Influence of Parity on Opting Optimal Season for Breeding in Murrah Buffaloes

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Abstract: Environmental factors place a crucial role in reproductive management of buffaloes by regulating their estrous cycle. Conception occurs if breeding takes place in favorable season where availability of sufficient herbage and water. Influence of parity on selection of breeding seasonal, leads to conception, was not yet reported in murrah buffaloes. Therefore, the present investigation was carried out to analyse the influence of parity on selecting an optimal season for breeding among murrah buffaloes in south India. Sixty reproductively active murrah buffaloes belonged to southern part of Indian subcontinent were recruited in the study and grouped based on their parity. Estrus behaviour, date of mating and consequent pregnancy was recorded for every individual buffalo. A conception rate of 81.67% was achieved with natural mating. Among the 49 pregnant animals, 12 were nulliparous (n=19), 15 were primiparous (n=16) and 22 were multiparous (n=25). Conception rate was high during winter (32.65%), followed by autumn (26.53%), monsoon (20.41%) and pre-winter (20.41%). Major factors such as age, low reproductive efficiency during late winter and early autumn, delayed resumption after calving appears to affect the conception rate. Prolonged summer, extended from March to July, noticed in recent years decreases the duration of other seasons like spring and autumn. Effective breeding of nulliparous was witnessed on winter, primiparous during autumn and multiparous was scheduled from monsoon to pre-winter. The present study concludes that selection of optimal season for breeding was rather influenced by the parity of individual buffaloes.

Keywords: Nulliparous, Primiparous, Multiparous, Breeding, Conception.

INTRODUCTION

Buffaloes are the prime livestock species of many developing nations, particularly Asian countries, which has an imperative role in their agricultural economy through dairy and beef industries [1]. Being highly populated in Southeast Asia [2], it contributes significantly to its economy by compensating the globe's growing demands of meat, milk and draught work. Owing to its better tolerance capability to hot and humid climate of tropical region, and its ability to acquire reasonable growth rate on meager quantity roughage feeding, buffalo increases its attention over bovine species. However, buffaloes are poor thermo-regulators due to their morphological and anatomical peculiarities. The reproductive effectiveness of this shy breeder was restricted by various physiological hitches such as delayed puberty, poor manifestation of estrus signs, long calving intervals and poor conception rate [3-4]. Environmental factors such as temperature, precipitation humidity, length of daylight, availability of water and food have direct effect on the reproductive process such as ovulation, fertilization, implantation, gestation and parturition.

Though buffaloes are polyestrous and capable of breeding throughout the year, a seasonal pattern of breeding activity and consequent calving has been reported from different countries [5]. Several lines of evidences suggested that climatic stress reduces ovarian cyclicity and estrus expression [6]; thus, buffaloes exhibits distinct seasonal variation in displaying estrus symptoms, follicular and luteal dynamics in buffalo cows, conception rate, and calving rate [7-15]. Seasonal effects on the reproductive function are governed by the pineal body and melatonin which constitute its secretory product [16]. Exposure of buffaloes to the hot conditions evokes a series of drastic changes in the biological functions that include depression in feed intake, efficiency and utilization, disturbances in metabolism of water, protein, energy, and mineral balances, enzymatic reactions, hormonal secretions, and blood metabolites [17]. Further, estrus detection was more frequent and stronger in the colder seasons than summer [18] and the conception rates drops dramatically from about 40–60% in colder months to 10–20% or lower in summer [19].

Reproduction of cattle exhibits complex dependency on nature of soil, herbage and climatic factors [20], particularly in tropical and subtropical parts of the world. The reproductive efficiency of this silent heat animal is usually negatively affected by increasing length of daylight. In equatorial regions, where the length of light hours is long, the reproductive function is mostly dictated by the availability of food stuff rather than length of light hours. Whereas in tropical regions,

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where photoperiod is relatively constant, annual changes in rainfall appear to influence the cyclical reproductive pattern with availability and quality of herbage [21-22]. Significant variations in reproductive endocrine activity without external signs of estrus (silent heat) are described to be more common in buffaloes [23-24]. However, heat stress during the hot summer months is a major cause of anestrus in buffalo in India [23], which causes huge loss to the dairy and beef industries. Majority of the studies indicate the reproductive activity of the buffaloes based on four seasons (i.e. summer, winter, autumn and spring). However, the four season rule is not applicable at all to tropical region such as India.

