium level compared with the calcium level suggested by the

other researches. As the feeds contain low concentrations of calcium, it is important to supplement the does with calcium. In this study calcium source was obtained from cockle shells. Besides that, the declining and rising of serum calcium level shown in supplemented group, contrarily it was not happening to the non-supplemented group. It seems that, the serum calcium level during pregnancy and lactating stage is really unpredictable. This situation happened might be due to several factors such as hormonal concentration (progesterone and estrogen level) along gestation and lactation period, fetus development, nutrition, excretion through waste (feces, urine and sweat) and skeletal formation and mineralization process. On the other hand, there was no significant different happened between two different breeds in calcium serum level during gestation and post-delivery. Finally, through this research and from overall observation, animal with calcium supplement maintain the normal calcium level in the body within the range and the level keep on increase appropriately for both breeds.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Sarjana Sains

**DIET TAMBAHAN DARI KULIT KERANG UNTUK MENGEKALKAN
TAHAP YANG SESUAI BAGI KALSIMUM SERUM PADA KAMBING
JAMNAPARI DAN BOER KETIKA BUNTING DAN LAKTASI**

Oleh

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Pengambilan nutrisi, mineral serta penjagaan yang optimum adalah sangat penting bagi kambing yang sedang bunting dan diperingkat laktasi. Kalsium adalah salah satu contoh mineral penting yang patut ada di dalam diet. Kulit kerang (*Anadara granosa*) telah di gunakan di dalam kajian ini sebagai sumber kalsium di dalam diet tambahan. Ini adalah kerana keadaan cengkerang adalah sama dengan tulang dan kalsium karbonat dapat menjadi penyumbang utama sumber kalsium. Sampel darah dan makanan diambil bagi mengkaji tahap kalsium. Pemerhatian yang pertama di dalam kajian ini adalah analisis makanan. Analisis makanan dijalankan bagi menganalisa kandungan kalsium di dalam makanan yang diberi oleh penternak. Kemudian disusuli dengan analisis darah. Sampel diambil sebelum dan selepas kalsium diet tambahan diberi untuk mengetahui tahap kalsium di dalam darah kambing. Sejumlah 45 ekor kambing dipilih di dalam kajian ini. Kalsium penting di dalam diet bagi membentuk tulang yang kuat dan ianya seringkali tidak dititikberatkan. Kekurangan kalsium akan menyebabkan masalah reproduksi. Ini adalah kerana kalsium adalah penting bagi fungsi otot licin. Kajian ini adalah amat penting bagi menekankan kaitan di antara kebuntingan dan laktasi kepada kepekatan kalsium di dalam serum. Hampir kesemua makanan yang diberi oleh penternak tidak mengandungi kalsium yang mencukupi jika dibandingkan dengan kandungan kalsium yang telah diusulkan di dalam kajian-kajian pengkaji lain. Maka, ianya adalah sangat perlu untuk menyediakan kalsium yang mencukupi bagi mengekalkan tahap kalsium di dalam darah dan tulang haiwan. Ujian t bagi min tak bersandar digunakan bagi membandingkan kepekatan kalsium serum di dalam unit mmol/L. Keputusan dilampirkan di dalam min \pm min ralat piawai. Kebarangkalian bagi $p < 0.05$ ditakrif sebagai signifikan bagi ujian statistik. Terdapat perbandingan signifikan yang berlaku di antara kumpulan yang ditentukan dari ujian t bagi fasa selepas pelahiran. Kajian menyatakan bahawa perubahan antara diet tambahan dan tanpa diet tambahan adalah signifikan secara statistic apabila $p < 0.05$. Manakala, perubahan yang signifikan berlaku antara fasa bunting pertengahan dan bunting berat bagi kambing Jamnapari. Sungguhpun begitu, keputusan keseluruhan dari jadual-jadual lain menunjukkan tiada perubahan signifikan yang berlaku pada fasa

yang lain. Akhirnya, didapati kebanyakan jenis makanan adalah kurang kandungan kalsium jika dibandingkan dengan jumlah yang telah diusul oleh kebanyakan pengkaji. Oleh kerana makanan haiwan mengandungi kepekatan kalsium rendah, diet makanan adalah penting bagi menyediakan kalsium kepada kambing. Sumber kalsium di dalam kajian ini adalah dari kulit kerang. Selain dari itu, penurunan dan penaikan kalsium serum berlaku pada kumpulan yang diberi diet tambahan, manakala keadaan sedemikian tidak berlaku pada kumpulan yang tidak diberi diet tambahan. Keadaan menerangkan bahawa tahap kalsium serum bagi fasa bunting dan laktasi adalah tidak boleh dijangka. Situasi ini berlaku adalah mungkin disebabkan oleh beberapa faktor seperti kepekatan hormon (progesteron and estrogen), nutrisi, perkumuhan (tinja, urin, peluh) dan proses pembentukan dan pemineralan rangka. Selain dari itu, tiada perubahan signifikan berlaku bagi kalsium serum semasa tempoh bunting dan selepas kelahiran yang berlaku bagi dua baka yang berbeza. Akhir sekali, melalui keseluruhan pemerhatian dari kajian ini didapati haiwan yang diberi diet tambahan mengekalkan tahap kalsium di antara julat normal dan ianya meningkat secara bersesuaian bagi kedua-dua baka.

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I Certify that the Thesis Examination Committee has met on 21 June 2016 to conduct the final examination of Husna Fasiah Binti Mohd Yusoff on her thesis entitled “Supplementation of Cockle Shells-Derived Calcium Maintains Appropriate Serum Calcium Level in Pregnant and Lactating Jamnapari and Boer Goats” in accordance with the Universities and University College act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The committee recommends that the student be awarded the Master of Science.

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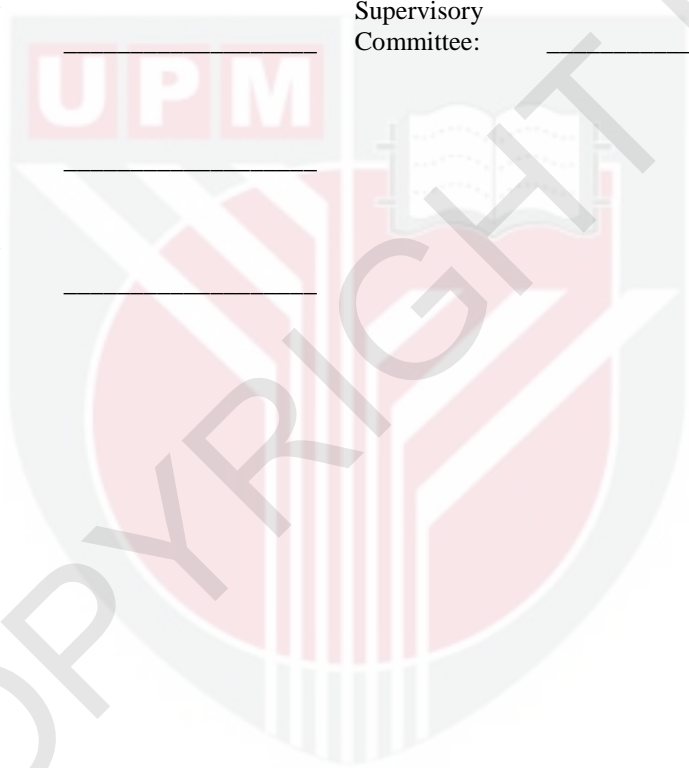


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LIST OF ABBREVIATIONS

CaCO ₃	Calcium Carbonate
HCL	Hydrochloric Acid
DM	Dry Matter
CP	Crude Protein
Kg	Kilogram
g	Gram
mg	Milligram
L	Litre
Mmol	Millimole
DVS	Department of Veterinary Services



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CHAPTER 1

INTRODUCTION

Goat's feed can be divided into two types; roughage and concentrate. Roughage is high in fiber. It comes from plants and can be divided into two types which are grasses and browse (leaves, twigs and shoots). Hay and straw are roughages that have been cut and cured, and making it ideal for storage. While, concentrate are complementary to roughages and usually refer to grain. It is commonly low in fiber but high in energy or protein (Cheryl, 2010). These two types of feed are very essential in a goat's diet. In fact, the optimum nutrition and better care of pregnant does are very important to achieve. If the deficiency in any of the necessary nutrients such as mineral likes calcium, it will affect the growth of the foetus. Fetuses put at 80% of their growth during the last few weeks of pregnancy. In four season countries, does are usually supplied with specially formulated and balanced goat pellets, goat mash, cracked corn or barley (Barbara, 2005). Some common feeds in other countries are corn, oats, barley and soybean (Cheryl, 2010). In summer, the goats will browse their own feed on pasture or on weed. While during the winter season, if the does live in an area where foraging is a possibility year round, the farmers keep their goats grazing or provide hay (Yvonne, 2012).

