UNIVERSITI PUTRA MALAYSIA

INFLUENCE OF SUCKLING AND NUTRITION ON RESUMPTION OF POSTPARTUM OVARIAN ACTIVITY IN SWAMP BUFFALOES (*Bubalus bubalis*)

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INFLUENCE OF SUCKLING AND NUTRITION ON RESUMPTION OF POSTPARTUM OVARIAN ACTIVITY IN SWAMP BUFFALOES *(Bubalus bubalis)*

By

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INFLUENCE OF SUCKLING AND NUTRITION ON THE RESUMPTION OF POSTPARTUM OVARIAN ACTIVITY IN SWAMP BUFFALOES (*Bubalus bubalis*)

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Four studies were conducted to evaluate the reproductive performance and factors affecting the resumption of postpartum ovarian activity in swamp buffaloes.

The reproductive performance of swamp buffaloes (n=104) under an extensive production system was evaluated using calving records from 1977 to 1990 (Study 1). The calving to conception interval (n=117) and the intercalving interval (n=117) of the buffaloes were 177 and 489 days respectively. There was no influence of rainfall on the occurrence of conceptions in the animals.

The dry matter intake, ovarian activity determined by plasma progesterone (P4) profiles, body weight and body condition changes postpartum in swamp buffaloes (n=12) under an extensive production system were assessed (Study 2). Delayed resumption of postpartum ovarian activity was confirmed as one reason for the long calving interval in suckled buffaloes under the extensive production system.

The effects of three suckling frequencies: unrestricted suckling (S); restricted suckling to once daily (RS); and early weaning (EW) on resumption of ovarian activity determined by plasma progesterone (P4) profiles, and body weight and body condition changes postpartum were evaluated on 36 swamp buffaloes (Study 3). The percentage of buffaloes resuming ovarian activity within sixty days postpartum, and the interval from calving to first ovulation were 8.3 (1 of 12), 41.7 (5/12) and 91.7% (11/12), and 91, 67 and 43 days for the S, RS and EW groups respectively. The delay in the resumption of ovarian activity was associated with a continuous loss of body weight and body condition. It was concluded that suckling delayed while early weaning and restricted suckling enhanced early resumption of postpartum ovarian activity.

The effect of plane of nutrition: high plane (HP); medium plane (MP) and low plane (LP) on the resumption of ovarian activity was determined by plasma progesterone (P4) profiles, and body weight and body condition changes postpartum on 33 swamp buffaloes (Study 4). The percentage of buffaloes resuming ovarian activity within sixty days postpartum was 66.7 (8/12), 16.7 (2/12) and 11.1% (1/9) for the HP, MP and LP groups respectively. By day 150 postpartum, 88.7% of the buffaloes in the LP were anoestrus compared with 8.3% in the HP and 0% in the MP. The earlier resumption of postpartum ovarian activity was associated with a faster recovery of body weight and body condition while the delayed resumption was associated with a slower recovery of body weight and reduced body condition after calving. It was concluded that a high plane of nutrition enhanced whereas a low plane of nutrition delayed the resumption of postpartum ovarian activity.

Two approaches for the induction of early postpartum ovarian activity are manipulation of suckling and feed intake. The results of this study have demonstrated that restricted suckling (once daily) is the most practical method for resumption of early postpartum ovarian activity in the suckled swamp buffalo without affecting the growth performance of the calf.

Abstrak Tesis Yang dikemukakan Kepada Senat Universiti Pertanian Malaysia Sebagai Memenuhi Syarat Keperluan Untuk Ijazah Doktor Falsafah

PENGARUH PENYUSUAN DAN PEMAKANAN TERHADAP PEMULAAN AKTIVITI OVARI SELEPAS KELAHIRAN PADA KERBAU SAWAH

Oleh

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Empat kajian telah dilakukan untuk menilai prestasi pembiakan dan faktor-faktor yang mempengaruhi pemulaan aktiviti ovari selepas kelahiran pada kerbau sawah.

Prestasi pembiakan kerbau (n=104) sawah dibawah sistem pengeluaran extensif ditentukan dengan menggunakan rekod-rekod kelahiran dari tahun 1977 hingga 1990 (Kajian 1). Purata selang (n=117) antara kelahiran hingga peng-konseifan dan selang (n=117) antara kelahiran masing-masing ialah 177 dan 489 hari. Adalah didapati bahawa taburan hujan tidak mempengaruhi bilangan pengkonseifan.