The climate of Indian subcontinent rather comprises a wide range of weather conditions across a vast geographic scale and varied topography. Hence, generalization of seasons for the whole nation by existing four season rule followed universally would not be suitable. Based on the Köppen system of classification India possesses six major climatic subtypes, i.e. winter, spring, summer, monsoon, autumn and pre-winter, but the order and duration varies widely between regions. Every region of India has unique shift in the days of Gregorian month corresponds to the season and followed their own regional names for seasons and indigenous calendar's. Since, the southern part of India contributes considerably for the economy through dairy and beef industries. It is necessary to evaluate the influence of season and status of parity with the conception of buffalo cows on the southern part of Indian subcontinent for better reproductive management and to increase their population.

In this concern, the present study aims to investigate the influence of parity on choosing optimal seasons for breeding among murrah buffaloes.

MATERIALS AND METHODS

Animals

As many as hundred buffaloes belonged to various farms located at Kollidam River bed, Tiruchirappalli, Tamil Nadu (10°51'40"N 78°42'45"E) were undertaken for this study. Buffaloes were housed in padlocks during nights and are free grazing throughout the daytime. Study animals were provided with standard mineral supplements and water *ad libitum*. Animals were examined with the help of veterinary assistants and individuals with known reproductive tract problems, pregnant, lactating and non-co-operative animals were excluded from the study as followed in our previous study [25].

Study Group

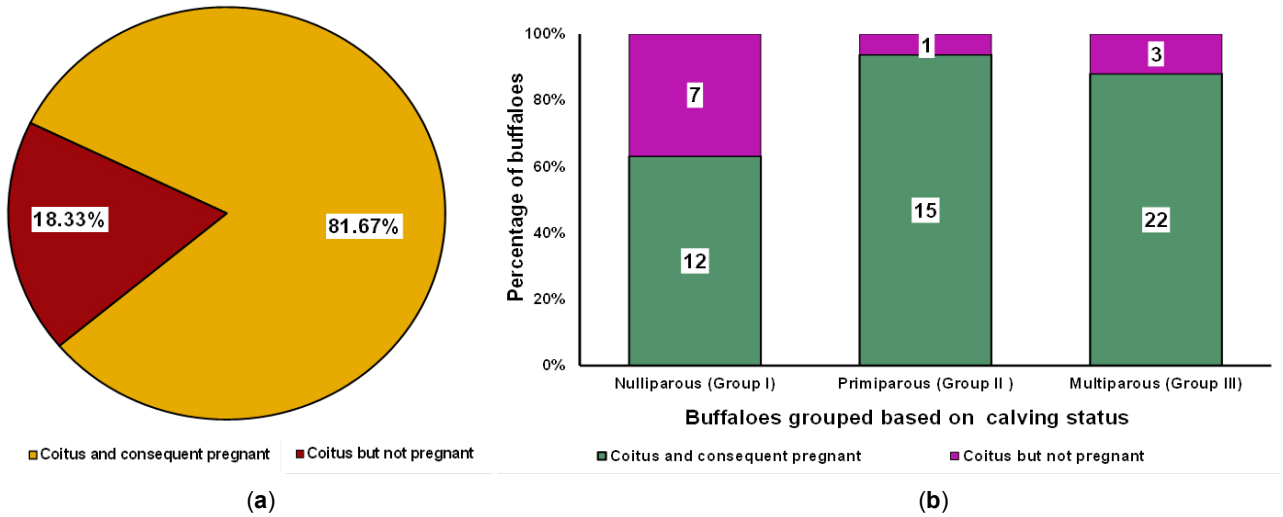
Regularly cycling (minimum three subsequent cycles) and reproductively active murrah buffalo cows aged between 2.5 and 12 were recruited for the present study. The information on the history and number of calving of each individual buffalo was obtained from the farm keepers and recorded. The animals were segregated into three groups based on their parity status: Group 1 - Nulliparous (heifers), Group II - Primiparous animals (calved single time), Group III - Multiparous (calved 2 to 5 times).