There are different types of goat's feed in certain part of Asia such as in Thailand and Indonesia. Leucaena is preferred in these two countries as a supplement to complete the diet. In fact, it is a plant that favoured by goats in parts of the tropics. Goats also been supplemented with another type of common feed, for example, in Thailand they were fed with cereal crop residues which increased the dry matter intakes and digestibility of the basal diet. In the previous research, it has been reported that the total dry matter intake of goats given Leucaena was higher than those given soybean meals (Aung, 2007). Leucaena leaf seemed to have higher calcium content than that was observed in grasses fed to the animals. Body weight of goats in the Leucaena consumption group tended to be higher than that of control animals (Maki *et al.*, 2004). In Indonesia, the roughage used can be divided into four groups: Legumes (Sesbania sesban, Leucaena and Kancu leaf), grass (king grass and native grass), leaves (jackfruit, banana, and mahogany) and agriculture waste products (Corn stover and dry cassava tuber skin) (Kustantinah *et al.*, 2005). Even though leucaena is widely used as a supplement that rich in protein and calcium (Maki *et al.*, 2004) around the Asia, unfortunately research made by Colin (1963), Jabbar *et al.* (1996) and Peter (1994) are against the statement by reporting that leucaena contains anti-nutritional factors in the leaves and harmful used in livestock feeding. The anti-nutritional for leucaena is mimosine (Colin, 1963; Jabbar *et al.*, 1996; Peter, 1994). Concern has arisen after the importance of this plant to the animals as a supplement increased. In addition, there are bad effects on the consumption of the mimosine to the ruminant. Research made by the report of the Philippine council for agricultural and resources, research and the united states national academy of sciences (1997) reported that the main symptoms of toxicity in ruminants

are poor growth, loss of hair and wool, swollen and raw coronets above the hooves, lameness, mouth and esophagus lesion, and depresses the serum thyroxin level. Reduction in pregnancy production due to leucaena feeding has also been noted (Jones *et al.*, 1989).

Contrarily, there are different varieties of feed commonly used in Malaysia for ruminants. Examples of the feeds are Napier grass, silage, soy waste, and concentrate. Napier is widely used in Malaysia as a main source of roughage. It has high cellulosic fiber content and is, therefore, an excellent cheap feedstock. Some of it does not need nitrogenous fertilizer to grow fast and it gives an advantage to the farmer to cut the cost. In addition, nitrogen fertilizer is not good for the environment as it requires the greatest amount of fossil fuel energy to produce chemicals and by avoiding their use, greenhouse gas emissions are also can be avoided. The advantage of using Napier is, it can propagate easily; it has the soft stem that is easy to cut; it has deep roots; so is fairly drought resistant; the tender young leaves are excellent animal feed and it grows very fast compared to other type of grass (Roland, 2012).

Even though, there are lots of advantages of using Napier in a goat's diet. Unfortunately, it contains low calcium content and high oxalate level. Thus, with the increase of Napier silage intake, there was a significant increase of oxalate too, with subsequent increase of the calcium excretion through feces (Das *et al.*, 2010). Hsieh-Weinchang *et al.* (2004) reported a higher oxalate in feces by feeding high amount of Napier grass as well. Dodson (1959) found a portion of oxalates is degraded in rumen with the probable formation of carbonate and bicarbonate. Moreover, the soluble part of oxalate also bind with available calcium in the rumen and excreted in feces. This is the probable cause of calcium deficiency occur in pregnant does (Das, *et al.*, 2010).

There are few reproductive problems that happen due to deficiency of calcium. One of the problems is the uterine prolapse. Uterine prolapse occurs within 12-18 hours after kidding or causes a difficult delivery (George and Paula, 2011). The study made by Pugh and Baird (2012) found that hypocalcaemia can contribute to flaccid that predisposed to uterine prolapse. If the deficiency of calcium is suspected, the female should be given a calcium solution as oxytocin is indicated to aid uterine contraction. Other than that, hypocalcaemia can also overlap with the clinical sign of pregnancy toxemia as these two diseases often seen as concurrent. Animals will recumbent and paralyzed due to this problem. This happens because little to no calcium is available to release acetylcholine at the neuromuscular junction and influence muscle contractibility (Pugh and Baird, 2012). The other problem caused due to hypocalcaemia is dystocia (Jill *et al.*, 2008).

Thus, it is important for the goats to consume enough calcium in order to maintain adequate blood and bone calcium levels. If calcium level drops below normal, calcium will be mobilized from the bone and passed into the blood in order to maintain blood calcium levels (Linda *et al.*, 2004). A calcium supplement is very important to the goats in order to avoid these problems from happening. The common calcium

supplement used by the local feed industry in Malaysia is derived from limestone (Raghavan, 2000). Calcium supplementation is still practiced in this sector, as the calcium absorption process can be easily accomplished by the addition of calcium carbonate (feed grade limestone). The example of calcium supplement sells for livestock consumption is by Jolly German Livestock Supplies-Dolomite (Limestone) by The Jolly German, Pete Lien and sons in depositing mined in northern Colorado and southern Wyoming and much more company who sell calcium supplement for livestock consumption. Malaysia also produces calcium limestone powder for animals' consumption in local industries. The example of the company is in Pulai calcium carbonate industries Sdn Bhd. It was incorporated in 1995 with modest start in Ipoh, Malaysia. From the entire example above, it shows really wide production of calcium supplement produce by using limestone source. In addition, Department of Veterinary Services (2009) suggest that calcium level for pregnant goats should be around 2 grams/ day for each head.

A calcium supplement is usually produced via CaCO_3 sources that are from limestone, which is obtained through mining and quarrying limestone hills. Yet, this study also able to exploit the vast availability of waste resources in Malaysia, which is cockle shell. Cockle shell had been chosen in this study as the source of calcium supplement to the pregnant does. As shells are very similar to bones and predominantly aragonite form of CaCO_3 that can provide the strong basis for the calcium potential source (Hemabarathy *et al.*, 2014), this study was conducted to analyze the calcium level after supplementation with this cockle shell powder. The shells represent a huge portion of waste products after the consumption of mussels. This was happening as it is widely consumed in South East Asian countries in various delicacies. The research is environmentally friendly and could be scaled up for industrial production, as it permitted a greener synthesis of naturally available material and utilizing the waste shells that are the by-product of one of the important seafood industry in Malaysia (Kamba *et al.*, 2013). Research by Awang-Hazmi *et al.* (2007), Islam *et al.* (2012) and Zuki *et al.* (2004) had found that potential use of the cockle shell based CaCO_3 powder as a source of biominerals for bone tissue applications. Thus, it shows CaCO_3 from cockle shell is very safe for animal consumption. A study by Awang-Hazmi *et al.* (2007) and Zuki *et al.* (2004) found that overall mineral composition of cockle shells of Peninsular Malaysia are CaCO_3 98.7%; Mg 0.05%; Na 0.9%; P 0.02%; others 0.2%. And CaCO_3 97.6%-98.7%; Mg 0.2%-0.52%; Na 0.72%-0.96%; P 0.02% - 0.05%; the rest was identified as another, respectively. Those studies proved there is high CaCO_3 contain in cockle shells and can make full use of it.

Hypothesis

Through this research, animal with calcium supplement maintain their normal calcium level in the body within the range and the level keep on increase appropriately for both breeds.

1.1 Significant of Study

This study is very significant to highlight the effect of pregnancy and lactation on the calcium concentration in goat's blood serum with the calcium supplement in two breed of goats, Jamnapari and Boer. The findings benefit the ruminant industry in Malaysia. As farmers will be more aware of the importance of providing sufficient calcium to their animals during pregnancy and post-delivery as the calcium level will be more fluctuate and imbalance during these stages.

1.2 Problem Statement

Most of the studies carried out so far were related to calcium concentration in blood serum during pregnancy and lactation period were only held in foreign countries. In addition, there are limited numbers of pregnant goats present in about the same age, weight and body score make the research more challenging. Besides that, the cockle shells powder productions are very hard to produce manually by using 90µm siever.

1.3 Research Objectives

The general aim of this research was to evaluate the effects of oral supplementation of cockle shell-derived CaCO_3 on calcium level in the blood between pregnant and lactating goat.

The specific objectives are:

- i. To analyze and determine the calcium level in goat's diet.
- ii. To determine the serum calcium level during pregnancy until post-delivery (with and without supplementation).
- iii. To determine the serum calcium level during pregnancy until post-delivery between two breeds of goats.

REFERENCES

- Abate, A. (1992). Analysis of the Kenyan Dairy Industry in the Last Decade: Constraints and Options. In *Proceeding of a Workshop on Priority Setting in Dairy Cattle Research, held at the National Agricultural Research Centre (NARC), Muguga, Kenya, 4 - 9 May, 1992*.
- Abrams, S.A., Sidbury, J.B., Muenzer, J., Esteban, N.V., Viera, N.E., & Yergey, A. L. (1991). Stable isotopic measurement of endogenous fecal calcium excretion in children. Title. *Journal of Pediatric Gastroenterology and Nutrition*, 12(4), 469–473.
- Acero-Camelo, A., Valencia, E., Rodríguez, A., & Randel, P. F. (2008). Effects of flushing with two energy levels on goat reproductive performance. *Livestock Research for Rural Development*, 20(9), 2–5.
- Acurero, M. (2000). Estrategias de suplementación en ovejas. Centro de Investigaciones Agropecuarias del Estado de Zulia. In *FONAIAP Divulga No. 66*. (p. 3).
- Adrienne, S.E., Howard, H.M.H.A. (2008). Dietary Calcium Supplementation to lower Blood Lead Level in Pregnancy and Lactation. *Journal of Nutritional Biochemistry*, 18(3), 172–178.
- Agriculture and Food Research Council, AFRC. (1998). The nutrition of goats. Technical committee on responses to nutrients report no 10 cab international (p. 137).
- Ahmed, M.M., Siham, K. A., & Barri, M. E. S. (2000). Macromineral profile in the plasma of 185 Nubian goats as affected by the physiological state. *Small Ruminant Research*, 38(3), 249–254.
- Aida, A., Pop, L.M., & Cristina, R. (2012). Calcium (Ca) and phosphorus concentration in dairy cow feeds, university of agricultural sciences and veterinary medicine Iasi Romania. *University of Agricultural Sciences and Veterinary Medicine Iasi*, 57, 70–74.
- Albright, F., & Reifensstein, E. C. (1984). Parathyroid Glands and Metabolic Bone Disease. Williams & Wilkins, Baltimore. *American Journal of Medicine*, 7(6), 844–846.
- Alemu, Y., Sileshi, Zewdie, E.D., Merkel, R.C., & Lawson, L. (2009). Bloat in sheep and goats : causes prevention and treatment. Ethiopia sheep and goat productivity improvement program. In *Technical Bulletin No 31* (pp. 1–9).
- Ali, F., Lodhi, L.A., Qureshi, Z.I., Samad, H.A., & Shahid, R. U. (2004). Some serum biochemical constituents of mares during different phases of reproductive cycle. *Pakistan Veterinary Journal*, 24(3), 147–152.

