STUDY ON THE EFFECTIVES OF FEEDING TONGKAT ALI (*Eurycoma longifolia* Jack) ON SEMEN PRODUCTION IN KAMPUNG CHICKENS

ASVERRANA BINTI ASIDI

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.....

ASVERRANA BINTI ASIDI
BR12160158

VERIFIED BY

1. Prof. Dr. Abdul Rashid Baba
   SUPERVISOR

.....

PROF. DR. ABDUL RASHID BABA
KETUA PROGRAM HG36
FAKULTI PERTANIAN LESTARI
UMS KAMPUS SANDAKAN

2. Assoc. Prof. Dr. Md Shahidur Rahman
   CO-SUPERVISOR

PROF. MADYA DR. MD. SHAHIDUR RAHMAN
PENSYARAH
FAKULTI PERTANIAN LESTARI
UMS KAMPUS SANDAKAN

.....

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ABSTRACT

This study was conducted at poultry house of the Faculty Sustainable Agriculture (FSA), University Malaysia Sabah to determine the effectiveness of feeding Tongkat ali *(Eurycoma longifolia* Jack*)* on semen production of Kampung Chickens. Tongkat ali *(Eurycoma longifolia* Jack*)* is an herbal medicinal plants of South-East Asian origin, and that plants part contain variety of bioactive compounds of high therapeutic and nutritive value. Fourteen Kampung Chickens were purchased from various districts in Sandakan, Sabah. They were divided into two treatment of group which are group treatment one (T1) were supplemented daily with Tongkat ali and another group (T2) were supplemented three times a week. The Tongkat ali was given to Kampung Chickens by force feeding using the syringe. Sperm parameter with respect to ejaculate volume, colour, gross motility, individual motility, sperm concentration, proportion of live and dead spermatozoa and proportion of abnormal morphology has been evaluated before and after the feeding of Tongkat ali. The effectives of Tongkat ali has proven well when supplemented daily on Kampung Chickens but giving less effectives result when supplemented 3 times a week. All the semen parameters with respect to ejaculate volume, colour, gross motility, individual motility, sperm concentration, proportion of live and dead spermatozoa and proportion of abnormal morphology has been evaluated. Supplemented daily (T1) of Tongkat ali was significant ($P<0.05$) for all semen parameters while supplemented 3 times a week only significant for colour, live and dead sperm and sperm abnormalities.

Key words: Tongkat ali *(Eurycome longifolia Jack),* Cockerel spermatozoa.

ABSTRAK

Kajian ini telah dijalankan di ladang ayam Fakulti Pertanian Lestari (FPL), Universiti Malaysia Sabah untuk mengkaji keberkesanan pemberian makan Tongkat ali *(Eurycoma longifolia* Jack) mengenai pengeluaran air mani ayam kampung jantan. Tongkat ali *(Eurycome longifolia* Jack) merupakan tumbuhan perubatan herba yang berasal dari Asia Tenggara, dan mempunyai kandungan pelbagai sebatian bioaktif yang tinggi nilai terapi nya dan juga jumlah nutrisi yang tinggi. Empat belas ekor ayam jantan dibeli dari pelbagai tempat di daerah Sandakan. Ayam jantan telah di bahagikan kepada dua kumpulan iaitu kumpulan yang diberi makan Tongkat ali secara harian (T1) dan kumpulan lain (T2) diberi makan hanya tiga kali dalam seminggu. Tongkat ali diberikan secara makan paksaan dengan menggunakan picagari. Data untuk isipadu air mani, warna, pergerakan kasar sperma, pergerakan individu sperma, kepekatan air mani, jumlah hidup dan mati sperma serta jumlah kecacatan sperma diambil kira. Ini membuktikan pemberian makan Tongkat ali secara harian sangat efektif untuk semua parameter iaitu isipadu air mani, warna, pergerakan kasar sperma, pergerakan individu sperma, kepekatan air mani, jumlah hidup dan mati sperma serta jumlah kecacatan sperma adalah signifikan ($P<0.05$). Manakala pemberian makan secara tiga kali dalam seminggu hanya signifikan pada parameter air mani untuk warna, jumlah hidup dan mati sperma serta jumlah kecacatan sperma.

Kata kunci: Tongkat ali *(Eurycome longifolia Jack)*, Sperma ayam kampung jantan.

LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
DVS	Department of Veterinary Services
ED	Erectile Dysfunction
GMO	Genetically Modified Organism
hcG	Human Chorionic Gonadotrophin
MMOT	Mass Motility
Mg	Miligram
G	Gram
SHBG	Sex Hormone Binding Globulin
SAS	Statistical Analysis System
UMS	Universiti Malaysia Sabah
WHO	World Health Organization

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

In Malaysia, livestock sector represent the largest food industry segment in terms of output value. The major proportion of livestock production takes place without government subsidies. Government support for livestock farming is more related to livestock based rural development and poverty eradication program. This has led to make the pig and poultry industries more efficient and productive and remains at par with the best in the world (FLAM, 2011). The poultry industry which is used to be subjected to ceiling price regulations from year 1998 to 2009 now only has ceiling price imposed on five festival occasions during the year (DVS, 2011).

In poultry production systems, some common supplements are used to enhance productions. The common supplements included supplemental lipids, probiotics, antiparasitic, antioxidative and antifungal compounds. The supplements were used to enhance body performance, to stimulate growth and disease control, reduce heat increment also to increase energy utilization.

Tongkat ali (Malay name), with botanical name of *Eurycoma longifolia* Jack, is a forest tree that belongs to the Simaroubaceae family. It is commonly distributed in Malaysia, lower Burma, Thailand, Indo-China and Borneo (Zhari *et al.,* 1999). The

leaves of Tongkat ali has been used for anti-tumor treatment in traditional medication while the root of Tongkat ali was used to enhance the sexual and aphrodisiac activity in human. The Tongkat ali roots received high demand from the local people or foreign country. They used the roots extract for making drink or tonic to enhance the health benefits. The effectives of Tongkat ali in improving the animals fertility has been proven in research study of mice (Mohd. *et al.,* 2005). It is prove that feeding Tongkat ali as feed supplement can increase the health fertility of the mice.

1.2 Justification

Tongkat ali is produced in large quantities in many countries including Malaysia and it serves as basic herbs in human health. Therefore, the purpose of this study is to evaluate the therapeutic effectives of this herbal species as a supplement for poultry production. The plant root and leaves contains a range of bioactive compounds like quassinoids and alkaloids (Bhat and Karim, 2010).

Tongkat ali is a unique herbal plant that possess a variety of therapeutic values. Although, not much information is available on its nutritional value, its utilization as supplements to enhance the animal health and production is envisaged.

Since the above mentioned studies have reported the effectiveness of Tongkat ali in improving the fertility of semen production in mice, it is proposed to conduct similar study in the effect of Tongkat ali in improving the quality and quantity of semen production in the Kampung Chickens.

1.3 Objective

To evaluate the effect on quality and quantity of semen production of the Kampung Chickens supplemented with Tongkat ali extract.

1.4 Hypotheses

H_o: There is no significant difference in the quality and quantity of semen production of the Kampung Chickens supplemented with Tongkat ali extract.

H_A: There is significant difference in the quality and quantity of semen production of the Kampung Chickens supplemented with Tongkat ali extract.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Tongkat ali (*Eurycoma longifolia* Jack) is a forest tree belongs to Simaroubaceae family. Tongkat ali also known as Malaysian Ginseng (Shaharudin *et al.,* 2004; Zuraini, 2004). It has many vernacular names such as penawar pahit, bedara pahit, tongkat baginda, petala bumi, pasak bumi and setunjang bumi (Malay). Tongkat ali is also grown in the green forest of South-East Asian. It is geographically distributed in Malaysia, lower Burma, Thailand, Indo-China to Sumatra and Borneo. There are four different species of Tongkat ali which include *E. longifolia, E. apiculata, Polyyathia bullata* and *Goniothalamus sp.* has been recorded (Bhat and Karim, 2010).

However only two species of Tongkat ali in Peninsular of Malaysia are well known and used such as *E longifolia* Jack and *E. apiculata*. However, only *E. longifolia* is planted commercially because it contains high level of bio-active compound compared to *E. apiculata.* Besides, density of *E. longifolia* in natural habitat is higher compared to *E. apiculata.* The root powder is creamy yellow in colour while leaves root powder is green and both of them are very bitter.

Products from Tongkat ali is predicted to enter the United States, Europe and Korean markets. Demand is also predicted to increase and therefore commercial farming for this particular plant is needed. For commercial purposes, it is usually planted for four to five years compared to wild tree in jungle. It is basically harvested at an age of 15 years.

2.2 Indigenous Local Breed of Chicken

Red jungle fowl *(Gallus gallus)* are the wild ancestors of all domestic poultry (Delacour, 1983). *G.gallus* is native to Southern Asia, particularly the jungles of India. *G.gallus* spread all over the world when people domesticated the chicken (Stevens, 1991) and (Peterson and Brisbin, 2010).