Prediction of Estrus

Estrous cycle phases were classified as pre-estrus (Day -4 to -2), estrus (Day 0), post-estrus (Day 6 to 9) and baseline or control (Day 10 to -8) according to Rajanarayanan and Archunan [26], with slight modification [25]. The reproductive cycle was delineated by visual observation (restlessness, abnormal posture, intermittent or frequent urination, vulval tumefaction, extend of vulval vascularization and vaginal discharge), gynaeco-clinical examination (uterine tonicity and cervical relaxation), biochemical analysis (cervical mucus crystallization or fern pattern, vaginal mucus cytology and volatiles identification) and behavioral analysis from bull and cow separately (bellowing, sniffing, licking, hypersalivation, flehmen, sexual motivation and mounting). The phases of estrous cycle were defined by the expression intensities of the above mentioned parameters [25].

Mating, Conception and Season

Mature bulls were introduced to the herd of study animals and allowed to graze along with buffalo cows. The bulls were allowed to mate naturally by choice and the information of mating with date, time and season was recorded. Pregnancy was confirmed thereafter by trans-rectal uterine palpation. The seasonal changes and availability of water were noted. The data for whole year was segregated into six seasons, adopted in south India, as Pinpani/Winter (mid-Jan to mid-Mar), Ilavaenil/Spring (mid-Mar to mid-May), Mudhuvaenil/ Summer (mid-May to mid-July), Kuthir/Autumn (mid-July to mid-Sep), Kar/Monsoon (mid-Sep to mid-Nov), Munpani/Pre-winter (mid-Nov to mid-Jan). Environmental factors such as temperature, humidity



(**a**) (**b**)

Figure 1: Pregnancy percentage of buffaloes engaged in natural breeding. (**a**) indicates the percentage of buffaloes become pregnant and not-pregnant after coitus. (**b**) specifies the percentage of pregnant and not-pregnant buffaloes in each group (nulliparous, primiparous and multiparous).

and precipitation were obtained from the weather forecast report.

RESULTS

Parity and Conception Rate

After scrutinizing buffaloes assigned to the present study, 60 animals satisfied the inclusion criteria were included in the study. Majority of the excluded animals were pregnant. The selected 60 animals were grouped based on their parity/status of calving as Group I - Nulliparous (n=19), Group II - Primiparous (n=16) and Group III - Multiparous (n=25). Buffalo cows were engaged in coitus during the phase of intensified estrus. Following coitus the study animals were subjected to pregnancy assessment and found that 81.67% (n=49) buffaloes turned out to be pregnant after coitus and the remaining 18.33% (n=11) buffaloes did not conceive (Figure **1a**). Among the conceived animals (n=49) 63.17% (n=12) was nulliparous, 93.75% (n=15) was primiparous and 88% (n=23) was multiparous. The rate of non-conception after natural coitus was very low in primiparous (6.25%, n=1) and multiparous (12%, n=3) compare to nulliparous (36.83%, n=7) buffaloes (Figure **1b**).

Season and Conception Rate

The seasons displayed in the southern part of Indian subcontinent was clearly depicted in Figure **2** with the regional name (Circle 1), their corresponding Gregorian month (Circle 3) and English name (Circle 3). Prominent expression of various estrus signs were observed between autumn (Kuthir) and winter (Pinpani), i.e. from August to February, with varied intensities from season to season. However, exhibition of various estrus signs were almost absent/ unnoticed or the intensity of their expression was very low, if present, during the period of spring, summer and early autumn (results not shown). The frequency of matting was observed from middle of August (Autumn/Kuthir) and extended till the middle of February (Winter/Pinpani). The conception rate was high during winter (32.65%) when compared to other seasons such as autumn (26.53%), monsoon (20.41%) and pre-

