

UNIVERSITY OF MALAYA
ORIGINAL LITERARY WORK DECLARATION

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IC No. : 860920-33-6245 Matric No. : SGR080180
Name of Degree : Master of Science
Title of Dissertation : Estimation of Goat Foetal Age during Pregnancy using
Transrectal and Transabdominal Probes in Ultrasound
Scanning

Field of Study : Reproductive Biotechnology

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ABSTRACT

Pregnancy diagnosis plays important role in modern goat management, especially when technologies such as artificial insemination and embryo transfer are employed in goat. Accurate pregnancy diagnosis may provide essential information for effective herd management in farm animals (Doize *et al.*, 1997). This study was carried out with the following objectives: a) to determine accuracy of pregnancy prediction by using ultrasound scanner, b) to determine the criteria for single and twin pregnancies using ultrasound scanner, c) to predict the gestation age based on ultrasound scanning using constructed regression equation, d) to compare the efficacy of two different probes on pregnancy diagnosis and e) to determine the effect of breeds and unknown date of mating on pregnancy diagnosis, using ultrasound scanning. Pregnancy diagnosis was conducted using real-time B-mode ultrasound scanner with transrectal (7.5 MHz) and transabdominal (5.0 MHz) probes. Experiments 1 and 2 were conducted as preliminary studies on detection of pregnancy-related structures and their echogenicity. Experiments 3 and 4 were designed for echogenicity and size measurement of pregnancy-related structures, using both probes as well as to derive equations for gestational age estimation. Flock test was conducted in Experiment 5 to test the accuracy of gestational age estimation equations derived from Experiments 3 and 4. Embryonic vesicles with foetus and foetal heart were detected on week 4 and week 5 of gestation, respectively. Single and twin foetuses were differentiated between weeks 4 to 7 and weeks 5 to 10 of gestation, respectively. Both probes firstly detected placentome on week 7 of gestation and measurable up to the delivery day (week 21 of gestation). Foetal heart measurement was possible starting from week 8 of gestation, owing to the changes in echogenicity of the foetal heart. Transrectal probe visualised foetal heart up to week 10 of gestation, while transabdominal probe until week 21 of gestation.

Skeletal structures, such as foetal head, were first viewed on week 6 and week 7 of gestation using transrectal and transabdominal probes, respectively. From Experiment 5, polynomial relationship between foetal heart area and gestational age (single pregnancy: $y = 0.033x^2 - 0.129x - 0.842$; twin pregnancy: $y = 0.088x^2 - 1.501x + 7.274$; where y: heart area (cm^2), x: gestational age (week)) gave highest accuracy with 58% accuracy for 1 week delivery difference and maximum accuracy of 94%, of which does delivered within 3 weeks difference from estimated date. Equation for gestational age estimation from placentome diameter derived from current research data ($y = -0.016x^2 + 0.605x - 1.759$; where y: placentome diameter (cm), x: gestational age (week)) only gave 8% and 38% accuracy, respectively. In summary, transrectal probe is reliable to detect pregnancy and estimate gestational age from weeks 4 to 10 of gestation, while transabdominal probe from weeks 5 to 21 of gestation. Foetal heart is proved to be a reliable indicator for determination of foetal number, viability of foetus and gestational age of goats. It is hoped that, in the near future, the outcomes of ultrasound scanning studies on pregnancy diagnosis will complement efficiently with other farm management practices for goat industry.

