

The Effect of energy levels on the follicular development in cattle

H. Yaakub¹, A. Azizah¹, S. Sukardi², A.R. Alimon¹ and H. Sharif³

Department of Animal Science
Faculty of Agriculture

²Department of Biomedical Sciences,
Faculty of Medical and Health Sciences
Universiti Putra Malaysia,
43400 UPM Serdang, Selangor,
Malaysia

³Livestock Research Centre,
Malaysian Agricultural Research and Development Institute (MARDI), P.O. Box 12301,
50774 Kuala Lumpur.

Telephone Number of Corresponding Author: 03- 89466894

E-mail of Corresponding Author: hali@agri.upm.edu.my

Key words: Bovine, Energy diet, Follicular development, Reproduction

Introduction

There is a wide range of reproductive responses to nutrition, ranging from the advent of puberty to the control of testicular growth and ovulation rate in adults. Dietary nutrients promote the programming and expression of the metabolic pathways that enable animals to achieve their genetic potential for production. The effect of nutrition on reproductive performance has been a subject of many studies. It has received considerable interest for commercially important animals where nutrition is one of the major costs of maintenance and production. One major cause of poor reproductive efficiency in cows is an extended interval from calving to first ovulation. Several factors influence this interval including pre and postpartum nutrition. It has been reported that low dietary intake reduced the diameter and persistence of dominant follicles the oestrous cycle and tended to increase the proportion of oestrous cycles with 3 dominant follicles in cattle. Most of the mechanisms involve the endocrine, which probably due to the effects of nutrient supply on the reproductive system. The nutrients may alter the secretion of gonadotrophins, rate of blood flow and probably secretion of growth hormone which is responsible for the secretion of steroid at the ovarian level. The changes in gonadotrophin in the blood circulation may alter the follicle development. The effect of diet on the reproduction, especially at the ovarian level still became a major topic. The dynamic of follicle growth became a topic of great interest since Rajokoski (1960) proposed the hypothesis that two 'waves' of follicular growth exist during the oestrous cycle in cattle. It is possible to visualise bovine ovaries and to follow daily the dynamics of follicular growth and regression in cattle using transrectal ultrasonography. The follicular wave begins with recruitment of a cohort of follicles from which a single follicle continues to grow while others undergo atresia. The growth of the dominant follicle is consistently associated with reduction in both number and growth of the subordinate follicles. Understanding follicle development will contribute to a more efficient embryo transfer industry, as time taken to prepare the animal for superovulation is very critical. It has been reported that the number of small follicles and the total number of follicles at the start of any superovulatory treatments were positively correlated with subsequent with superovulatory response. The objective of this study is to determine the follicular development of cow on different levels of energy diet.

Materials and Methods

Thirty crossbred cows, which ranging from 3 to 5 years of age. The animals were allocated at random into two treatment groups. The first group were given a single maintenance diet (GSM; n=15) as the second group a double maintenance diet (GDM; n=15) calculated based on energy level of feed. Calculated diet was offered to the animals individually early in the morning and allowed to graze at evening on pasture area planted with *Bracharia decumbens*.

All the animals were acclimatized for 14 days selection and on treatment diet from day of synchronisation until the third normal oestrous cycles (ranges from 18 to 21 days) before artificial insemination (AI). All the animals were received intravaginal progesterone releasing device-containing 1.38g of progesterone (CIDR[®] B: Pharmacia & Upjohn; Australia) for 7 days and 1 ml synthetic prostaglandin analogue (250 µg/ml cloprostenol; Estrumate[®]; Schering-Plough Animal Health, Australia) administered 2 days before CIDR removal to synchronised the oestrus.

Ovaries were scanned every second day using ultrasound machine (Aloka[®] SSD-500; Japan) attached to 7.5 MHz linear array transducer, transrectally. The ultrasound images of the follicles were measured for the diameter and mapped to identify follicular development and persistence follicles. The day of follicular wave emergence was determine as the day on which the first follicle > 5 mm in diameter.