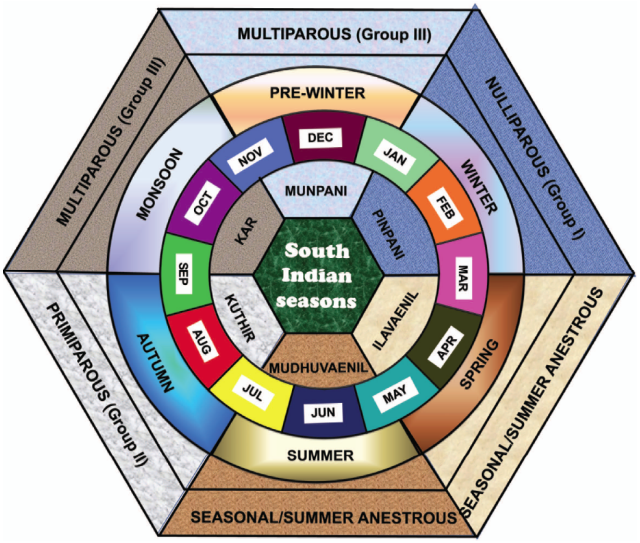
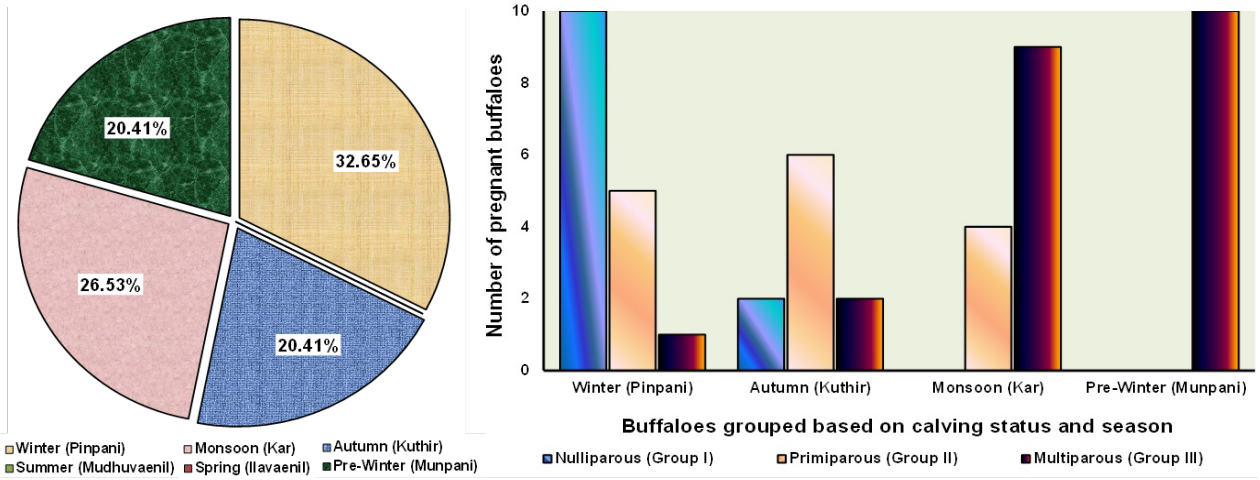


Figure 2: South Indian seasons and preference of season for breeding based on parity of buffaloes. Circle 1 displays the regional Tamil names for each season. Circle 2 exhibits the Gregorian month corresponds to each season. Circle 3 shows the common English names of season of each corresponding months. Circle 4 demonstrates the preferred season of breeding of all three groups of buffaloes, segregated based on its parity.



(**a**) (**b**)

Figure 3: Percentage of pregnancy in various seasons. (**a**) shows the percentage of pregnancy observed in all the four breeding seasons (winter, autumn, monsoon and pre-winter). (**b**) portraits the numbers of buffaloes become pregnant in each group during all the four seasons (winter, autumn, monsoon and pre-winter, respectively).

winter (20.41%) as depicted in Figure **3a**. The hot climate of summer (Mudhuvaenil), fallen generally on May to June in the southern part of India, was witnessed to be extended between March and July in recent years.

Parity Based Season Selection

Winter (Pinpani) favors the conception of more number of nulliparous (n=10) animals, followed by primiparous (n=5) and multiparous (n=1) as evidenced from Figure **3b**. Though the number of buffaloes conceived is less during autumn (Kuthir), animals belonged to all age group engaged in reproductive behavior. However, more numbers of primiparous (n=6) was found to conceive compared to nulliparous (n=2) and multiparous (n=2). Increased number of multiparous animals (n=9) and reasonable number of primiparous (n=4) was found to engage in coitus and consequently conceived during monsoon but not nulliparous (heifers). During pre-winter (Munpani) season conception was observed only in buffaloes belonged to multiparous group (n=10). Though engaged in coitus, no nulliparous and primiparous were found to conceive during pre-winter (Munpani). The preference of breeding season by buffaloes of different parity was clearly depicted in Figure **2** (Circle 4).

DISCUSSION

Conception rate of more than 80% was obtained in the present study in buffalo cows engaged in natural breeding (Figure **1a**). Presence of health bull(s) in the herd and its easy access to its herd-mates is important for effective reproductive management. Less number of buffaloes in the study group (group 2) and possibilities for conception during the postpartum period after first calving might be the reasons for increased conception rate in the primiparous group of buffaloes (Figure **1b**). Increased age of the buffalo, its physical status to undergo the gestation period and its hesitant to engage in successful coitus might be some of the reasons for non-conception in multiparous animals. On the other hand, the decreased rate of conception in nulliparous may due to un-familiarization of coitus and exhibition of irregular reproductive cycles in heifers. The heifers may engage in copulation to some extent, not to become pregnant but familiarizing for breeding activity and thereby to regularize its ovarian cyclicity.

