



UNIVERSITI PUTRA MALAYSIA

**PREVALENCE AND CONTROL OF KETOSIS IN POSTPARTURIENT
HOLSTEIN COWS IN SELECTED REGIONS OF IRAN**

ABDOLLAH SAMIEI

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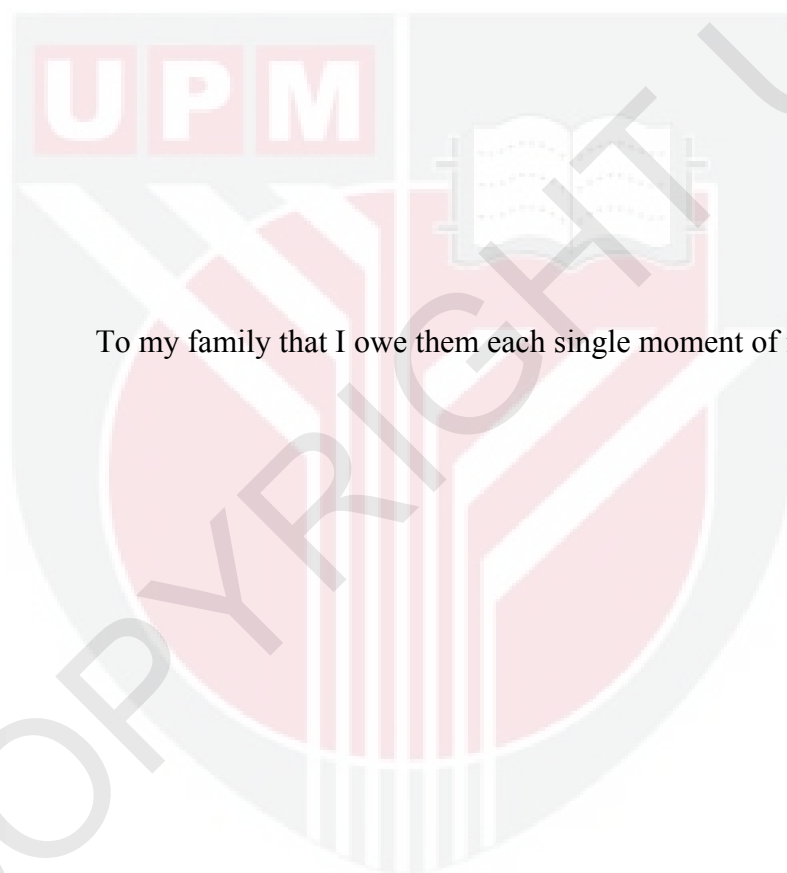
By

ABDOLLAH SAMIEI

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

February 2011

DEDICATION



To my family that I owe them each single moment of my life

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

**PREVALENCE AND CONTROL OF KETOSIS IN POSTPARTURIENT
HOLSTEIN COWS IN SELECTED REGIONS OF IRAN**

By

ABDOLLAH SAMIEI

February 2011

Chairman : Liang Juan Boo, PhD

Institute : Bioscience

This thesis investigated the prevalence of ketosis among 1,002 Iranian Holstein cows in 13 regions in Iran and examined the relationship between concentrations of β -hydroxybutyrate (BHBA) in milk and blood to assess the reliability of the BHBA concentrations in milk measured by a semi quantitative keto-test paper to detect subclinical ketosis (SCK). In addition, the relationships between dietary energy level, body condition score (BCS) and butyric silage with SCK in dairy cows during first month after calving and the effect of supplementation of Glycol-Line (a commercial glucose precursor) plus non-fiber carbohydrate (NFC) in diet on BHBA and glucose concentrations, based on the reduction of prevalence of SCK in fresh cows (four weeks after calving) were studied.

The prevalence of SCK and clinical ketosis among cows in the 13 regions were 12.21% and 3.52%, respectively. The mean milk production for cows suffering from clinical ketosis, SCK and healthy cows were 28, 35 and 45 kg/d, respectively, suggesting a reduction in milk yield for the diseased cows. There were associations

between regions, lactation stage, blood glucose and peak milk yield during first month lactating ($p < 0.01$). The correlation between blood glucose concentration and lactation stage was also significant ($p < 0.01$).

High correlation coefficients were observed between blood BHBA and blood NEFA, and between blood and milk BHBA. Milk yield of cattle with SCK decreased ($p < 0.01$) but fat percentage and milk fat:protein ratio increased ($p < 0.01$) as compared to those of the health cows. The commercial keto-test paper used had a low false positive result at a cut-off point of 200 μmol of BHBA/L of milk. The results showed that the best time to assess SCK using the commercial keto-test paper was 0, 14 and 17 days after calving.