Blood samples were collected into a plain vacuum tube (Vacutainer[®], BD Vacutainer, USA) on the day of follicles mapping for serum progesterone concentrations (P4) determination. Serum P4 was determined by radio-immunoassay (RIA) using the solid phase coated tube system employing 125I as tracer supplied in kit form as recommended by the Joint FAO/IAEA (1993), which prepared at MARDI, Serdang and count at MINT (Data still need to be analysed). The number of follicles at emergence, day at follicle wave emergence, diameter, day and the growth rate of the dominant follicle was determined.

Results and Discussion

Result shows the percentage of cows with one wave of follicular development for GSM (40%) is higher than GDM (20%) and on the other hand, cows with two waves of follicular development for GSM (60%) is lower than GDM (80%). This shows that the double energy diet will increase the number of cows with two waves. As a result the cows will be more uniform in term the number of follicular waves. Based on the number of follicular wave, the new emergence follicle can be predicted since follicle development will contribute to a more efficient embryo transfer industry, as time taken to prepare the animal for superovulation is very critical. General observation for follicle parameter such as the diameter of dominant for first wave, second wave and duration for both wave were the same and yet the data need to be analysed properly to get a meaningful results. The average duration of the follicular wave and diameter of dominant follicle for GSM and GDM that have one follicular wave were 19.0 days, 18.7 days and 14.5 mm, 14.5 mm, respectively. The average duration of the first and second follicular waves and the diameter for the first and second dominant of follicle for GSM and GDM that have two follicular waves were 12.2 days, 10.9 days; 14.2 days, 12.6 days and 12.7 mm, 12.4 mm; 12.4 mm, 12.7 mm, respectively. Other parameter of the follicular development such as the day of emergence of the follicle and day of dominant are needed to be analysed. Based on the available results the high energy diets only alter the percentage of cows with one or two follicular waves. In two wave cycles, maturation of the second dominant follicle is often associated with spontaneous regression of the corpus luteum and, therefore, this follicle ovulates after luteolysis (Savio *et al.*, 1988; Taylor and Rajamahendran, 1991) with significantly shorter luteal phase and oestrous cycles (Ginther *et al.*, 1989; Taylor and Rajamahendran, 1991; Fortune 1993). Alternatively, the second dominant follicle may become atretic and if this occurs, a third follicular wave will be initiated resulting in a longer inter-oestrous interval compared to cattle with two waves (Ginther *et al.*, 1989; Taylor and Rajamahendran, 1991; Fortune 1993). In this study, all cows return to oestrus within 18-24 days. It is important to evaluate the number of follicle greater than 5 mm in diameter were first detected, according to Adams *et al.* (1992) the number of small follicles and the total number of follicles at the start of any superovulatory treatments were positively correlated with subsequent superovulatory response.

Conclusions

In conclusion, the double energy diet are able to increase the number of cows with two follicular wave, as a results, more uniform cow in term of follicular development, which is more suitable for embryo transfer industry.

Benefits from the study

Able to manipulate the follicular wave of the cows, by increasing the percentage of cows with two follicular waves. As a result the cows will be more uniform, before superovulatory treatment and be able to estimate number of follicle produced.

Patent(s), if applicable:

Nil

Stage of Commercialization, if applicable:

Nil

Project Publications in Refereed Journals:

Nil

Project Publications in Conference Proceedings

1. A. Azizah, H. Yaakub, S. Sukardi and H. Sharif. 2003. Pregnancy rate of crossbred cows offered different level of energy diets. In Proceedings of the 25th Malaysian Society of Animal production Annual conference. 1-3 August 2003, Melaka, Malaysia. P139-141.

Graduate Research

Name of Graduate	Research Topic	Field of Expertise	Degree Awarded	Graduation Year
Azizah Amri	The effect of energy levels on the follicular development in cattle.	Nutritional Reproduction	MSc.	Writing stage.
Norhayati Sabar (Final year project Report)	The effects of feeding levels on pregnancy rate in cattle	Nutritional Reproduction	BSc. Bioindustry – Major Animal Science	April 2003

Herny Marini Mhd Hisham (Final year project Report)	The effects of feeding different energy levels on oestrus behaviour in cattle	Nutritional Reproduction	BSc. Bioindustry – Major Animal Science	April 2003
--	---	-----------------------------	---	------------

IRPA Project number01-02-04-0511
UPM Research Cluster:AFF
Project Leader Halimatun Yaakub