- Allen, W.M., & Sansom, B. F. (1986). Metabolic disorders. In *Howard JL ed. Current Veterinary Therapy: Food Animal Practice*. (pp. 311–322). W.B. Saunders, Philadelphia.
- Allison, M.J., Cook, H.M., & Dawson, K. A. (1981). Selection of oxalate degrading rumen bacteria in continuous culture. *Journal of Animal Science*, *53*, 1233–1238.
- Alwan, A.F., Amin, F.A.M., & Ibrahim, N. S. (2010). Blood progesterone and estrogen hormones level during pregnancy and after birth in Iraqi sheep and goat. *Basrah Journal of Veterinary Research*, (10), 153.
- Antonello, C., Giuseppe, P., & Ana, H. D. F. (2005). Dairy Goats Feeding and Nutrition (pp. 26–38).
- Arnold, G.W., & Hill, J. L. (1972). Chemical factors affecting selection of food plants by ruminants. In *Phytochemical Ecology Animal Proc. Phytochem, Harborne* (pp. 71–101).
- Arnold, G. W. (1985). Ingestive behaviour. In *World Animal Science. 5. Ethology of Farm Animals. Neimann-Sorensen* (pp. 183–198).
- Aung. (2007). Investigation on the control of its toxicity in small ruminants. In *Feeding of Leucaena Mimosine on small ruminants* (pp. 14–15).
- Awang-Hazmi, A.J., Zuki, A.B.Z., Noordin, M.M., Jalila, A., & Norimah, Y. (2007). Mineral composition of the cockle (*Anadara granosa*) shells of west coast of Peninsular Malaysia and its potential as biomaterial for use in bone repair. *Journal of Animal and Veterinary Advances.*, *6*(5), 591–594.
- Ayo, J.O., Minka, N.S., Sackey, A.K.B., & Adelaiye, A. B. (2009). Responses of serum electrolytes of goats to twelve hours of road transportation during the hot-dry season in Nigeria, and the effect of pretreatment with ascorbic acid. *The Onderstepoort Journal of Veterinary Research.*, *76*, 409–418.
- Azab, M.E., & Abdel-Maksoud, H. A. (1999). Changes in some haematological and biochemical parameters during pre-partum and post-partum periods in female Baladi goats. *Small Ruminant Research*, *34*, 77–85.
- Baranow-Baranowski S., & Klata W.O.W. (2001). Effect of season and maintenance system on content of Ca, Mg, P and AP activity in cows' blood serum. (p. 8).
- Barbara, V. (2005). Farming meat goats. In *Breeding, production and marketing* (pp. 53–54).
- Barros, M.C., Bello, P.M., Bao, M., & Torrado, J. J. (2009). From Waste to Commodity: Transforming Shells into High Purity Calcium Carbonate. *Journal of Cleaner Production.*, *17*(3), 400–407.
- Bertoni, G., Piccioli Cappelli, F., Baldi, A., Borghese, A., Duranti, E., Falasachini, A., Formigoni, A., Grasso, F., Lacetera, N., Lupi, P., Meluzzi, A., Pinna, W., Rosi, F., Stefanon, B., Zicarelli, L., Bernabucci, U., Campanile, G., Moniello, G., & Tr,

- M. F. (2000). Progress in Nutrition. In *Interpretation of metabolic profiles in farming animal*. (pp. 51–76).
- Bhat, M.S., Shaheen, M., Zaman, R., & Muhee, A. (2011). Mineral inter-relationship among soil, forage and dairy cattle in Kashmir India. *Vet World.*, 4(12), 550–553.
- Bisant, K. (2010). Consumer preference for goat meat in Malaysia: market opportunities and potential. *Journal of Agribusiness Marketing.*, 3, 40–55.
- Blaney, B.J., Gartner, R.J.W., & Mc Kenzie, R. A. (1981). The inability of horses to absorb calcium from calcium oxalate. *Journal of Agriculture Science Cambridge.*, 97, 639–641.
- Blood, D.C., & Studdert, V. P. (1999). *Saunders comprehensive veterinary dictionary* (p. 1189). W B Saunders London.
- Boass, A., Garner, S.C., Schultz, V.L., & Toverud, S. U. (1997). Regulation of serum calcitriol by serum ionized calcium in rats during pregnancy and lactation. *Journal of Bone and Mineral Research*, 12, 909–914.
- Boey, P.L., Maniam, G.P., Abd Hamid, S., & Ali, D. M. H. (2011). Utilization of waste cockle shell (*Anadara granosa*) in biodiesel production from palm olein: Optimization using response surface methodology. *Fuel*, 90, 2353–2358.
- Bo-Linn, G.W., Davis, G.R., Buddrus, D.J., Morawski, S.G., Santa Ana, C., & Fordtran, J. S. (1984). An evaluation of the importance of gastric acid secretion in the absorption of dietary calcium. *The Journal of Clinical Investigation.*, 73(3), 640–647.
- Brian, F. (2009). *Common sense meat goat-nutrition*. Available from: <http://www.kikogoats.com/Goat%20Nutrition%20and%20Feeding%20-Kiko%20Compatibility%20Mode.pdf>.
- Brommage, R., Binacua, C., & Carrie, A. L. (1993). Ovulation associated increase in intestinal calcium absorption during the rat estrous cycle is blunted by ovariectomy. *Biology of Reproduction.*, 49(3), 544–548.
- Bruce, C. (2002). *Supplement Feeding Of Dairy Sheep And Goats On Intensively Managed Pastures*. University of New Hampshire Cooperative Extension Durham, New Hampshire (pp. 66-77).
- Caldeira, R.M., Belo, A.T., Santos, C.C., Vazques, M.I., & Portugal, A. V. (2007). The effect of long-term feed restriction and over-nutrition on body condition score, blood metabolites and hormonal profiles in ewes. *Small Ruminant Research.*, 68(242), 255.
- Carnegie, J.A., & Tsang, B. K. (1984). The calcium calmodulin system; participation in the regulation of steroidogenesis activity at different stages of granulose cell differentiation. *Biology of Reproduction.*, 30, 515–522.
- Carol, A. (2013). Everything You Need to Know, Updated and Revised. In *How to*

Raise Goats. (pp. 140–142).

- Ceylan, A., Serin, I., Aksit, H., & Seyrek, K. (2008). Concentrations of some elements in dairy cows with reproductive disorders. *The Bulletin of the Veterinary Institute in Pulawy.*, 52, 109–112.
- Chang, F., Li, G., Haws, M., & Niu, T. (2007). Element concentrations in shell of *Pinctada margaritifera* from French Polynesia and evaluation for using as a food supplement. *Food Chemistry.*, 104(3), 1171–1176.
- Chao, C.C., Brown, R.D., & Deftos, L. J. (1985). Metabolism of calcium and phosphorus during pregnancy and lactation in white-tailed deer. *Acta Endocrinol (Copenh)* ., 109, 269–275.
- Cheeke, P.R., & Hull, L. R. (1985). *Natural toxicants in feeds poisonous plants* AVI. co USA (p. 492).
- Chen, J., & Xiang, L. (2009). Controllable synthesis of calcium carbonate polymorphs at different temperatures. *Powder Technology.*, 189, 64–69.
- Cheryl, K. S. (2010). Cheryl, K.S. In *Raising Goats for Dummies.* (pp. 84–87).
- Chisowa, D. M., & Mwenya, J. (2013). Evaluation of *Leucaena leucocephala*, *Caliandra calothyrsus*, *Gliricidia sepium* and *Sesbania sesban* leaves as basal feeds for growing rabbits (*oryctolagus cuniculus*). *European Academic Research.*, 1(8), 1935–1952.
- Claps, S., Rubino, R., & Fedele, V. (1997). Feeding behaviour of grazing and zero-grazing goats fed with the same herbage. In I. Lindberg, J.E. Gonda, H.L. Ledin (Ed.), *Recent advances in small ruminant nutrition Zaragoza : CIHEAM Options Méditerranéennes : Série A. Séminaires Méditerranéens.* (pp. 79–82).
- Colin, P., Chris, C., Kathy, P., Jennifer, W., & Janet, K. (2009). No Title. In *Sheep and goat management in Alberta, Alberta lamb producers and Alberta goats breeders association.* (pp. 100–176).
- Colin, S. E. (1963). Establishment and nodulation in *Leucaena Glauca*. In *Thesis. Inter-America of agriculture sciences of the O.A.S Turrialba-Costa Rica.* (pp. 5–8).
- Corbett, R. (2008). Mineral for beef cattle. available online at http://en.engormix.com/MA-beef-cattle/article/minerals-beef_cattle_936.htm.
- Costanzo, L. S. (1985). Localization of diuretic action in microperfused rat distal tubules: Ca and Na transport. *American Journal of Physiology.*, 248, 527–535.
- Curhan, G.C., Willett, W.C., Speizer, F.E., Spiegelman, D., & Stampfer, M. J. (1997). Comparison of dietary calcium with supplemental calcium and other nutrients as factors affecting kidney stones in women. *Annals of Internal Medicine.*, 127(9), 846.
- Daramola, J.O., Adeloye, A.A., Fatoba, T.A., & Soladoye, A. O. (2005).