Indian subcontinent gets maximum rain from two monsoons, southwest and northeast, which varied between topography. The southern parts of India host a tropical semi-arid steppe climate which has six seasons commonly called as Ilavaenil, Mudhuvaenil, Kuthir, Kar, Munpani and Pinpani (Figure **2**). Our observation of estrus signs during middle of autumn (Kuthir) to middle of winter (Pinpani) was in concordance with previous studies carried out in India, which showed that about 64% to 75% of buffaloes exhibited estrus during September to January with a peak during October to November [12, 14, 27]. Unobserved (silent) estrus and shortened duration of estrus were also reported to be common in swamp buffalo during the summer [28]. Earlier studies proved that changes in the secretion patterns of P4, estradiol and the number and amplitude of the LH pulses also varied with season [18]. Also, the less expression of estrus in buffaloes might be due to low circulating concentrations of 17-β oestradiol [29].

The present study demonstrates that the breeding and consequent conception of buffaloes residing in the southern part of Indian subcontinent was perceived from autumn (Kuthir) to winter (Pinpani) (Figure **3a**). This was in contradiction with previous studies, where winter and spring were reported as optimum seasons for breeding [15] with highest breeding frequency, which was slowly decreased in autumn and was lowest in summer [13] in several countries. This might be because of the extended summer (March to July) happened in the study region which eventually reduces the duration of other seasons, especially spring and autumn. High ambient temperature during summer affects the duration and intensity of expression of estrus and increases the duration of anestrus and silent ovulation which may be responsible for low pregnancy rates and high embryonic losses in cattle [30]. The incidence of true anestrus was reported to be 78% in July and 14% in November [12]. However, summer and autumn perhaps enhance the reproductive efficiency by improving the environmental conditions and food quality [15].

Majority of the nulliparous animals prefers to breed in winter (Pinpani), but previous reports states that buffaloes calving in late winter and early summer have lower reproductive efficiency compared to those calving during other periods [31-33]. In addition, poor libido and semen quality of bulls may also contribute to lower fertility during that season. These are some possible reasons for the observation of increased non-conception rate in nulliparous (heifers) buffaloes (Figure **1b**). Nulliparous animal actually conceived between January and February calved between October and November and perhaps will conceive again during autumn (Kuthir) season, after a short summer anestrous. This might be a convincing reason for selection of autumn (Kuthir) by primiparous animals for breeding (Figure **2**) and they calved during late spring (Ilavaenil) or early summer (Mudhuvaenil). It was reported that the resumption of ovarian activity after calving was significantly delayed in buffaloes which calved from February to May (116–148 days) compared to the rest of the year (38–64 days) [36]. Thus, multiparous animals prefer to breed during monsoon to pre-winter (Figure **2**) after the resumption of their ovarian activity.

CONCLUSION

To our best understanding, this is the first ever report discloses the influence of parity on the selection of season for breeding in murrah buffaloes located in the southern part of Indian subcontinent. Our finding reveals that 81.67% of buffalo cows engaged in breeding activities by their own choice become pregnant after successful coitus. However, the conception rate of nulliparous buffaloes (heifers) was comparatively lesser than calved (primiparous and multiparous) buffaloes. Due to extended summer (from spring to early autumn), conspicuous breeding was not observed from March to July. Majority of the nulliparous animals, which conceived for the first time, prefers winter for breeding and quite few prefers monsoon. Primiparous animals showed breeding activities during autumn, winter and monsoon but not during pre-winter. Though breed throughout the favorable season, multiparous animals exhibited increased conception during pre-winter and monsoon. Thus, the results states that winter is more suitable for the breeding of nulliparous, autumn for primiparous and the season from monsoon to pre-winter is appropriate for the breeding of multiparous buffaloes. Although, favorable environmental conditions, availability of sufficient herbage and water during the gestation period, calving and lactation were considered as major criteria for the occurrence of breeding, our present study strongly concludes that selection of an optimal season, among the wide range of season, for breeding was dictated by the status of the parity of every individual.

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