ABSTRAK

Diagnosis kebuntingan memainkan peranan penting dalam pengurusan ternakan kambing terutamanya apabila teknologi seperti pernianian beradas dan pemindahan embrio diaplikasikan ke atas ternakan. Kajian ini dijalankan dengan objektif a) untuk menentukan ketepatan pengesanan kebuntingan dengan menggunakan pengesan ultrabunyi b) untuk menentukan kriteria kandungan tunggal dan kembar menggunakan pengesan ultrabunyi c) untuk menentukan usia kandungan melalui persamaan regresi d) untuk membandingkan keberkesanan kedua-dua jenis prob ke atas diagnosis kebuntingan e) untuk menentukan kesan baka dan ketiadaan maklumat pembiakan kambing ke atas diagnosis kebuntingan dengan pengesan ultrabunyi. Diagnosis kebuntingan dijalankan dengan menggunakan pengesan bunyi *real-time B-mode* yang dilengkapi dengan prob transrektal (7.5 MHz) dan transabdominal (5.0 MHz). Eksperimen 1 dan 2 merupakan kajian awal untuk pengesanan struktur berkait kebuntingan dan ekogenisitinya. Eksperimen 3 dan 4 dirangka untuk kajian ekogenisiti dan pengukuran saiz struktur berkait kebuntingan serta menerbitkan persamaan regresi. Ujian flok dijalankan dalam Eksperimen 5 untuk mengkaji ketepatan persamaan regresi dari Eksperimen 3 dan 4. Vesikel embrionik dengan fetus dan jantung fetus dikesan pada minggu 4 dan minggu 5 kebuntingan dengan prob transrektal dan transabdominal. Bilangan fetus boleh ditentukan antara minggu 4 hingga 7 dan minggu 5 hingga 10 kebuntingan, masing-masing. Kedua-dua prob pertama kali mengesan plasentom pada minggu 7 kebuntingan dan boleh diukur hingga hari kelahiran (minggu 21 kebuntingan). Pengukuran jantung fetus hanya boleh dijalankan mulai minggu 8 kebuntingan, dengan perubahan ekogenisiti jantung. Bagaimanapun, prob transrektal cuma boleh mengesan jantung sehingga minggu 10 kebuntingan, manakala prob transabdominal

hingga minggu 21 kebuntingan. Struktur bertulang, seperti kepala fetus, pertama kali dikesan pada hari minggu 6 dan minggu 7 kebuntingan menggunakan prob transrektal dan transabdominal, masing-masing. Dari Eksperimen 5, perhubungan polinomial antara jantung fetus dan usia kebuntingan (Kebuntingan tunggal: $y = 0.033x^2 - 0.129x - 0.842$; Kembar: $y = 0.088x^2 - 1.501x + 7.274$; di mana y : saiz jantung (cm^2), x : usia kebuntingan (minggu)) memberikan ketepatan tertinggi untuk perbezaan tarikh kelahiran seminggu iaitu 58% dan ketepatan maksimum 94% untuk kelahiran dalam tempoh masa 3 minggu dari tarikh jangkaan. Persamaan dari diameter placentum ($y = -0.016x^2 + 0.605x - 1.759$; di mana y : diameter placentum (cm), x : usia kebuntingan (minggu)) memberikan ketepatan 8% dan 38%, masing-masing. Kesimpulannya, prob transrektal boleh sesuai digunakan untuk mengesan dan menentukan usia kebuntingan dari minggu 4 hingga 10 kebuntingan, manakala prob transabdominal dari minggu 5 hingga 21 kebuntingan. Jantung fetus terbukti sebagai petunjuk yang berkesan untuk penentuan bilangan fetus, mati-hidup fetus dan usia kebuntingan kambing. Adalah diharapkan supaya pada masa depan, penemuan dari kajian diagnosis kebuntingan menggunakan pengesan ultrabunyi ini akan membantu dalam pengurusan ladang yang efektif bagi industri kambing.

ACKNOWLEDGEMENTS

I would like to express the highest gratitude and am entirely grateful to Allah, the Almighty, for giving me the strength throughout this challenging journey and successfully completed my study. I am blessed to be around fantastic individuals whom contributed a lot during my study and led to my M.Sc. completion. During the two years of my study, these kind hearted persons have been with me through the thick and thin of my life, and guided me throughout this chapter of life-learning, not only educated me of being a better researcher, but as well as a wiser person. From the bottom of my heart, thank you all.

First and foremost, a million thanks to my supervisor, Prof. Dr. Wan Khadijah Embong and my co-supervisor, Prof. Dr. Ramli bin Abdullah for being such a great mentor for this young researcher to groom his ability in scientific research field. Thank you for having such strong faith in me to conduct this study study, of which I believe the findings will benefit others in many ways. Thank you for spending your valuable hours assisting me in my thesis write-up. Thank you for your criticism, encouragements and enthusiasm in making my research a success. Their valuable kindness was immeasurable and I am truly grateful for that. From the bottom of my heart, thank you.

My sincere gratitude to Yayasan Khazanah for sponsoring my 2 years M.Sc. study as well as being good coach for me. All the real industrial world exposure they provide me have opened my eyes and changes the way I look at upcoming challenges in life; challenges used to be seen as obstacle for me, but now they are the stepping stone of being the better me. Being a part of the Yayasan Khazanah family is one of the best things ever happened to me.