All native chicken in developing countries are said to be descendants of the Red Jungle Fowl, *G.gallus* (Crawford, 1984). They normally scavenge for food in backyards and reared in small scale production even though there is great demand for them among population. Reproduction in the domestic Kampung Chicken is a complex mechanism with multiple environmental and physiological factors interacting and contributing to successful copulation and fertilization (Malik *et al.,* 2013). In general, native Kampung Chicken has a small body, different plumage colours, and dual-purpose type. The egg size seldom exceeds 42g and the chicken usually reaches market weight of 1.0-1.5kg at the age of 4 to 5 month (Aini, 1990). Kampung Chicken meat is perceived by some to have better taste and proved to have relatively little fat as compared to commercial broilers (Engku-Azahan *et al.,* 1990), thus contributing to the health benefits to the consumer.

The taxonomic hierarchy of *Gallus gallus Domesticus*;

Kingdom	: Animalia
Class	: Aves
Order	: Galliformes
Family	: Phasianidae
Genus	: *Gallus*
Species	: *Gallus gallus*
Subspecies	: *Gallus gallus domesticus*

Male and female *G.gallus* depicts a very strong sexual dimorphism. The male *G. gallus* is more vibrant-looking thank the female. According to Stevens (1991) and Peterson and Brisbin (1999), the red jungle fowl rooster is said to be more brilliantly colored that its tame relative. During June to October, *G. gallus* molts into an eclipse plumage. An eclipse plumage is for male, black long feather across the middle of his back and slender redorange plues on the rest of his body. For a female, an eclipse plumage cannot be distinguished, but she does molt. The female Red Jungle Fowl is leaner than tame hens.

G.gallus is an omnivorous and insectivore. Red Jungle Fowls eat corn, soybean, worms, grass, and different kinds of grains found on the grounds. Red jungle Fowl eats a variety of animals and plants. It prefers to eat the pericarp of oil palm *(Elaeisguineensis)* fruit, Iskandar palm *(Archontophoenix alexandrae),* Chiku *(Achrassapota),* Papaya *(carica papaya),* Cempedak *(Artocarpus integer),* rubber *(Hevea brasiliensis)* nuts, and seeds of *Macaranga sp.* Analyses of crops content shows that among the animals, Dermaptera, Hymenoptera, Isoptera, Orthoptera, Coleoptera, Crustacea (Isopoda), leeches and snail are the predominant food. It also ate snails, egg shells, bones, and snakes. The male Red Jungle Fowl consumed oil palm fruit more than did the female whereas the female consumed invertebrates and vertebrates more than did the male (Arshad, *et al.,* 2000).

The breeding season of the red jungle fowl is spring and summer. The chicks will start their lives in the warmth of the summer sun. An egg is laid each day. For twenty-one

days before hatching, the chick will develop inside of the egg. On the first day, the heart and blood vessels of the chick develop and start to work. At the end of the first day, the head starts to take shape. By the fourth day, all organs of the future chick are present. On the fifth day, external sex structure developed. By the thirteenth day, the skeleton begins to calcify using the calcium from the egg shell. From the time when the egg is laid until hatching, the chick feeds on the yolk that surrounds him. The yolk penetrates in the chick body by the umbilicus. On the twenty-first day, the chick, now fully developed, starts to break through his thin shell. This action can take anywhere from ten to twenty hours (Mack O. North, 1990).

Kampung Chicken are typically small and light weight, and not very productive in terms of both eggs and meat. They take longer time to reach maturity and lay fewer clutches of egg per year compared to modern breeds (Safalaoh, 1997). However, they have high resistance to endemic diseases compared to commercial broilers or layers. This is possibly because they have been familiar with the local environment and adapted well to environmental changes. Moreover, village chicken meat has more flavor and thus more favourable to the consumers and this make it fetches a higher price compared to broilers meat (Solihati *et al.*,2006).