- Haematological and biochemical parameters of West African Dwarf goats. *Livestock Research for Rural Development*, 17(8), 2–15.
- Das, N.G., Huque, K.S., Alam, M.R., Sultana, N., & Amanullah, S. M. (2010). Effects of oxalate intake on calcium and phosphorus balance in bulls fed Napier silage (*Pennisetum purpureum*). *Journal of Animal Science*, 39(1), 58–66.
- David, A. T. (2006). Animal Feeds, Feeding and Nutrition, and Ration Evaluation CD-ROM (pp. 432-648).
- De Nicolo, G., Parkinson, T.J., Kenyon, P.R., Morel, P.C.H., & Morris, S. T. (2009). Plasma progesterone concentrations during early pregnancy in spring- and autumn-bred ewes. *Animal Reproduction Science*, 111, 279–288.
- Dendougui, F., & Schwedt, G. (2004). In vitro analysis of binding capacities of calcium to phytic acid in different food samples. *European Food Research and Technology*, 219(4), 409–415.
- Department of Veterinary Services. (2009). Nutrient composition of Malaysian feed materials and guides to feeding of cattle and goats. In *Feeding Guide Series* (2nd ed., pp. 1–55).
- Devendra, C. (2006). Enhancing animal protein supplies in Malaysia. In *Opportunities and challenges*. Kuala Lumpur: Academy of Sciences Malaysia.
- Devendra, C. (1986). Prospect for developing small ruminant in humid tropical asia. In Timon V.M & Hanrahan. In J. . Timon V.M., Hanrahan (Ed.), *Animal health and production paper (FAO) no 58 expert consultation on increasing small ruminant production* (pp. 184–198).
- Diego, M., & Gimenez, J. (1994). Nutrient Requirements of Sheep and Goats. *Extension Animal Scientist*, 2–7.
- Dinamani, M., Vishnu, K.P., & Sheshadri, R. (2002). Electrochemical synthesis of calcium carbonate coatings on stainless substrates. *Material Research Bulletin*, 37, 661–669.
- Dodson, M. E. (1959). Oxalate ingestion studies in the sheep. *Australian Veterinary Journal*, 35, 225.
- Dong, N.T.K., Elwinger, K. Lindberg, J.E., & Ogle, R. B. (2005). Effect of replacing soybean meal with soya waste and fish meal with ensiled shrimp waste on the performance of growing crossbred ducks. *Asian-Australian Journal of Animal Science*, 18, 825–834.
- Drackley, J. R. (1999). Biology of dairy cows during the transition period: the final frontier? *Journal of Dairy Science*, 82, 2259–2273.
- Dumont, B. (1995). Déterminisme des choix alimentaires des herbivore au pâturage: principales théories. *Inra Productions Animales*, 8(4), 285–292.

- Elbert, L., Little, J.R., & Roger, G. S. (2003). *Koa Haole, Leucaena Agriculture handbook no 679*.
- Faez, F.J.A., Abdinasir, Y.O., Yusuf, A., Lawan, A., Konto, M., Abdulnasir, T., Anis, A.M., Abdul, A.S., & Wahid, A. H. (2014). . Stage two milk fever in dairy cow: a case report. *Journal of Agriculture and Veterinary Science.*, 7(1), 71–73.
- Falade, F. (1995). An Investigation of Periwinkle Shells as Coarse Aggregate in Concrete. *Building and Environment.*, 30(4), 573–577.
- Fedele, V., Pizzilo, M., Claps, S., Morand-Fehr, P., & Rubino, R. (1993). Grazing behaviour and diet selection of goats on native pasture in Southern Italy. *Small Ruminant.*, 1, 305–322.
- Fernandez, E., Lavecchia, C., Davanzo, B., Franceschi, S., Negri, E., & Parazzini, F. (1996). Oral contraceptives, hormone replacement therapy and the risk of colorectal cancer. *The British Journal of Cancer.*, 73, 1431–1435.
- Francavilla, A., Di Leo, A., Polimeno, L., Conte, D., Barone, M., Fanitta, G., Chiumarulo, C., Rizzo, G., & Rubino, M. (1987). Nuclear and cytosolic estrogen receptors in human colon carcinoma and in surrounding noncancerous colonic tissue. *Gastroenterology.*, 93, 1301–1306.
- Frank, C.C., Leroy, O.M., Richard, A., Nelson, L., & Ross, H. A. P. (1962). Relationship Between Calcium in Sweat, Calcium Balance, and Calcium Requirements. *Journal of Nutrition.*, 78, 78–88.
- Fredeen, A. H., & Van Kessel, J. S. (1990). . Effect of sudden loss of Ca resorption in mature sheep. *Canadian Journal of Animal Science.*, 70, 884–887.
- Fubini, S. L., & Ducharme, G. N. (2006). Surgical Conditions of the Post Partum Period. In *Text Book of Farm Animal Surgery*. (pp. 333–338).
- Fukui, Y., & Fujimoto, K. (2012). Bioinspired nanoreactor based on miniemulsion system to create organic-inorganic hybrid nanoparticle and nanofilm. *Journal of Material Chemistry.*, 22(8), 3493–3499.
- Gabryszuk, M. (1992). Calcium in nutrition of ruminants. *Post Nauk Rol*, (1), 83–94.
- Gadberry, S. (2009). Composition of Some Livestock Feeds, Division of Agriculture, University of Arkansas. *Agriculture and Natural Resources*, 1–5.
- Gallagher, J.C., Riggs, B.L., Eisman, J., Hamstra, A., Arnoud, S.B., & DeLuca, H. F. (1979). Intestinal calcium absorption and serum vitamin D metabolites in normal subjects and osteoporotic patients. *The Journal of Clinical Investigation.*, 64, 729–736.
- Garner, S.C., Peng, T.C., & Toverud, S. U. (1988). Modulation of serum parathyroid hormone and ionized calcium concentrations during reproduction in rats fed a low calcium diet. *Journal of Bone and Mineral Research.*, 3, 319–323.

- George, C., Fthenakis., & Paula, M. (2011). No Title. In *Therapeutics and Control of Sheep and Goat Diseases, An Issue of Veterinary clinics of North America, food animal practice.* (Vol. 27, pp. 20–55).
- Georgievskii, V. I., Annenkov, B.N., & Samokhin, V. T. (1982). Mineral Nutrition of Animals. In *Mineral Nutrition of Animals.* (p. 368).
- Gerald, E.H., Carolyn, L.S., Nyles, G.P., Anne, V.R., Barbara, A.R., & Juan, N. G. (2008). Alfalfa utilization by livestock. *University of California Agriculture and Natural Resources*, 24(17), 2–16.
- Gesek, F.A., & Friedman, P. A. (1992). Mechanism of calcium transport stimulated by chlorothiazide in mouse distal convoluted tubule cells. *The Journal of Clinical Investigation.*, 90, 429–438.
- Guo, J., Peters, R.R., & Kohn, R. A. (2007). Effect of a transition diet on production performance and metabolism in periparturient dairy cows. *Journal of Dairy Science.*, 90, 5247–5558.
- Hale, C., & Olson, K. C. (2001). Minerals supplements for beef cattle. *MU Extinction University of Missouri Columbia.*, 2–8.
- Harvey, J. A. (1990). Superior calcium absorption from calcium citrate than calcium carbonate using external forearm counting. *Journal of the American College of Nutrition.*, 9(6), 583–587.
- Hazurina, N.O., Bakar A.B.H., Megat J.M.A., & Mat, D. (2013). Potential Use of Cockle (*Anadara granosa*) Shell Ash as Partial Cement Replacement in Concrete. *Caspian Journal of Applied Sciences Research*, 369–376.
- Heaney, R.P., & Recker, R. R. (1994). Determinants of endogeneous fecal calcium in healthy women. *Journal of Bone and Mineral Research.*, 9(10), 1621–1627.
- Heaney, R.P., Dowell, M.S., & Barger-Lux, M. J. (1999). Absorption of calcium as the carbonate and citrate salts, with some observations on method. *Osteoporosis International.*, 9(1), 19–23.
- Heaney, R.P., Robert, R.R., & Connie, M. W. (1990). Absorbability of calcium sources: the limited role of solubility. *Calcified Tissue International.*, 46(5), 300–304.
- Heaney, R.P., Smith, K.T., Recker, R.R., & Hinders, S. M. (1989). Meal effects on calcium absorption. *The American Journal of Clinical Nutrition.*, 49(2), 372–376.
- Heaney, R. P. (1991). Calcium supplements: practical considerations. *Osteoporosis International.*, 1(2), 65–71.
- Hemabarathy, B., Zuki, A.B.Z., Enoch, K.P., Loqman, M.Y. , & Muhajir, H. (2014). Mineral and Physiochemical Evaluation of Cockle Shell (*Anadara granosa*) and other Selected Molluscan Shell as Potential Biomaterials. *Sains Malaysiana.*, 43(7), 1023–1029.