Pengambilan bahan kering, aktiviti ovari yang ditentukan dari profil progesteron plasma, perubahan berat badan dan skor keadaan badan selepas kelahiran pada kerbau sawah (n=12) yang dibela di bawah sistem pengeluaran extensif ditentukan (Kajian 2). Kelewatan pemulaan aktiviti ovari selepas kelahiran

telah disahkan sebagai satu sebab yang memanjangkan sela antara kelahiran pada kerbau-kerbau yang dibela di dalam sistem pengeluaran tersebut.

Kesan tiga kekerapan penyusuan: penyusuan tidak terhad (S); penyusuan terhad (RS); dan ceraisusu awal (EW) ke atas pemulaan aktiviti ovari yang ditentukan dari profil progesteron plasma, perubahan berat badan dan keadaan badan selepas kelahiran telah dikaji ke atas 36 ekor kerbau sawah (Kajian 3). Peratus kerbau memulakan aktiviti ovari dalam masa enam puluh hari selepas kelahiran, dan sela dari kelahiran hingga ovulasi pertama ialah 8.3 (1/12), 41.7 (5/12) dan 91.7% (11/12), dan 91, 67 dan 43 hari masing-masing bagi kumpulan S, RS dan EW. Kelewatan pemulaan aktiviti ovari berkaitan dengan penurunan berat badan dan keadaan badan yang berterusan. Dari kajian ini adalah diputuskan bahawa penyusuan tidak terhad melambatkan manakala penyusuan terhad dan ceraisusu awal mempercepatkan pemualaan aktiviti ovari selepas kelahiran.

Kesan tiga aras pemakanan: aras tinggi (HP); aras sederhana (MP) dan aras rendah (LP) ke atas pemulaan aktiviti ovari yang ditentukan dari profil progesteron plasma, perubahan berat badan dan keadaan badan selepas kelahiran telah dikaji ke atas 33 ekor kerbau sawah (Kajian 4). Peratus kerbau memulakan aktiviti ovari dalam masa enam puluh hari selepas kelahiran ialah 66.7 (8/12), 16.7 (2/12) dan 11.1% (1/9) masing-masing bagi kumpulan HP, MP dan LP. Pada hari ke-150 selepas kelahiran 88.7% kerbau kumpulan LP takestrus (anoestrus) berbanding dengan 8.3% pada kumpulan HP dan 0% pada kumpulan MP. Keawalan pemulaan aktiviti ovari selepas kelahiran berkaitan dengan kecepatan pemulehan berat dan keadaan badan manakala kelewatan pemulaaan aktiviti ovari berkaitan dengan kelambatan pemulehan berat badan dan penurunan keadaan badan selepas

kelahiran. Dari kajian ini adalah diputuskan bahawa aras pemakanan tinggi mempercepatkan manakala aras pemakanan rendah melambatkan pemulaan aktiviti ovari selepas kelahiran.

Dua pendekatan untuk mempercepatan pemulaaan aktiviti ovari selepas kelahiran ialah dengan manipulasi kekerapan penyusuan dan pengambillan makanan. Hasil dari kajian-kajian ini telah menunjukkan bahwa penyusuan terhad kapada sekali sehari ialah cara yang paling praktikal untuk mempercepatkan pemulaan aktiviti ovari selepas kelahiran pada kerbau swawah yang menyusukan anak tanpa menjejaskan pembesaran anak.

CHAPTER 1

INTRODUCTION

Domestic water buffaloes (*Bubalus bubalis*) are of two types. The river type is primarily kept as a dairy animal and the swamp is mainly used for draught. The river type has 50 chromosomes and includes well-known breeds like Murrah, Jafarabadi, Kundi, Nilli-Ravi and Surti. The swamp type is represented by only one breed which has 48 chromosomes (Fischer, 1974; Bongso and Hilmi, 1982). The river buffalo is found in the western-half of Asia whereas the swamp type is found in the eastern-half of the continent. More than half of the world buffalo population is found in the Indo-Pakistan Subcontinent (Cockrill, 1981). The distribution of swamp buffalo which is indigenous to Southeast Asia extends northwards as far as Yangtze Valley of China and westward as far as Assam (Mason, 1974). According to the FAO Production Year Book (1986) China, Thailand, Philippine, Indonesia and Vietnam have 20, 6.3, 3, 2.9, and 2.7 million swamp buffaloes, respectively.

