بسم الله الرحمن الرحيم

STUDIES ON SEMEN QUALITY, FREEZABILITY AND FERTILITY OF BUFFALO BULLS DURING LOW AND PEAK BREEDING SEASONS

By

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TO

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"We, the members of Supervisory Committee, certify that the contents and form of thesis submitted by Mr. Muhammad Younis have been found satisfactory and recommend that it be processed for evaluation, by the External Examiner for the award of degree".

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Introduction

CHAPTER ONE

INTRODUCTION

Buffalo is the major dairy animal in Pakistan. Its present population in the country is approximately 19.2 million heads which provide about 71 per cent of total milk and 50 per cent of beef annually (Jaiudeen, 1988; Anonymous, 1993-94). Due to a great economic significance of the buffalo for the farmer, the research activities are mainly focused to improve the productive and reproductive performance of this species through better feeding, management and use of superior germ plasm.

The buffalo is generally considered as a seasonal breeder. Females of this species are not as sexually active during the hot summer months as in winter (Pandey and Raizada, 1979). Buffalo bulls are comparatively sluggish and are more susceptible to heat stress due to their poor heat regulation mechanism than the females (Akhtar, 1988). The testes are extremely sensitive to high ambient temperature, resulting in degenerative changes, characterized by a reduction in testicular size and a change in its consistency (Jubb *et al.*, 1985; McEntee, 1990).

Adverse effects of high ambient temperature during summer on the testicular size, libido and semen quality have been reported in sheep and goats (Ahmad, 1994), cattle (Soderguist *et al.*, 1992; Udala, 1992) and buffaloes (Nazir *et al.*, 1981; Bajwa *et al.*, 1982; Nazir, 1988; Barnabe *et al.*, 1992). In general, testis size and libido in these species decline during summer, with an increase in following autumn and winter. Progressive sperm motility and percentage of live and morphologically normal spermatozoa are higher in ejaculates collected during winter than those collected in summer (Heuer *et al.*, 1987; Madhumeet *et al.*, 1992). Increased number of dead and morphologically abnormal spermatozoa during summer results in low freezability and fertilizing ability of spermatozoa leading to poor conception rates (Tuli and Singh, 1983).

Deep freezing of semen in liquid nitrogen has been proved very useful for the effective preservation of spermatozoa to ensure their long-term storage without damaging their fertilizing ability. At deep freezing, any damage to the sperm membrane due to ice crystals, cold shock or unfavorable concentration of extender ingredients causes extracellular release of sperm enzymes (Tuli *et al.*, 1982; Nath *et al.*, 1991), including glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT). These enzymes are located in mid-piece of spermatozoa and are concerned with oxidative metabolism (Salisbury *et al.*, 1978; Dhami and Shani, 1993). An increase in the activity of these enzymes in the seminal plasma is usually used as an indicator of sperm cell membrane damage (Graham *et al.*, 1973; Bhosrekar *et al.* 1991).

Although research work in segments on sexual behaviour, semen quality and freezability of different breeds of buffalo bulls during low and peak breeding seasons has been done in the past, yet comprehensive information on the influence of seasons on these parameters in different ages in relation to fertility of Nili-Ravi bulls maintained under Pakistani environment is lacking. The present project was, therefore, carried out in order:

1) To study the testis size, libido and semen quality in three age groups of Nili-Ravi buffalo bulls during low (May to July) and peak (September to November) breeding seasons.
2) To study the freezability of semen collected during these two seasons from bulls of three age groups through monitoring the percentage motility, liveability, sperm morphology and extra-cellular release of GOT and GPT enzymes.
3) To correlate various semen attributes with conception rates.

Review of Literature

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Testicular Development and Spermatogenesis

Testicular growth and development depends mostly upon body weight, age and blood testosterone concentrations. Differences in testis growth are associated with variations in gonadotrophin stimulation arising from breed differences in their sensitivity to the negative feed back from the testes. It has been suggested that an early rise in gonadotrophin secretion is important for the initiation of testicular growth and development, as it occurs just prior to tubule lumination and differentiation of Sertoli and Leydig cells (Berndston *et al.*, 1977). Based on these observations, it appears that the early rise in gonadotrophin secretion may play a regulatory role in the timing of puberty in bull calves (Berndston and Dejasdins, 1974; Hafez, 1987; Evans *et al.*, 1995).

Ahmad *et al.* (1987) studied the testicular development and onset of spermatogenesis in male Nili-Ravi buffalo calves. Testicular weight increased from 3.5 $\pm$ 0.7 g at one month to 185 $\pm$ 30 g at 24 months of age. The seminiferous tubular diameter increased in a linear fashion from 57 μ at one month to 178 μ at 24 months of age and the lumen first appeared at 12 months of age. Differentiation of basal supporting cells to "Sertoli cells" began at 6 months and was completed by one year of age. Gonocytes predominated at one month but were replaced by spermatogonia by 12th month of age. Spermatocytes appeared first at 12th month of age, their number increased through 18-24 months. Establishment of progressive spermatogenesis occurred by 18 months of age.

According to Ahmad *et al.* (1989), mean body weight and testicular volume markedly increased between 8 and 15 months of age, when the average rate of increase per month was