Although in the total mixed ration (TMR), net energy for lactation (NE_L , 1.48 Mcal/kg), crude protein (CP, 13.4%) and NFC (30.5%) were lower while the fibre (NDF 44.23%) were higher than the recommended requirements of lactating cows, only NE_L was found to be significantly ($p < 0.05$) affecting incidence of SCK. Butyric acid concentration in the corn silage was high in four out of the ten farms studied but butyric acid had no significant effect on the occurrence SCK. Cows showed more than 0.5 unit loss of BCS during first month after calving because of the low energy content of the TMR used in the farms. However, BCS at calving was normal in most of the dairy cows and had no significant effect on the incidence of SCK.

Blood BHBA concentration was lower in cows fed with 38% NFC (non-fiber carbohydrate) and 300 g Glyco-Line in the close-up period and 40% NFC and 300 g Glyco-Line during the first month after calving (513 $\mu\text{mol/L}$). They also had higher

blood glucose concentration than the other groups. Average milk yield was the highest when 300 g Glycol-Line and 40% NFC were fed (37.5 kg/cow/d). Therefore, the most effective way to control or minimize incidence of SCK in dairy farms under conditions similar to those in this study would be to provide sufficient dietary energy to meet the requirements of the cows, especially during the first month after calving when the SCK prevalence is normally high.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**PENCEGAHAN DAN PENGAWALAN KETOSIS DALAM LEMBU
HOLSTEIN POSTPARTURIENT DALAM DAERAH TERPILIH DI IRAN**

Oleh

ABDOLLAH SAMIEI

Februari 2011

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Tesis ini mengkaji kekerapan ketosis yang terdapat pada 1,002 ekor lembu Holstein dalam 13 buah daerah di Iran dan hubungannya dengan kandungan (3-hidroksibutirat (BHBA) dalam susu dan darah dengan mengadar kebolehpercayaan konsentrasi BHBA dalam susu diukur dengan kertas keto-ujian semi kuantitatif untuk mengesan ketosis subklinis (SCK). Selain itu, hubungan antara tahap tenaga diet, skor keadaan tubuh (BCS) dan silaj butirat dengan SCK pada lembu tenusu dalam tempoh bulan pertama selepas beranak dan kesan pemberian Glycol-Line (sejenis prekursor glukosa komersial) yang ditambah dengan karbohidrat bukan serat (NFC) dalam diet ke atas kandungan BHBA dan glukosa berdasarkan kepada penurunan bagi kekerapan SCK pada lembu baru beranak (empat minggu selepas beranak) juga diselidik.

Kekerapan SCK dan ketosis klinikal pada lembu di 13 daerah masing-masing adalah, 12.21% dan 3.52%. Pengeluaran susu bagi lembu yang mengalami ketosis klinikal, SCK dan lembu sihat masing-masing adalah 28, 35 dan 45 kg/hari,

dan ini menunjukkan penurunan pengeluaran susu daripada lembu yang sakit. Terdapat hubungan antara daerah, tahap laktasi, glukosa dalam darah dan hasil susu puncak bagi bulan pertama laktasi ($p < 0.01$). Korelasi antara kandungan glukosa dalam darah dan tahap laktasi juga adalah berkesan ($p < 0.01$).

Pekali korelasi yang tinggi didapati antara BHBA dan NEFA dalam darah, dan antara BHBA dalam darah dan susu. Penghasilan susu bagi lembu yang menghadapi SCK turun ($p < 0.01$) tetapi peratus lemak dalam susu dan nisbah lemak susu:protein susu meningkat ($p < 0.01$) berbanding dengan lembu yang sihat. Kertas ujian-keto komersil yang digunakan untuk mengesan SCK mempunyai keputusan positif palsu yang rendah pada titik pengasingan 200 μmol BHBA/L susu. Keputusan kajian menunjukkan waktu terbaik untuk menilai SCK menggunakan kertas ujian-keto komersil adalah 0, 14 dan 17 hari selepas beranak.