2.3 Basic Anatomy and Physiology of Chicken Reproductive Tract

The primary sexual organs of male Kampung Chickens are testes. Their main functions are to produce sperm and male sex hormone and testosterone. Both testes are functional in the male when sexual maturity is attained. The testes are located in the center of body cavity, and spermatogenesis occurs at body temperature (41°C), as opposed to the mammalian scrotal temperature of 24°C to 26°C. The chicken reproductive tract is comprised of a duct system with a paired of epididymis and vas deferens. Seminal vesicles, Cowpers gland, prostate gland and a penis are absent. Before copulation in the chicken, the vas deferens increase in diameter allowing semen to be stored in bulbous region. Semen is then released from the vas deferens during the sexual stimulation (Perry,

1960). An accurate method of determining the quantity of sperm that a chicken can produce is by measuring the circumference of the testes. The larger the testicular circumference, the larger is the volume of semen produced (Senger, 2003).

2.4 Tongkat ali *(Eurycoma longifolia* Jack)

A medium size slender shrub reaching 10m in height and it is often unbranched with reddish brown petioles. Leaves compounds, even pinnate reached about 1m in length. Each compounds leaves consists of 30-40 leaftlets, lanceolate to abovate-lanceolate. Tongkat ali leaftlet is about 5-20cm long, 1.5-6.0cm wide, much paler on the ventral side. It is inflorescence axillary, in large brownish red panicle, very pubescent with very fine, soft, glandular trichomes. Flowers are female, male and hermaphrodite. It petals is small and very fine pubescent. It drupe is hard, ovoid, yellowish brown when young and brownish red when ripe (Zhari *et al.,* 1999).

Figure 1.0: Tongkat ali tree with reddish brown petiole

REFERENCES

Aini, I. (1990). Indigenous chicken population in South-East Asia. *World's Poultry Science Journal,* 46, 51-57.

Anderson, J. (2001). *The semen of animals and its use for artificial insemination.* India: Greenworld publishers.

Anon, 2006. *Tongkat untuk Seks Hebat: Direktori Industri Herba dan Rawatan Alternative Malaysia.* Edisi Khas 2006. D'herba PP1415/6/2006.

Arshad, M. I., Zakaria, M., Sajap, A. S., and Ismail, A. (2000). Food and Feeding Habits of Red Jungle fowl. *Pakistan Journalof Biological Sciences,* 3 (6), 1024-1026.

Asiah, O., Jordan, B., Lessard, and P., Housma, D. E. 2004. Searching *For Snps in Eurycoma Longifolia.* New Dimensions in complementary Health Care. *Proceedings of the Seminar on medicinal Plants.* 20-21 August 2004. Kepong, Kuala Lumpur. 59-63.

Azimahtol, H.L.P. 2004.*Current Status on the Effect of Eurycoma longifolia* (Tongkat Ali) *Extracts as Sexual Stimulant Agent.* School of Bioscience and Biotechnology, Faculty Science and Technology, Universiti Kebangsaan Malaysia, Selangor.

Bhat, R., and Karim, A. A. 2010. Tongkat Ali *(Eurycoma longifolia* Jack): A Review on its Ethnobotany and Pharmacological Importance. *Ethnobotany and Pharmaceutical Journal* **01985:** 1-11.

Brillard, J.P. (2003). Practical aspects of fertility in poultry. *World's Poultry Science Journal, 59, 441-446.*

Burrows, W. H., and Quinn, J. P. (1973). The collection of spermatozoa from the domestic fowl and turkey. *Poultry Science, 26,* 19-24.

Chan, K. L. 2004. *Recent Advances in Research on Tongkat Ali.* School of Pharmaceutical Sciences, Universiti Sains Malaysia, Penang.

Chooi, O. H., 2004. Tumbuhan Liar: Khasiat Ubatan dan Kegunaan Lain. Terbitan Pertama. Utusan Publication & Distribution Sdn. Bhd. Kuala Lumpur.

Colin, G. S., George, and B., Ensmiger. M. E. 2004. *Poultry Science.* Pearson Education, Inc. Upper Saddle River, New Jersey.

Crawford, R. D. (1984). Domestic fowl: In CC Manson (Ed). Evolution of domesticated animals. *Longman, London,* pp 298-302.

Delacour, J. (1983). *The Pheasantof the World. Second edition.* Howell Book House. Pp 434.

Donoghue, A. M., and Wishart, G. J. (2000). Storage of poultry semen. *Animal Reproduction Science, 62*(1-3), 213-232.

Dutta, R. K., Islam, M.S., and Kabir, M. A. (2013). Production Performance of Indigenous Chicken (Gallus domesticus L.) is Some Selected Areas of Rajshahi, Bangladesh. *American Journal of Experiental Agriculture, 3*(2), 308-323.

DVS. 2011. Report on Census of Broiler Industry and Population of Broiler in Malaysia: Department of Veterinary Science 2010. Malaysia.

