CHAPTER - I

Introduction

Buffalo is the backbone of farmers’ economy in India, South Asia and several European countries, benefiting nearly half of the human population in over 40 countries. The world buffalo population is estimated at 166.4 million, out of which 161.4 million (97.2%) are in Asia (FAO, 2002). Asian countries are producing over 96 per cent of 48 million tons of the total world’s buffalo milk output at an annual growth rate of 4 per cent (Sasaki, 1997). India alone has about 97.7 million buffaloes that are 57 per cent of the world’s buffalo population.

About 50 per cent of the rural poor in India are dependent on livestock for their livelihood (Thornton et al., 2002). Buffaloes are preferred over cattle in India because of certain unique qualities. These animals are well adapted to hot and hot-humid climate, have better feed conversion efficiency, greater resistance to diseases and higher milk fat percentage. Buffaloes are also valued for meat and draught purpose. In fact, buffaloes are considered an asset financially as they serve as instrument of insurance against the risk of crop failure due to natural calamities.

Buffalo may be considered seasonal polyestrous in short daylight periods, such as goats and sheep. Buffaloes in India have established themselves superior to crossbred cows in many respects. However, low reproductive efficiency, as evident from delayed first postpartum estrus and conception, prolonged service period resulting in long inter-calving period and seasonality in breeding etc., is a major constraint that leads to reproductive problems like subestrus, anestrus and repeat breeding in these animals and hence there is a dire need to improve the level of fertility in dairy buffaloes.

A number of reproductive problems in buffaloes such as late maturity, seasonal variation in fertility, poor estrus symptoms, anestrus conditions and long periods between calving are mainly due to our poor knowledge of the basic reproductive physiology of the female (Hemeida, 1988; Janakiraman, 1988). The low reproductive efficiency of buffaloes may also be due to some genetic, physio-pathological, nutritional and environmental factors (Richter et al., 1987). Other factors responsible for low reproductive efficiency include formation of relatively less
number of primordial follicles during embryogenesis and extensive follicular atresia during reproductive life of female buffalo (Guraya, 1987; Settergen, 1987).

Reproduction is the most important determinant of productivity and healthy puerperium is of great significance in achieving early and optimum postpartum fertility in dairy animals. The production of one calf every year is desirable for economic viability of livestock enterprise, but it depends upon postpartum repair and reorganization of genital organs for resumption of reproductive functions. Following parturition, the female passes through a series of physiological and anatomical changes in the uterus and ovaries as a result, the animal conceives and reproduces to maintain productivity.

The major factor of economic importance in buffalo reproduction is reduced postpartum fertility culminated into prolonged calving interval due to aberrated state of hypothalamo-hypophyseal-gonadal axis, apart from uterine involution, which is characterized by rhythmic contractions of uterine musculature with sloughing of excess caruncular tissue (Olson et al. 1986), and reduction in outer diameter similar to pregravid horn (Hussain and Daniel, 1991). The process of uterine involution depends upon both magnitude and duration of PGF$_2$α release and circulatory concentration gradually declines to the basal level within few weeks of calving.

Duration of postpartum anestrus has an important influence on reproductive performance. Factors such as limited energy intake, lower body reserves, and postpartum diseases can delay the uterine involution and thereby return to cyclicity. Therefore, the event of parturition and the time thereafter play a key role in resuming the reproductive life and come back to cycle. A trouble-free calving predisposes to prompt resumption of postpartum ovarian activity. Ideally, this should be followed by a minimal period of negative energy balance (NEB). The nutritional, managemental and environmental factors have impact on fertility. Transitional period and early postpartum phase in particular exerts biological and physiological stress on the dam (Setia et al., 1992).

During puerperal period there are different activities such as shrinking of the uterus with regular myometrial contractions which promote the elimination of lochia and there is an overall reduction of smooth muscle mass (Salma et al., 1999). The structure of the endometrium and deeper layers of the uterine wall get restored along with resumption of ovarian activity and elimination of bacterial contamination (Noakes, 2001). Smooth muscles play an important role in the expulsion of the uterine
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contents and reduction of the uterine size (Bacjsy et al., 2005). The greatest change in
the uterus occurs within a few days postpartum. Uterine involution and diameter of
uterine horns can be monitored directly by palpation per rectum with precalibrated
hand (Suthar and Kavani, 1992; Kindahl et al., 1999; Theodore et al., 2016), using the
transrectal real time ultrasonography (Sheldon et al., 2003; Theodore et al., 2016), or
indirectly by estimating the concentration of PGF2α metabolite or acute phase proteins
in serum (Sheldon et al., 2001; Heppelmann et al., 2013; Dhami et al., 2017).

Fats in the diet can influence reproduction positively by altering both ovarian
follicle and corpus luteum function by way of improving energy status and by
increasing precursors for the synthesis of reproductive hormones such as steroids and
prostaglandins. Oldick et al. (1997) reported that the days postpartum till first
ovulation were reduced after feeding extra-glycogenic nutrients. In addition, there
were elevated plasma progesterone (P₄) levels (Sklan et al., 1991), increased
diameters of preovulatory follicles, and greater follicular populations (Lammoglia et
al., 1997; Theodore et al., 2016) after dietary fat supplementation. Also the days
required for complete uterine involution were also reduced by extra-supplementation
of bypass fat or protein in transitional crossbred cows and buffaloes (Ramteke et al.,
2014, Dhami et al., 2017; Kalasariya et al., 2017).

It is further established that macro and micro-nutrients play an important role
in animal reproduction because they form components such as metallo-enzymes and
enzyme co-factors. Some of these are components of hormones and thus directly
regulate endocrine activity. Due to its involvement in carbohydrate, protein and
nucleic acid metabolism, any change in the level may alter the production of
reproductive and other hormones, thereby affecting postpartum fertility (Kumar et al.,
2011). Therefore, the present study was envisaged to investigate the effect of
incorporation of macro-micronutrients, by pass fat as well as uterine ecbolic herbal
drug during the transitional or so called periparturient period for enhancing the uterine
involution and postpartum fertility in Jaffarabadi buffaloes of an organized farm with
the following main objectives:

1) To study the effect of peripartum nutritional (multi-minerals and by-pass fat)
   supplementation on uterine involution and postpartum ovarian activities in
   Jaffarabadi buffaloes.

2) To study the uterine involution using hand calibration technique and
   ultrasonography in postpartum Jaffarabadi buffaloes.
(3) To evaluate the effect of herbal ecbolic (Exapar) and injectable micro minerals (Stimvet) formulations on uterine involution and postpartum fertility in Jaffarabadi buffaloes.

(4) To study the alterations in metabolic, mineral and hormonal attributes with uterine involution process in treated and control animals.

(5) To study the influence of various factors affecting the process of uterine involution and postpartum fertility in Jaffarabadi buffaloes.