I would like to thank my colleagues at ABEL; Mr. Razali Jonit, Mr. Parani Baya, Ms. Raja Ili Airina Raja Khalif, Mrs. Nor Fadillah Awang, Ms. Kwong Phek Jin, Mrs. Nor Farizah Hamid, Mrs. Azieatul Ashikin Abdul Aziz, Ms. Kong Sow Chan, Mr. Shahrulzaman Shahrudin, Ms. Soh Hui Hui, Ms. Tan Wei Lun, Ms. Goh Siew Ying, Mr. Xiao Zhi Chao, Mr. Mohd Rokibur Rahman and Ms. Noor Azlina Kamaruding for helping me during my experiments. Thank you for sharing valuable information and makes ABEL a livelier place to work in. I am proud to say I metamorphed into a better researcher and person throughout my study and research in ABEL. Thank you so much for that.

My sincere thank you to PERDA Penang, and Rumpun Asia Sdn. Bhd. (RASB), for allowing me to conduct my research at KBKB farm Penang, and RASB farm Batang Kali, respectively. Thank you to all the staff and workers who give their cooperation and aid in farm management and without which it might be a struggle for me to complete this study. Thank you to IPPP for the research grant (Grant no; PS272/2009C) during the past two years. Other than that, I would like to thank Institute of Biological Sciences (ISB) in Faculty of Science, University Malaya for giving me a place to do my postgraduate studies.

Last but not least, thanks to my family especially my parent, Hj. Abdul Rashid Salleh and Hjh Nariah Dollah, for their tolerance and wisdom in supporting me throughout this memorable journey. Thanks to my beloved brothers and sisters, Fauziah Abdul Rashid, Fakri Abdul Rashid, Ramli Abdul Rashid, Fatimah Abdul Rashid, Faizah Abdul Rashid, Najid Abdul Rashid, Abdul Wahid Abdul Rashid, Fauzi Abdul Rashid and Saidi Abdul Rashid who continuously remind me of what is important in life, the better half of me, Siti Wahida Suahaimin, for her understanding and love. I would like to thank all individuals who involved in this study. Again, from the deepest of my sincere heart, thank you all.

LIST OF PUBLICATIONS, PRESENTATIONS AND AWARDS

Conferences (Oral Presentation)

Mohd Nizam A.R., W.E. Wan Khadijah, R.B. Abdullah. 2010. Changes in foetal heart size and echogenicity as indicator for gestational age estimation in pregnant Jermasia does. Proceedings of the Malaysian Society of Animal Production 31st Annual Conference, June 6-8, Kelantan, Malaysia (extended abstract).

Mohd. Nizam A.R. 2009. Improving pregnancy detection in pregnant does. Yayasan Khazanah Research Forum 2009, November 21, Penang, Malaysia (abstract).

Conferences (Poster Presentations)

W.E. Wan Khadijah, R.B. Abdullah, **Mohd Nizam A.R.** 2010. Ultrasonography diagnosis of foetal heart for gestational age estimation in does. Proceedings of 15th Biological Sciences Graduate Congress, December 15-17, Kuala Lumpur, Malaysia (abstract).

Mohd Nizam A.R., W.E. Wan Khadijah, R.B. Abdullah. 2010. Foetal heart size and echogenicity as reliable reference for gestational age estimation in pregnant does. Proceedings of Asian Reproductive Biotechnology Society Annual Conference, November 8-10, Kuala Lumpur, Malaysia (abstract).

Mohd Nizam A.R., W.E. Wan Khadijah, R.B. Abdullah, R.K. Raja Ili Airina. 2010. Accuracy of ultrasonographic assessment for gestational age estimation based on analysis of pregnancy-related structures in different breeds of goats. Proceedings of Universiti Malaysia Terengganu 9th International Annual Symposium On Sustainability Science and Management, May 8-11, Terengganu, Malaysia (extended abstract).

Mohd Nizam A.R., W.E. Wan Khadijah, R.B. Abdullah. 2009. Accuracy of ultrasonographic assessment of pregnancy-related structure in Boer does. Proceedings of the International Conference on Animal Health and Human Safety, December 6-8, Putrajaya, Malaysia (abstract).

Award Obtained

Best poster presenter, Universiti Malaysia Terengganu 9th International Annual Symposium On Sustainability Science and Management, May 8-11, Terengganu, Malaysia

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LIST OF ABBREVIATIONS

ABEL	Animal Biotechnology-Embryo Laboratory
CL	Corpus luteum
Heartbeat	Detection of heart in foetus
KBKB	Kambing Bakabaik Kepala Batas
NE	Non-echogenic
RASB	Rumpun Asia Sdn. Bhd.