In Malaysia, the swamp buffalo is known as the 'kerbau' and the number of the animals is decreasing. The buffalo population was estimated at 230,040 heads in 1970 and 139,674 in 1989 (Division of Veterinary Services, 1990) giving a declining rate of - 1.96% per annum. Many reasons have been proposed for the decline in the buffalo population in Malaysia. The increasing use of the tractors

for ploughing the rice fields has minimized and even eliminated the use of swamp buffaloes as draught animals. Improvement of irrigational facilities has led to double-cropping of rice fields which has left less time for the management of the buffalo. The intensive cultivation of agricultural lands has reduced the area for the buffalo to graze, and combined with the low level of husbandry has compounded the slow natural increase in buffalo numbers. Further, the demand for meat by a rising human population has led to increased slaughter of the buffalo for human consumption. The slaughter rate of the animal has been estimated at 17.7% per annum (Division of Veterinary Services, 1984).

Being an important source of draught power and meat, the swamp buffalo is highly regarded especially in East and Southeast Asian countries as an important component of a sustainable integrated farming system. It utilizes non-marketable farm by-products and wastes and supply manure to the farmlands. However, the swamp buffalo has a low reproductive efficiency which represents the major constraint for a viable, large scale buffalo beef industry. The breed is noted for delayed age at first calving and long intercalving intervals (Cameons, 1976; Jainudeen, 1983).

In the past 10 to 15 years, most of the research on buffalo reproduction has been in the river breeds. On the other hand, little research has been conducted on the reproductive capacity of the swamp buffalo.

Among the reproductive processes a buffalo has to undergo, resumption of postpartum ovarian activity represents a vital reproductive function. It influences the calving interval. A delayed resumption of postpartum ovarian activity results in a prolongation of a calving interval, hence, lowering reproductive efficiency.

Several factors influence the recurrence of postpartum ovarian function. Nutrition and suckling are two important external factors influencing the onset of postpartum ovarian activity in farm animals (Peters and Lamming, 1990; Randel, 1990; Williams, 1990). To a lesser extent, ovarian activity is also influenced by season, parity and level of milk yield. The effects of nutrition and suckling on postpartum ovarian function had been extensively studied especially in beef cattle, but very little has been reported in swamp buffaloes.

The reproductive performance of farm animals such as buffaloes is not only influenced by nutrition and suckling but also by the production system in which they are reared and managed (Cameons, 1976; Jainudeen, 1983; Nordin *et al.*, 1990). Besides suckling and feeding practices, factors such as breeding management, disease control, housing and care of the postpartum animals are also contributing factors determining the productivity of buffaloes in the production system. Presently buffalo rearing in Malaysia can be grouped into three production systems: intensive, semi-intensive and extensive production. The intensive and semi-intensive production systems are usually practised in dairy buffaloes. The swamp buffaloes, in most cases, are raised under an extensive system and seldom under an intensive system except for fattening in feedlot operations.

In view of the influence of the production system, suckling and nutrition on the onset of postpartum ovarian activity in swamp buffaloes, and the dearth of information on their effects, four studies were conducted with the following objectives:-

1. To evaluate the reproductive variables associated with the postpartum interval to the resumption of ovarian activity in swamp buffaloes under an extensive production system,

2. To asses feed and energy intake, body weight and body condition changes and ovarian activity postpartum in swamp buffaloes under an extensive production system,

3. To determine the influence of suckling on resumption of postpartum ovarian activity, and

4. To evaluate the effects of plane of nutrition on the onset of postpartum ovarian activity.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

The calving interval or the interval between calvings is the most commonly used measure of reproductive efficiency in the buffalo; other measures include calving rate, conception rate and services per conception. Reproductive performance is minimally influenced by the genetic make-up of the animal whereas environmental factors generally override genetic factors. The heritability of calving intervals in farm animals may range from 0 to 20 per cent (Mason, 1974) and the heritability is almost zero per cent in swamp buffaloes (Cameons, 1976).

The calving interval comprises the interval from calving to conception (service period) and from conception to parturition (gestation period). Since the gesta- tion period is more or less a constant, variations in calving intervals are mainly due to the variations in the service period. Therefore, the key component in control- ling the length of the calving interval is the service period. A long service period prolongs the calving interval. From a survey of the literature, the gestation period of the swamp buffalo is 310-330 days and the service period is 60-300 days; this gives a calving interval of 390 - 630 days.

The service period consists of two components: (a) the postpartum interval, i.e. the interval from calving to the onset of the first ovarian cycle or ovarian

activity and is indicated by the presence of the first postpartum oestrus and ovulation; and (b) the interval from first oestrus to conception. The latter interval depends on number of services per conception. Heritability of the service period ranged from 0 to 20 percent (Mason, 1974). A repeatability of 0.142 in the service period of a dairy buffalo breed was reported (Shah and Khan, 1981). Factors such as apparent silent ovulation, non-ovulatory oestrus, ovarian inactivity, embryonic mortality and infertile services contribute to the lengthening of the service period (Shalash, 1985).