- Hendrickse, C.W., Jones, C.E., Donovan, I.A., Neoptolemos, J.P., & Baker, P. R. (1993). Oestrogen and progesterone receptors in colorectal cancer and human colonic cancer cell lines. *British Journal of Surgery.*, *80*, 636–640.
- Herath, H. M. I., Bandara, D.C., & Banda, D. M. G. A. (2000). Effect of pre-harvest calcium application level for the post-harvest keeping quality in Mauritius pineapple. *Tropical Agricultural Research.*, *12*, 408–411.
- Hoenderop, J.G., Muller, D., Suzuki, M., Van, O.C.H., & Bindels, R. J. (2000). Epithelial calcium channel: gate-keeper of active calcium reabsorption. In *Current Opinion in Nephrology and Hypertension*. (pp. 335–340).
- Holdsworth, R.J., Heap, R.B., Goode, J., Peake, M., & Walters, D. E. (1983). Mammary uptake and metabolism of progesterone in goats and its effect on milk progesterone concentrations during the oestrus cycle and early pregnancy. *Journal of Endocrinology.*, *98*, 263–270.
- Holmberg-Marttila D., Leino, A., & Sievänen, H. (2003). Bone turnover markers during lactation postpartum amenorrhoea and resumption of menses. *Osteoporos.*, *14*, 103–109.
- Hsieh-WeinChang., Wang-De, C., Yan-Shen, S., & C.-Y. (2004). Comparison of different oxalate contents of Napier grass fed to yellow cattle and goats. *Taiwan Livestock Research Journal.*, *37*(4), 313–322.
- Huque, K.S., Amanullah, S.M., & Islam, M. M. (2006). Impacts of fodder crop introduction into farming systems of selected areas on smallholder dairy development in Bangladesh annual report (2005 and 2006). *Bangladesh Livestock Research Institute Savar.*, *1341*, 107–109.
- Hussain, M. Z., Naidu, R., Turuki, I., & Singh, R. (1983). *Wild Animal Review.*, *48*, 25–32.
- Paula, I.M. (2015). Parturient Paresis in Sheep and Goats. In *The Merck Veterinary Manual* Retrieved from: http://www.merckvetmanual.com/mvm/metabolic_disorders/disorders_of_calcium_metabolism/parturient_paresis_in_sheep_and_goats.html
- Invarlsen, K.C., & Andersen, J. B. (2000). No Title. *Journal of Dairy Science.*, *83*, 1573–1597.
- Isabel, M., Paulo, C.A.P., Fernando, C.F.L., Juliana, C. P., & L. R. F. (2015). Digestibility of pelleted rations containing diverse potato flour and urea. *Animal Production*, *45*(11), 1–6.
- Islam, K.H., Zuki, A.B.Z., Ali, M.E., Zobir, M.H., Noordin, M.M., Loqman, M.Y., Wahid, H., Hakim, M.A., & Sharifah, B. A. H. (2012). Facile synthesis of calcium carbonate nanoparticles from cockle shells. *Journal of Nanomaterials.*, 1–5.
- Islam, K.H., Zuki, A.B.Z., Noordin, M.M., Hussein, M.Z.B., Rahman, N.S.S.B.A., &

- Ali, M. E. (2011). Characterisation of calcium carbonate and its polymorphs from cockle shells (*Anadara granosa*). *Power Technology.*, 213(3), 188–191.
- Jabbar, M.A., Larbi, A., & Reynolds, L. (1996). Socioeconomics and Policy Research Working Paper No 2. In *Alley farming for improving small ruminant productivity in West Africa: ILRI's experiences.* (pp. 35–78).
- James, I.F., & Butcher, J. E. (1972). Halogeton poisoning of sheep effect of high level oxalate intake. *Journal of Animal Science.*, 35, 1233–1238.
- Jill, E.M., Stephen, W.P. , & David, C. (2008). No Title. In *Jill, E.M., Stephen, W.P. and David, C* (pp. 533–534).
- Jill, W.V., Tuan, M.T., Li Zhang, Mark R.K., & Steven, C. H. (1998). Estradiol Enhances Thiazide-sensitive NaCl Cotransporter Density in the Apical Plasma Membrane of the Distal Convoluted Tubule in Ovariectomized Rats. *The Journal of Clinical Investigation.*, 101(8), 1661–1669.
- John, J. (2003). Alfalfa for dairy cattle. *Agriculture and Natural Resources FSA 4000.*, 1–4.
- Johnson, C.L., & Powley, G. (1990). Magnesium metabolism in lactating goats fed on grass diets differing in minerals contents. *Journal of Agriculture Science.*, 114, 133–138.
- Jones, R. M., McLennan, M.W., & Dowsett, K. F. (1989). The effect of *Leucaena leucocephala* on the reproduction of beef cattle grazing *Leucaena*/grass pastures. *Tropical Grasslands.*, 23, 108–114.
- Kader, M.A., & Sylvia, L. (2010). Cytosolic calcium and pH signaling in plants under salinity stress. *Plant Signal Behaviour.*, 5(3), 233–238.
- Kadzere, C. T., Llewelyn, C.A., & Chivandi, E. (1996). Plasma progesterone, calcium, magnesium and zinc concentrations from oestrus synchronization to weaning in indigenous goats in Zimbabwe. *Small Ruminant Research.*, 24(1), 21–26.
- Kalkwarf, H.J., Specker, B. L. Bianchi, D.C. Ranz, J., & Ho, M. (1997). The effect of calcium supplementation on bone density during lactation and after weaning. *New England Journal of Medicine.*, 337(8), 523–528.
- Kalkwarf, H. J. (2004). Lactation and maternal bone health. *Advances in Experimental Medicine and Biology.* , 554, 101–114.
- Kamba, A. S., Ismail, M., Azmi, T., Ibrahim, T., Abu, Z., & Zakaria, B. (2013). Synthesis and Characterisation of Calcium Carbonate Aragonite Nanocrystals from Cockle Shell Powder (*Anadara granosa*), 2013.
- Kerr, C., Loken, H.F., Glendenning, M.B., & Gordon, C. S. (1962). Calcium and phosphorus dynamics in pregnancy. *American Journal of Obstetrics and Gynecology.*, 83, 2–8.

- Khaled, N. F., Illek., & Gajdusek, S. (1999). Interaction between nutrition, blood metabolic profile and milk composition in dairy goats. *Acta Veterinaria Brunensis.*, 68, 253–258.
- Khan, J.R., & Ludri, R. S. (2002-a). Changes in blood glucose, plasma non-esterified fatty acids and insulin in pregnant and non-pregnant goats. *Tropical Animal Health and Production.*, 34, 81–90.
- Khan, J.R., & Ludri, R. S. (2002-b). Hormone profile of crossbred goats during the periparturient period. *Tropical Animal Health and Production.*, 34, 151–162.
- Khan, Z.I., Hussain, A., Ashraf, M., Asyraf, M.Y., & Mc, D. L. R. (2007). Macromineral status of grazing sheep in a semi-arid region of Pakistan. *Small Ruminant Research.*, 68, 279–284.
- Khan, M. A. (1993). *Effects of oestrogens on the fluid balance in ovariectomized rats* (pp. 88-279).
- Kida, Y., Ueda, H., Tanaka, H., & Ichinose, M. (2007). Estimation of protein intake using urinary urea nitrogen in patients with early-stage liver cirrhosis. *Hepatology International.*, 1, 382–386.
- Klopfenstein, T. J., Angel, R., Cromwell, G., Erickson, G.E., Fox, D.G., Parsons, C., S.L.D., & Sutton, A. L. (2002). Animal Diet Modification to Decrease the Potential for Nitrogen and Phosphorus Pollution. *Animal Science*, (21), 1–16.
- Kovacs, C.S., & Kronenberg, H. M. (1997). Maternal-fetal calcium and bone metabolism during pregnancy, puerperium, and lactation. *Endocrine Reviews.*, 18(6), 832–872.
- Kovacs, C. S. (2008). Vitamin D in pregnancy and lactation: maternal, fetal, and neonatal outcomes from human and animal studies1,2,3,4. *American Journal of Clinical Nutrition.*, 88, 520–528.
- Krajnicakova , M., Kovae, N.S., Kostecky, M., Valocky, I., Maraeeek, I., S. I., & Lenhart, L. (2003). Selected clinic-biochemical parameters in the puerperal period of goats. *Bulletin of the Veterinary Institute in Pulawy.*, 47, 275–279.
- Kusina, N.T., Chinuwo, T., Hamudikuwanda, H., Ndlovu, L. R., & Muzanenhamo, S. (2001). Effect of different dietary energy level intakes on efficiency of estrus synchronization and fertility in Mashona goat does. *Small Ruminant Research.*, 39(3), 283–288.
- Kustantinah., Hartadi, H., Yusiati, L.M. Utomo, R., Agus, A., Suhartanto, B., Holil, F., & Dahono, E. (2005). Effect of supplementation of protein feeds to various roughages as a basal feed on the performance of Bligon goats. *MeKarn Project*, 29(4), 163–168.
- Lewis, G. S., Lishman, A.W., Butcher, R.L., Dailey, R.A., & Inskeep, E. . (1981). Factors affecting function of induced corpora lutea in postpartum anestrous ewes. *Journal of Animal Science.*, 52, 1122–1129.