Enku-Azahan, Yeong, E.A., and Noroziah, M. (1990). Intensive rearing of Kampung chicken for meat production. *In Proceedings of 2nd Congres Veterinarian Association. Malaysia,* pp 108-110.

FLAM. 2011. Report on Broiler Population and Production in Malaysia. Federation of Livestock Farmer's Associations of Malaysia. Access on 22nd July 2011 http://www.flfam.org.my/main.php?section=statistic&page=statistic_index

Froman, D.P., and Feltman, A. J. (2005). Fowl (Gallus domesticus) sperm motility depends upon mitochondrial calcium cycling driven by extracellular sodium. *Biol. Reprod, 72*(97-101).

Fuquay, J. I., and Renden, J. A. (1976). Reproductive performance of broiler breeder maintained in caged of floors through 59 week of age. *Poultry Science, 59,* 1524-1526.

Indu, B. J. and Lean., T. N., 2000. *Herbs: The Green Pharmacy of Malaysia.* Vinpress Sdn. Bhd. In collaboration with the Malaysian Agriculture Research and Development Institute (Mardi). Malaysia.

J Sex Med. 2012. www.menprovement.com/tongkat-ali-extract. (22th November 2014)

Jerry C, 1972. *Herb and other Medicinal Plants with an Introduction.* Orbis Books London. Novara.

Johari Saad (2010), Malaysia's True Aphrodisiac | Medicine Hunter. www.medicinehunter.com/tongkat-ali. (22nd November 2014).

Kean, O. B., Nik Musa'aadah, M., Rasadah, M. A. 2004. *TPA-Induced Mouse Ear Oedema Inhibitory Activity of Eurycoma longifolia (Tongkat Ali).* New Dimensions in Complementary Health Care. *Proceedings of the Seminar on Medicinal Plants.* 20-21 August 2004. Forest Research Institute Malaysia (FRIM), Kuala Lumpur. 197-200.

Khadijah, 2006. *Anatomical Atlas of Malaysia Medicinal Plants Volume 1.* Universiti Kebangsaan Malaysia Bangi, Selangor.

Kolasa, 1999. *Malaysian Herbal Monograph Vol 1.* Published By Malaysian Monograph Committee, Kuala Lumpur

Kwan, T. K., Saad, J. M., Farizaturradiah, O., and Koh, B.H. 1995. *The Effect of Eurycoma longifolia on Rats and Human Testicular Steroidogenesis.* Department of Biochemistry and Surgery, Faculty of Medicine, University of Malaya, Kuala Lumpur.

Lemmens, R. H. M. J., and Bunyapraphatsara, L. S. D. P. 2003. *Plant Resources of South East Asian No 12(3): Medicinal and Poisonous Plants 3.* Prosea Foundation. Indonesia.

Machebe, N. S. and Ezekwe, A. G. (2005). Ejaculate characteristics of three genotypes of local cocks in the humid tropics. Journal of Agriculture, Food, Environmental Extension, 3, 33-37.

Mack O. North, D. D. B. (1990). *Commercial Chicken Production Manual.* 4th edition. Springer. Pp 913.

Malik, A., Haron, A. W., Yusoff, R., Nesa, M., Bukar, M., and Kasim, A. (2013). Evaluation of the ejaculate quality of the red jungle fowl, domestic chicken, and bantam chicken in Malaysia. *Turkish Journal of Veterinary and Animal Sciences, 37,* 564-568.

Mohammad, A., 2004. *Future Herb Plantation Planning By TA ANN HOLDING BERHAD: Tongkat Ali Plantation Integrated with Acacia Magnum.* Dimensions in Complementary Health Care. *Proceedings of the Seminar on Medicinal Plants.* 20-21 August 2004. Kepong, Kuala Lumpur. 30-33.

Mohd N.J., Muhammad, G. M., and Musa, Y. 2005. *Penanaman Tumbuhan Ubatan & Beraroma.* Cetakan Pertama. Institut Penyelidikan dan Kerajaan Pertanian Malaysia (Mardi). Kementerian Pertanian and Industri Asas Tani Malaysia, Kuala Lumpur.

Mosenene, T. M. B. (2009). *Characterization And Cryopreservation Of Semen Of Four South African Chicken Breeds.* Degree of Master of Science Thesis. University of the Free State, Bloemfontein, 132pp.

Olyemi, F. O., Adenji, D. A., and Oyeyemi, M. O. (2011). Evaluation of Sperm Motility and Viability in Honey-Included Egg Yolk Based Extenders. *Global Veterinaria, 7*(1), 19-21.