Postpartum Ovarian Activity

The early resumption of postpartum ovarian activity is vital because it influences the length of the service period, hence the calving interval. Thus to achieve optimal reproductive efficiency, a minimum delay in the resumption of postpartum ovarian activity is of vital importance.

The onset of postpartum ovarian activity may be determined through regular rectal palpation or by direct observation of the ovaries by such techniques as laparoscopy for the presence of ovarian structures such as corpus luteum/follicles, and radioimmunoassay (RIA) technique by monitoring the progesterone level in plasma/serum.

Another indication of the occurrence of first ovulation could be determined by subtracting three days from the date at which the first palpable corpus is detected (El-Fouly *et al.*, 1976), or through direct visualization of the ovaries by laparoscopy (Jainudeen *et al.*, 1982). First postpartum ovulation was noted at 90 days after calving in swamp buffaloes (Jainudeen *et al.*, 1982) and between 60-90 days postpartum in Murrah buffaloes (Perera, 1981). It could also occur as early

as 38 days after parturition (Singh *et al.*, 1979). Postpartum ovulation is not necessarily manifested or preceded by oestrus. From progesterone levels and visible observations, 50% of dairy buffaloes in India showed at least one silent oestrus during the postpartum period (Arora and Pandey, 1982).

The appearance of the first postpartum oestrus, the principal component of service period, is an external indication of the resumption of ovarian activity. It occurs between 40 and 275 days with an average of 90 days after calving in swamp buffaloes (Jainudeen, 1983) and 132 days postpartum in dairy buffaloes (El-Fouly *et al.*, 1976).

Delayed resumption of postpartum ovarian activity or postpartum anoestrus affects 30-40% of swamp buffaloes (Jainudeen *et al.*, 1983) and persists until calves are weaned or separated from their dams. The incidence is more common in suckled swamp buffaloes than in milked river buffaloes (Jainudeen, 1988). Delayed resumption of ovarian activity after calving is the major cause of long calving intervals in river-type buffaloes in Sri Lanka, with conceptions occurring rapidly after the onset of cyclic activity (Perera *et al.*, 1984).

Endocrinology of the Postpartum Period

Following parturition, there is a period of reproductive inactivity of variable length characterised by anoestrus and a lack of ovarian activity in farm animals such as in cows, sheep, and pigs (Peters and Lamming, 1990). As ovarian function is controlled by the gonadotrophins secreted by the hypothalamus and pituitary, the lack of ovulation and ovarian cycles during this period could be due to inhibition at several levels of the hypothalamo-pituitary-ovarian axis (Peters and Lamming,

1990). During the postpartum period, changes in the concentrations of gonadotrophins and ovarian hormones occur to initiate the onset of postpartum ovarian activity (Radford *et al.*, 1978; Rawlings *et al.*, 1980; Carruthers *et al.*, 1980; Schallenberger *et al.*, 1982; Lamming *et al.*, 1982)

Cattle

Prior to parturition, the plasma LH levels are low (less than 1 ng/ml) and after parturition until day 5 postpartum the level may range from 0.8 to 1.6 ng/ml (Peters *et al.*, 1981; Schallenberger *et al.*, 1982). The level increases to 2.9 ng/ml on day 25 and to 3.9 ng/ml on day 128 postpartum (Schallenberger *et al.*, 1982). Levels of LH vary in an episodic pattern with increasing frequency and magnitude of LH peaks. The maximum magnitude and frequency of LH peaks occur 33-10 days before initial elevation of plasma proges-terone (Rawlings *et al.*, 1980). Plasma LH concentrations are lower in suckled than in non-suckled or milked cows (Radford *et al.*, 1978; Peters *et al.*, 1981). The concentrations of plasma LH are 0.98 and 2.06 ng/ml in suckled and non-suckled cows respectively during day 13-19 postpartum (Peters and Lamming, 1981)

Plasma FSH concentrations are high in the cow during the postpartum period. The FSH levels range from 104 ng/ml 2 days prior to parturition to 299 ng/ml on day 25 postpartum (Schallenberger et al., 1982). There is no consistent pattern or any significant change in the concentration of FSH during the post-partum period, and it is considered that FSH secretion is not a limiting factor to follicle development during this period (Peters and Lamming, 1984)