- Lewis, G. S. (2010). Pregnancy rates after ewes were treated with estradiol-17 β and oxytocin. *Sheep and Goat Research Journal.*, 25, 21–25.
- Liesegang, A., Risteli, J., & Warner, M. (2007). Bone metabolism of milk goats and sheep during 2nd pregnancy and lactation in comparison to first lactation. *Journal of Animal Physiology and Animal Nutrition.*, 91, 217–225.
- Linda, H., Vanessa, A.F., & Veronica, A. M. (2004). Calcium Supplement Guidelines. In *Calcium Supplement Guidelines.* (pp. 1–4).
- Luginbuhl, J. M., & Poore, M. H. (1998). Nutrition of Meat Goats. Retrieved from http://www.cals.ncsu.edu/an_sci/extension/animal/meatgoat/MGNutr.htm.
- Luqmani, Y.A., Ryall, G., Shousha, S., & Coombes, R. C. (1992). An immunohistochemical survey of pS2 expression in human epithelial cancers. *International Journal of Cancer.*, 50, 302–304.
- Maki, H., Edgar, A.O., Emilio, M.C., Libertado, C.C., & Tsutomu, F. (2004). Is Leucaena leaf useful as a selenium supplement for growing Philippine goats? *Journal of Animal Science.*, 75(5), 423–430.
- Malcolm, T., & Basil, B. (2003). Whole grain in lamb rations. *Ministry of Agriculture, Food and Fisheries.*, 1–3.
- Manjusha, H., Neethumol, V., Benny Cherian, A., Sreenivasan, P.V., Jenish, P., & Asmy Antony, K. A. (2014). Synthesis and Characterisation of CaCO₃ (Calcite) Nano Particles from Cockle Shells Using Chitosan as Precursor. *International Journal of Scientific and Research.*, 4(10), 1–5.
- Man, Q., Zuyan, Z., Kenshi, M., Mariko, N., Akiko, M., & Mitsutaka, K. (1998). The effect of calcium supplement given with a mixture of calcium carbonate and calcium citrate on the mandibular alveolar bone of pubertal rats. *Journal of Bone and Mineral Metabolism*, 16, 88–95.
- Maria, B., & Monika, K. (2010). The Influence of Pregnancy And Lactation On The Magnesium And Calcium Concentration In Goats' Blood Serum. *Journal of Elementology.*, 15(1), 31–47.
- Marko, S., Tomislav, D., Marija, L., Ivica, H., Nikica, P., Juraj, G., Gordana, G.G., Vesna, D., Berislav, R., & Drazen, D. (2011). Comparison of blood serum macromineral concentrations in meat and dairy goats during puerperium. *Journal of Veterinarski Arhiv.*, 81(1), 1–11.
- Markovic, J., Strabanovic, R., Cvetkovic, M., & Anđelković Zivković, B. (2009). Effect of growth stage on the mineral concentrations in alfalfa (*Medicago sativa* L.) leaf, stem and whole plant. *Biotechnology in Animal Husbandry.*, 25(5), 1225–1231.
- Martínez, D.A.M., Mazzarri, G., Rodríguez, J., Quintana, H., & Chicco, C. (1986). Protein Supplements And Pre-Energy Service In Sheep West African. *Suplementación Energética Y Proteica Pre-Servicio En Ovejas West African.*

Zootecnia Tropical., 4(2), 19–28.

- Masson, C., Rubino, R., & Fedele, V. (1991). Forage utilization in goats. In P. Morand-Fehr (Ed.), *Goat Nutrition* (pp. 145–159).
- Mbassa, G.K., & Poulsen, J. S. (1991). Influence of pregnancy, lactation and environment on some clinical chemical reference values in Danish landrace dairy goats (*capra hircus*) of different parity-I. electrolytes and enzymes. *Comparative Biochemistry and Physiology.*, 100(2), 413–422.
- Mc Kenzie, R.A., Bell, A.M., Storie, G.J., Keenan, F.J., Cornack, K.M., & Grant, S. G. (1988). Acute oxalate poisoning of sheep by buffel grass (*Cenchrus ciliaris*). *Australian Veterinary Journal.*, 65, 26.
- McDowell, L. R. (1985). Nutrition of grazing ruminants in warm climates. In *Academic Press Inc. San Diego.* (pp. 168–169).
- Meggouh, F., Lointier, P., & Saez, S. (1991). Sex steroid and 1,25-dihydroxyvitamin D3 receptors in human colorectal adenocarcinoma and normal mucosa. *Cancer Research.*, 51, 1227–1233.
- Meissner, H.H., & Paulsmeier, D. V. (1995). Plant compositional constituent affecting between-plant and animal species prediction of forage intake. *Journal of Animal Science.*, 73, 2447–2457.
- Milos, M., & Drinceanu, D. (1980). DIET AND NUTRITION ANIMALS. *Editura Ceres.*, 72–82.
- Minson, D. J. (1990). Forage in ruminant nutrition. *Sydney Australia: Academic Press.*, 403–461.
- Mohamed, D.J.M., Yusup, S., & Maitra, S. (2012). Decomposition study of calcium carbonate in cockle shell. *Journal of Engineering Science and Technology.*, 7(1), 1–10.
- Mude, S.W., Waghmare, S.P., Mode, S.G., Sukare, P.G., & Adlak, S. A. (2010). Effect of Mineral Supplementation on Post-parturient diseases in Pregnant goats. *Veterinary World.*, 3(3), 109–110.
- Mull, J.W., & Bill, A. H. (1934). Variations in serum calcium and phosphorus during pregnancy. *American Journal of Obstetrics and Gynecology .*, 27, 510–517.
- Muruganandan, S., Roman, A.A., & Sinal, C. J. (2009). Adipocyte differentiation of bone marrow-derived mesenchymal stem cells: cross talk with the osteoblastogenic program. *Cellular and Molecular Life Sciences.*, 66(2), 236–253.
- Mustakimah, M., Suzana. Y., & Saikat, M. (2010). Composition Study of Calcium Carbonate in Cockle Shell. In *8th Conference on Advanced Processes Materials, World Engineering Congress 2010, Kuching, Sarawak.* (pp. 16–20).

- Muthusamy, K., & Sabri, N. A. (2012). Cockle Shell: A Potential Partial Coarse Aggregate Replacement in Concrete. *International Journal of Science, Environment and Technology.*, 1(4), 260–267.
- Nakatani, N., Takamori, H., Takeda, K., & Sakugawa, H. (2009). Trans esterification of soybean oil using combusted oyster shell waste as a catalyst. *Bioresource Technology.*, 100(3), 1510–1513.
- Nasri, H. A. E. (2015). Biochemical blood parameters of different goat breeds in Sudan. *Global Journal of Animal Scientific Research.*, 3(4), 294.
- Need, A.G., Morris, H.A., Horowitz, M., Scopacasa, E., & Nordin, B. E. (1998). Intestinal calcium absorption in men with spinal osteoporosis. *Clinical Endocrinology Oxford.*, 48(2), 163–168.
- Nkrumah, J.D., Keisler, D.H., Crews, D.H.J., Basarab, J.A., Wang, Z., Li, C., Price, M.A., Okine, E.K., & Moore, S. S. (2007). Genetic and phenotypic relationships of serum leptin concentration with performance, efficiency of gain, and carcass merit of feedlot cattle. *Journal of Animal Science.*, 85, 2147–2155.
- Oberst, W.F., & Plass, E. D. (1932). The variations in serum calcium, protein, and inorganic phosphorus in early and late pregnancy, during parturition and the puerperium, and in non-pregnant women. *Journal of Clinical Investigation*, 11, 123–127.
- Orodho, A. B. (2006). The role and importance of Napier grass in the smallholder dairy industry in Kenya. *Food and Agriculture Organization of the United Nations*, 2–10.
- Orwa, C., Mutual, A., Kindt, R., Jamnadass R., & Anthony, S. (2009). Agroforestry database. In *A tree reference and selection guide version 4.0*. (pp. 1–8).
- Osman, M., Isam T.K. and Edward, W. (2012). Goat Meat Production and Quality., 169–171.
- Ott, R.S., Nelson, D.R., & Hixon, J. E. (1980). Peripheral serum progesterone and luteinizing hormone concentrations of goats during synchronization of estrus and ovulation with prostaglandin F2a. *American Journal of Veterinary Research.*, 41, 1432–1434.
- Overton, T.R., & Waldron, M. R. (2004). Nutritional management of transition dairy cows: Strategies to optimize metabolic health. *Journal of Dairy Science.*, 87, 105–119.
- Pancieria, R.J., Martin, T., Burrows, G.E. Taylor, D.S., & Rice, L. E. (1990). Acute oxalate poisoning attribute to ingestion of curly dock (*Rumex crispus*) in sheep. *Journal of American Veterinary Medicine Association.*, 196, 1981–1984.
- Papachristou, T.G., & Papanastasis, V. P. (1994). Forage value of Mediterranean deciduous woody fodder species and its implication to management of silvo-pastoral systems for goats. *Agroforestry Systems.*, 27, 269–282.