Sungguhpun dalam campuran makanan (TMR), tenaga bersih untuk laktasi (NE_L , 1.48 Mcal / kg), protein kasar (CP, 13.4%) dan NFC (30.5%) adalah lebih rendah manakala serat (NDF 44.23%) adalah lebih tinggi berbanding keperluan yang disarankan untuk lembu tenusu, hanya NE_L didapati mempengaruhi kejadian SCK secara berkesan ($p < 0.05$). Kandungan asid butirat dalam silaj jagung adalah tinggi dalam empat dari sepuluh ladang yang dikaji tetapi pengaruhnya adalah tidak berkesan ke atas kejadian SCK. Lembu menunjukkan kehilangan lebih daripada 0.5 unit BCS dalam tempoh bulan pertama selepas beranak kerana kandungan tenaga yang rendah dalam TMR yang digunakan di ladang. Namun, BCS semasa beranak adalah normal bagi sebahagian besar lembu tenusu dan ianya tiada pengaruh berkesan ke atas kejadian SCK.

Kandungan BHBA dalam darah adalah rendah bagi lembu yang diberi makanan 38% NFC dan 300 g Glyco-Line bagi tempoh terakhir laktasi dan 40% NFC dan 300 g Glyco-Line bagi tempoh bulan pertama selepas beranak (513 $\mu\text{mol/L}$). Glukosa dalam darah bagi lembu-lembu tersebut juga adalah lebih tinggi berbanding dengan kumpulan-kumpulan lain. Purata hasil susu (37.5 kg/lembu/hari) adalah tertinggi dengan pemberian 300 g Glycol-Line dan 40% NFC. Oleh itu, cara yang paling berkesan untuk mengawal atau mengurangkan kejadian SCK di ladang lembu tenusu dalam keadaan serupa dengan kajian ini ialah menyediakan tenaga dalam diet untuk memenuhi keperluan lembu, terutamanya dalam tempoh bulan pertama selepas beranak ketika kekerapan SCK biasanya tinggi.

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I certify that an Examination Committee met on 17 February 2011 to conduct the final examination of Abdollah Samiei on his thesis entitled “Prevalence and Control of Ketosis in Postparturient Holstein Cows in Selected Regions of Iran” in accordance with the Universities and University Colleges 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 Doctor of Philosophy.

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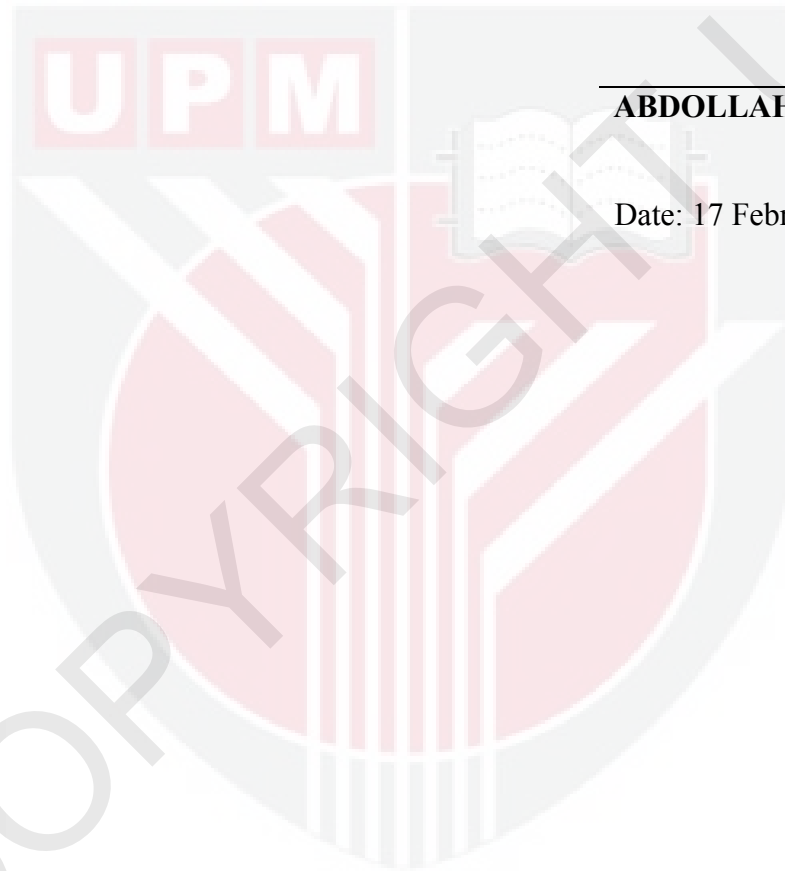
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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or other institutions.



ABDOLLAH SAMIEI

Date: 17 February 2011

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