Parker, T.H., Thompson, D., Ligon, J.D., Schneider, B. & Byrn, F., 2006. Does red jungle fowl comb size predict sperm swimming speed and motility? Eth. Ecol. Evol. 18, 53-60.

Penfold, L. M., Wildt, D. E., Herzog, T. L., Lynch, W., Ware, L., Derrickson, S.E., and Monfort, S. L. (2000). Seasonal pattern of LH, testosterone and sperm quality in the Northern Pintail duck. *Reproduction, Fertility, Development.,* 12, 229-235.

Perry, E. J. (1960). The Artificial Insemination of Farm Animals. *Rutgers University Press.*

Peterson, a. T., and Brisbin, I. L. (2010) Genetic endangerment of wild Red Junglefowl *Gallus gallus? Bird Conservation International,* 8 (04), 387-394.

Rukyah, A. 2006. *Tumbuhan Liar Berkhasiat Ubatan.* Dewan Bahasa dan Pustaka, Kuala Lumpur.

Safalaoh, A. (1997). Characteristics of indigenous chicken of Malawi. *Annual Genetic Resources Information Bulletin,* 22, 61-66.

Senger, P. L. (2003). Pathways to pregnancy and Parturition (2nd Edition). Washington, USA: Ed. Pullman.

Seopadmo, E., Oh, S. H., Wong, W. H., Laily, D., and Chuah., W. H. 1989. *Perubatan Tradisi Malaysia.* Institute of Advanced Studies, University of Malaya and Malaysia Institute of Chemistry, Kuala Lumpur.

Shaharudin, M.I., Abd Rahman. A.R., and Zahari, I. 2004. The prospect of Plantation and Conversation of Tongkat Ali (Eurycoma longifolia) in Peninsular Malaysia. New Dimensions in Complementary Health Care. Proceedings of the Seminar on Medicinal Plants. 20-21 August 2004. Kepong, Kuala Lumpur. 34-44.

Solihati N, R. Idi, R.Setiawan, I. Y. A. and B. I. S. (2006). Effect of storage period of chilled semen in 5°C on fertile period and fertility of village chicken spermatozoa. *Jurnal Ilmu Ternak,* 6 (1), 7-11.

Stevens, L. (1991). *Genetics and evolution of the Domestic Fowl.* Cambridge University Press. Pp 234.

Sundu, B., Kumar, A., and Dingle, J. 2009. World's Poultry Science Association 2009. *World's Poultry Science Journal,* ***Vol. 65.***

Suraii, P. F., and Wishart, G. J. (1996). Poultry artificial insemination technology in the countries of the former USSR. *World's Poultry Science Journal, 52*(27-43).

Tilden, W. P., Arthur, E. C., and Robert, S. L. 2003. *Feeds and Feeding. Sixth Edition.* Pearson Education Inc Upper Saddle River, New Jersey 07458.

Wan Hassan. 2007. *Healings Herbs of Malaysia.* Revised Edition January 2007. Publisher Federal land Development Authority (FELDA), Kuala Lumpur.

Witney, G. W., Hofman, P. J., and Wolstenholme, B.N. 1990. Effect of Cultivar, Tree Vigour and Fruits Position on Calcium Accumulation in Avocado Fruits. *Science Horticulture* 44: 269-278.

Zainon, 2004. *Tumbuhan penawar pelbagai penyakit: Tongkat Ali, Kacip Fatimah, dan Pegaga.* New Dimensions in Complementary Health Care. *Proceedings of the Seminar on Medicinal Plants.* Kepong, Kuala Lumpur. 3-6.

Zaniboni, L., and Cerolini, S. (2009). Liquid storage of turkey semen: Changes in quality parameters, lipid composition and susceptibility to induced in vitro peroxidation in control, n-3 fatty acids and alpha-tocopherol richs spermatozoa. *Animal Reproduction Science, 112*(1-2), 51-65.

Zhari, I., Norhayati, I., and Jaafar, I. 1999. *Malaysian Herbal Monograph Vol 1.* Published By Malaysian Monograph Committee, Kuala Lumpur.

Zuraini, D. Ali. Y. M. S., Mohd. Nor, A., Suzuri, H., and Zhari, I. 2004. *Artificial Tongue, an Innovative Tool for Verifying Tongkat Ali Products.* New Dimensions in

Complementary Health Care. *Proceedings of the seminar on Medicinal plants.* Kepong, Kuala Lumpur. 21-27.