- Peracchia, C. (1978). Calcium effect on gap junction structure and cell coupling. *Natland*, 271, 669–671.
- Peter, J. V. S. (1994). No Title. In *Nutritional Ecology of the Ruminant*. (2nd ed., pp. 209–210).
- Pitkin, R.M., & Gebhardt, M. P. (1977). Serum calcium concentrations in human pregnancy. *American Journal of Obstetrics and Gynecology.*, 127, 775–778.
- Polatti, F., Capuzzo, E., Viazzo, F., Colleoni, R., & Klersy, C. (1999). Bone mineral changes during and after lactation. *Journal of Obstetrics Gynecology.*, 94, 52–56.
- Portal Rasmi Jabatan Veterinar Malaysia. (2015). Nutrition. Retrieved from <http://www.dvs.gov.my/pemakanan>
- Prentice, A. (2000). Calcium in Pregnancy and lactation. *Annual Review of Nutrition.*, 20, 249–272.
- Preston, R. L. (2009). Feed composition tables beef magazine. In *Feed composition tables beef magazine*. (pp. 315–366).
- Pritchard, R. H., & Bruns, K. W. (2003). Controlling variation in feed intake through bunk management. *Journal of Animal Science.*, 81(2), 133–138.
- Prompt, C.A., & Quinton, P. M. (1978). Functions of calcium in sweat secretion. *Nature*, 171–172.
- Pugh, D.G., & Baird, A. N. (2012). Feeding and Nutrition. In *Sheep and Goat Medicine*. (2nd ed., pp. 18–49).
- Radostits O.M., & Blood, D. C. (1994). Veterinary Medicine. In *8th edition* (pp. 86–180).
- Radostits, O.M., Gay, C.C., Blood, D.C., & Hinchcliff, K. W. (2000). a textbook of the disease of cattle, sheep, pigs, goats, and horses. In *Veterinary medicine*. (pp. 493–498).
- Raghavan, V. (2000). Managing risks by the feed industry for safe food. In *22nd MSAP Annual. Conference*. (pp. 27–48).
- Rahman, M.M., Abdullah, R.B., & Wan Khadijah, W. E. (2012). A review of oxalate poisoning in domestic animals. Tolerance and performance aspects. *Animal Physiology Animal Nutrition Journal.*, 1011–1111.
- Rahman, M.M., Abdullah, R.B., Wan Khadijah, W.E., Nakagawa, T., & Akashi, R. (2013-a). Feed Intake and Growth Performance of Goats Offered Napier Grass (*Pennisetum purpureum*) Supplemented with Concentrate Pellet and Soya Waste. *Sains Malaysiana*, 43(7), 967–971.
- Rahman, M.M., Ikeue, M., Niimi, M., Abdullah, R.B., Wan Khadijah, W.E., Fukuyama, K., & Kawamura, O. (2013-b). Case study for oxalate and its related

mineral contents in selected fodder plants in subtropical and tropical regions. *Asian Journal of Animal and Veterinary Advance.*, 8(3), 535–541.

- Rahman, M.M., Ishii, Y., Niimi, M., & Kawamura, O. (2008). Effect of levels of nitrogen fertilizer on oxalate and some mineral contents in Napier grass (*Pennisetum purpureum schumach*). *Grassland Science.*, 54, 146–150.
- Rahman, M.M., Ishii, Y., Niimi, M., & Kawamura, O. (2009). Effect of clipping interval and nitrogen fertilisation on oxalate content in pot-grown Napier grass (*Pennisetum purpureum*). *Tropical Grasslands Journal.*, 43, 73–78.
- Rahman, M.M., Nakagawa, T., Niimi, M., Fukuyama, K., & Kawamura, O. (2011). Effect of feeding oxalate containing grass on intake and the concentration of some minerals and parathyroid hormone in blood of sheep. *Journal of Animal Science.*, 24, 940–945.
- Rahman, M.M., Numi, M., Ishii, Y., & Kawamura, O. (2006). Effects of season, variety and botanical fractions on oxalate content of Napier grass (*Pennisetum purpureum schumach*). *Japanese Society of Grasslands.*, 52, 161–166.
- Rahman, M.Z., Ali, M.Y., Huque, K.S., & Taluker, M. A. I. (2014). Effect of dicalcium phosphate on calcium balance and body condition score of dairy cow fed Napier grass. *Bangladesh Journal of Animal Science.*, 43(3), 197–201.
- Recker, R. R. (1985). Calcium absorption and achlorhydria. *The New England Journal of Medicine.*, 313(2), 70–73.
- Reinaldo, C., Aurora V., & Charles, E. (2008). Calving School. *Beef Cattle Science*, (20), 1–56.
- Robinson, J. J. (1982). Pregnancy. In *Sheep and Goat Production*. (pp. 114–116).
- Roland, A. J. (2012). Second Generation Biofuels and Biomass. In *Essential Guide for Investors, Scientists and Decision Makers*. (pp. 2–4).
- Rumosa, F.G., Chimonyo, M., & Dzama, K. (2012). Original Paper Effect of season and age on blood minerals, liver enzyme levels, and faecal egg counts in Nguni goats of South Africa. *Czech Journal Animal Science.*, 57(10), 443–453.
- Sakha, M., Shamesdini, M., & Mohamad-zadeh, F. (2008). Serum Biochemistry Values in Raini Goat of Iran. *The Internet Journal of Veterinary Medicine.*, 6(1), 1–7.
- Sandra, G. S. (2006). Technical Paper No 6. In *Feeding management of a meat goat herd*. (pp. 1–11).
- Savage, G.P., Vanhanen, L., Mason S.M., & Ross, A. B. (2000). Effect of cooking on the soluble and insoluble oxalate content of some New Zealand food. *Journal of Food Composition and Analysis.*, 13, 201–206.
- SBS News (2014). Water crisis as drought dries up Malaysia. Natural disaster officials in the Malaysian state of Negeri Sembilan will begin to supply treated water to

8000 households, where taps have run dry. Retrieved from <http://www.sbs.com.au/news/article/2014/02/19/water-crisis-drought-dries-malaysia>

- Schwartzkopf-Genswein, K. S., Beauchemin, K.A., Gibb, D.J., Crews, D.H., Jr., Hickman, D.D., Streeter, M., & McAllister, T. A. (2003). Effect of bunk management on feeding behavior, ruminal acidosis, and performance of feedlot cattle: A review. *Journal of Animal Science.*, *81*(2), 149–158.
- Sheikh, M.S., Carol, A., Santa, A., Michael, J.N., Lawrence, R.S., & John, S. (1987). Gastrointestinal absorption of calcium from milk and calcium salts. *The New England Journal of Medicine.*, *317*(9), 532–536.
- Sidhu, P.K., Joshi, D.V. , & Srivastava, A. K. (1996). Oxalate toxicity in ruminants fed overgrown Napier grass (*Pennisetum purpureum*). *Indian Journal of Animal Nutrition.*, *13*, 181–183.
- Silva, J.A., Hamasaki, R., Paull, R., Ogoshi, R., Bartholomew, D.P., Fukuda, S., Hue, N.V., Uehara, G., & Tsuji, G. Y. (2006). Lime, Gypsum, and Basaltic Dust Effects on the Calcium Nutrition and Fruit Quality of Pineapple. In *Lime, Gypsum, and Basaltic Dust Effects on the Calcium Nutrition and Fruit Quality of Pineapple*. (pp. 123–132).
- Smith, M., C. (1994). Goat Medicine. In *Goat Medicine* (pp.110-811).
- Soetan, K.O., Olaiya, C.O., & Oyewole, O. E. (2010). The importance of mineral elements for humans, domestic animals and plants. *African Journal of Food Science.*, *4*(5), 200–222.
- Sowell, B.F., Bowman, J.P.G., Branine, M.E., & Hubbert, M. E. (1998). Radio frequency technology to measure feeding behavior and health of feedlot steers. *Applied Animal Behaviour.*, *59*, 277–284.
- Specker, B. L., Vieira, N.E., O'Brien, K.O., Ho, M.L., Heubi, J.E., Abrams, S.A., & Yergey, A. L. (1994). Calcium kinetics In lactating women with low and high calcium intakes. *American Journal of Clinical Nutrition.*, *59*(3), 593–599.
- Stojevic, Z., Pirsljin, J., Milinkovic-Tur, S., Zdelar-Tik, M., & Ljubic, B. B. (2005). Activities of AST, ALT and GGT in clinically healthy dairy cows during lactation and in dry period. *Veterinar Arhives.*, *75*(1), 67–73.
- Straub, D. A. (2007). Calcium supplement in clinical practice: a review of forms, doses, and indications. *Nutrition in Clinical Practice.*, *22*(3), 286–296.
- Stupp, S.I., & Braun, P. V. (1997). Molecular manipulation of microstructures: Biomaterials, ceramics, and semiconductors. *Science.*, *277*(5330), 1242–1248.
- Sugiyama, M. (2004). The Compressive Strength of Concrete Containing Tile Chips, Crushed Scallop Shells and Crushed Roofing Tiles. In J. J. Limbachiya, M.C. and Roberts (Ed.), *Sustainable Waste Management and Recycling: Construction Demolition Waste*. (pp. 165–172).

- Susu, J., Weixi, C., & Baojun, X. (2013). Food Quality Improvement of Soy Milk Made from Short-Time Germinated Soybeans. *Foods.*, 2, 198–212.
- Swezey, N.B., Gauthier, C., Gagnon, S., Ferretti, E., & Kopelman, H. (1996). Progesterone and oestradiol inhibit CFTR- mediated ion transport by pancreatic epithelial cells. *American Journal of Physiology.*, 271, 747–754.
- Sykes, A. R., & Dingwall, R. A. (1975). Calcium absorption during lactation in sheep with demineralised skeletons. *Journal of Agricultural Science Cambridge.*, 84, 245–248.
- Takeda, H., Yamakawa, M., Takahashi, T., Imai, Y., & Ishikawa, M. (1992). An immunohistochemical study with an estrogen receptor-related protein (ER-D5) in human colorectal cancer. *Cancer.*, 69, 907–912.
- Tambuwal, F.M., Agale, B.M., & Bangana, A. (2002). Haematological and Biochemical values of apparently healthy Red Sokoto goats. In *27th Annual Conference Nigerian Society of Animal Production (NSAP)*. (pp. 50–53).
- Tamukai, K., Takami, Y., Akabawe, Y., Kamazaroa, Y., & Une, Y. (2011). . Plasma biochemical reference values in clinically healthy captive bearded dragons (*Pogona Vitticeps*) and the effects of sex and season. *Veterinary Clinical Pathology.*, 368–373.
- Tharwat, M., Ali, A., & Al-Sobayil, F. (2014). Hematological and biochemical profiles in goats during the transition period *Comparative Clinical Pathology. Comparative Clinical Pathology.*, 24(1), 1–7.
- Tharwat, M., Oikawa, S., & Buczinski, S. (2012). Ultrasonographic Prediction of hepatic fat content in dairy cows during the transition period. *Journal of Veterinary Science & Technology.*, 3(1), 1–5.
- Theisinger, B., Guthke, R., Blin, N., Welter, C., & Seitz, G. (1993). In Vivo. In *Influence of steroid hormones on pS2/BCE1 gene expression in xenografted colon tumors*. (pp. 411–414).
- The Philippine Council for Agriculture and Resources Research and the United States National Academy of Sciences. (1997). Leucaena. In *Promising Forage and Tree Crop for the Tropics*. (pp. 33–37).
- Thibier, M., Pothelet, D., Jeanguyot, N., & de Montigny, G. (1981). Estrous behavior, progesterone in peripheral plasma and milk in dairy goats at onset of breeding season. *Journal of Dairy Science.*, 64, 513–519.
- Thorburn, G.D., & Schneider, W. (1972). The progesterone concentration in the plasma of the goat during the oestrous cycle and pregnancy. *Journal of Endocrinology.*, 52, 23–36.
- Van, S. R. J. (2007). Puerperal nutrition and metabolic diseases (Caprine Section, Chapter 75). In *Current Therapy in Large Animal Theriogenology*. (2nd ed., pp. 562–572).

- Wang, C., Zhao, J., Zhao, X., Bala, H., & Wang, Z. (2006). Synthesis of nanosized calcium carbonate (aragonite) via a polyacrylamide inducing process. *Powder Technology*, *163*(3), 134–138.
- Waziri, M. A., Ribadu, A. Y., & Sivachelvan, N. (2010). Changes in the serum proteins, hematological and some serum biochemical profiles in the gestation period in the Sahel goats. *Veterinary Archives*, *80*, 215–224.
- Welter, C., Theisinger, B., Rio, M.C., Seitz, G., Schuder, G., & Blin, N. (1994). Expression pattern of breast-cancer-associated protein pS2/BCE1 in colorectal tumors. *International Journal of Cancer*, *56*, 52–55.
- Wilson, G.P., & Alan, W. B. (2005). No Title. In *Encyclopedia of animal science*. (pp. 482–484).
- Wulster-Radcliffe, M. C., Costine, B.A., & Lewis, G. S. (1999). Estradiol- 17 β -oxytocin induced cervical dilation in sheep: Application to transcervical embryo transfer. *Journal of Animal Science*, *77*, 2585–2593.
- Yair, L., Shraga, S., Patricia, S., & Betty, S. (1999). Estrogen Increases 1,25-Dihydroxyvitamin D Receptors Expression and Bioresponse in the Rat Duodenal Mucosa. *Endocrinology*, *140*, 280–285.
- Yang, E.I., Yi, S.T., & Leem, Y. M. (2005). Effect of Oyster Shell Substituted for Fine Aggregate on Concrete Characteristics: Part 1. Fundamental Properties. *Journal of Cement and Concrete Research*, *35*, 2175–2182.
- Yaqub, L.S., Kawu, M. U., Ayo, J.O., Ambali, S.F., & Habibu, B. (2013). Full Length Research Paper Effect of oestrous cycle on serum electrolytes and liver enzymes in Red Sokoto goats. *African Journal of Biochemistry Research*, *7*(9), 174–178.
- Yusof, M., Ujai, S.J.J., Sahari, F., Taib, S.N.L., & Noor Mohamed, N. H. (2011). Application of Clam (Lokan) Shell as Beach Retaining Wall. In *EnCon 2011: 4th Engineering Conference, Kuching, Sarawak*. (pp. 1–4).
- Yvonne, Z. (2012). In *The Meat Goat Handbook: Raising Goats for Food, Profit, and Fun*. (pp. 96–97).
- Zeitlin, P.L., Wagner, M., Markakis, D., Loughlin, G.M., & Guggino, W. B. (1989). Steroid hormones: modulators of Na⁺ absorption and Cl secretion in cultured tracheal epithelia. In *The National Academy of Sciences of the United States of America*. (pp. 2502–2505).
- Zuki, Z.A.B., Zakaria, N., & Kasimb, Z. (2004). Mineral composition of the cockle (*Anadara granosa*) shells, hard clam (*Meretrix meretrix*) shells and corals (*Porites* spp.): A comparative study. *Journal of Animal and Veterinary Advances*, *3*(7), 445–447.
- Zumbo, A., Rosa, R.D., Casella, S., & Piccione, G. (2007). Changes in some blood haematological parameters of Maltese goats during lactation. *Journal of Animal and Veterinary Advances*, *6*, 706–711.

APPENDICES

Appendix A

Production of Supplement (Cockle Shell)



Cockle Shell



Break into small pieces



Heating



Grinding



Sieving



Heating



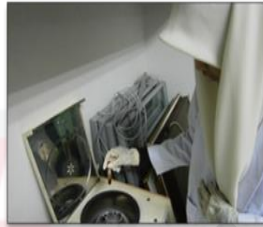
Packaging

Appendix B

Blood Sampling and Analysis



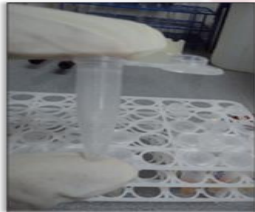
Blood sampling



Centrifuge



Serum separation



Loading serum
for reading



Transfer into tube



Result

Appendix C

Feed Analysis



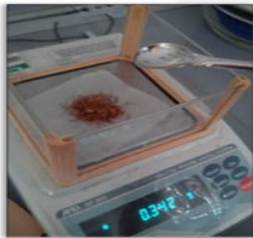
Heating



Grinding



Storing



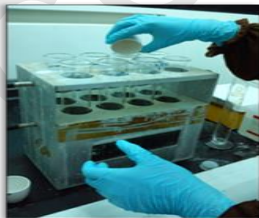
Weighing



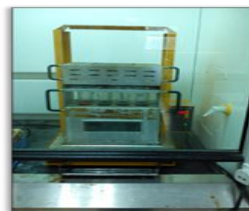
Ashing



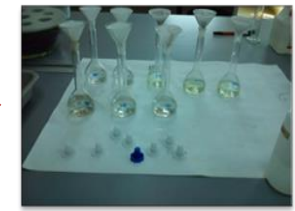
Weighing



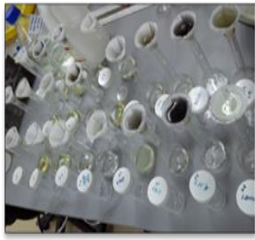
Digest



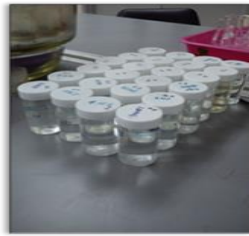
Digest



Filter



Dilute



Dilution



Reading



Result



BIODATA OF STUDENT

Husna Fasiah binti Mohd Yusoff was born on 26th January 1990 at General Hospital Parit Buntar. She was raised in Perak Darul Ridzuan, and studied at Sekolah Kebangsaan Selama Jalan Menteri and Sekolah Menengah Kebangsaan Dato' Haji Hussein. After finishing her school, she furthered her study at the Perak Matriculation College and then entered the Faculty of Agriculture and Biotechnology, Universiti Sultan Zainal Abidin, Terengganu, Malaysia to do the Bachelor of Animal Production and Health. She was accepted to the Master of Veterinary Science Program at Faculty of Veterinary Medicine in Universiti Putra Malaysia.

