INFLUENCE OF NUTRITION AND SEASON ON BREEDING VALUES OF BULL – A REVIEW

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ABSTRACT

The maintenance of sire, suitable for breeding in healthy condition is essential for success of breeding programme. Malnutrition of bull calves can delay the sexual maturity and lessen the quantity and quality of their semen. The inter-relationship between nutrition, growth rate and age at puberty in the male are very similar to those in the female. Thus, male reared on high as opposed to low plane of nutrition reach puberty at early ages and heavier body weights.

Many efforts have been made towards improving the milk production in India and crossbreeding programme is being implemented in a big way. However, economic productivity of a species cannot be correctly ascertained by ignoring the male offsprings. In tropical regions testicular functions, semen output and quality and mating behaviour of bulls can vary from season to season, depending mainly on availability and quality of feed and climatic conditions. However data on the effects of nutrition and season on the patterns of reproductive development, nutrient utilization, testicular growth and semen quality of zebu bulls and their crosses with exotic breeds are limited. The present review covers the various aspects, particularly effect of protein and energy on the growth, nutrient utilization, feed conversion efficiency, age at puberty and quality of semen in bull calves. The effect of season has also been discussed.

The importance of the genetically superior bull as a produce of large quantities of normal fertile spermatozoa in any programme of artificial insemination is obvious. The mature bull has no other importance except the salvage value of his flesh. In the interest of economy and of early genetic testing for either beef or milk production, the objective of feeding and management of the young, carefully selected sire should be to bring him to optimum sperm-cell production early and to maintain his condition during his mature life for as long as it is consistent with genetic progress. In mature and older bulls the reproductive function has a higher physiological priority than does body maintenance. The level of feeding at various stages of the physiological state seems to have an important influence on reproductive performance. Malnutrition has long been known to exert a deleterious influence upon the male reproductive system. Thus, nutrition ranks high among factors which control generation and, output of sperms and accessory fluid in male. Nutrient requirement for spermatogenic and androgenic functions is very difficult to determine. A depleted animal may have abnormalities. Although spermatogenic and androgenic functions in biological system are normal functioning of a physiological state, this may be exploited by in during at early stage with proper nutrition. A further complication arises from the effects of so-called ‘nervous’ stress or conditioning factor. It can alter the normal requirement of an individual for a specific nutrient by affecting food absorption, storage and metabolism in the tissue and their excretion to such an extent that the result is malnutrition, inspite of the adequate composition of food (Ershoff, 1948). Improperly balanced diet can also lead to a serious disturbance in male reproductive functions.

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nutrition, growth rate and age at puberty in the male are very similar to those in the female. Thus, males reared on high plane of nutrition, reach puberty at earlier ages and heavier body weights (Waddad and Gaili 1985). With regard to specific nutrient, low concentration of protein (about 80 g/kg) occurs widely in ruminants feed and when compared with diets containing 145g/kg have been shown to delay puberty in indigenous Nigerian bulls and their Friesian crosses. Interestingly, the extent of the delay was high (5 months) for the crossbred bulls (Rekwot et al., 1987) Mineral and Vitamin requirements are different in bull to that of castrated males and females. Zinc content of semen is very high and is an important element for spermatogenesis. It has synergetic role with Vitamin A. Vitamin A plays an essential role in the attainment of puberty and in the maintenance of both libido and the integrity of the testicular germinal epithelium (Hurley and Doane, 1989).

The information on adequate feeding of crossbred bull calves in literature is scanty. It has been emphasized that bull calves should grow faster to attain early sexual maturity for better breeding value at the age of 18 to 20 months.

Influence of dietary protein/energy on the growth of Bull calves

An inverse relationship exists between growth rate and age at puberty (Waddad and Gaili, 1985). Young bulls kept on grazing plus concentrate feed showed better growth rate than those on grazing alone with an earlier age at puberty and a greater scrotal circumference (Perry et al., 1991; Tegegne et al., 1992). Angus bull fed on CP and ME below or about maintenance by 75 and 150% respectively, affected the average daily change in scrotum circumference, but not the libido score or semen quality (Chase et al., 1993).

Testicular sperm/spermatid reserves of $5.2 \times 10^9$ and epididymal sperm reserves of $2.4 \times 10^9$ in bulls on the high plane of nutrition were significantly ($P<0.05$) higher than those for the bulls on the low and medium planes (Rekwot et al., 1994).

Influence of different levels of energy and protein on age at puberty, libido and quality of semen

Low protein feeding has shown to delay puberty (Rekwot et al., 1987), poor testicular development and smaller ejaculates compared to adequate protein (Rekwot et al., 1988). The seminal vesicles contain less fructose and citric acid as well as smaller Leydig cells and seminiferous tubules and decreased testosterone level under protein stress conditions (Nolon et al., 1990). Even older bulls were susceptible to low dietary protein and showed decreased testicular size and reduced fertility (Lindsay et al., 1982; Rekwot et al., 1988). Restriction of both protein and energy also prevented Merino lambs from reaching puberty in their first potential breeding season (Ketut Sutama and Edey, 1985) with reduced testicular size and sperm concentration in the ejaculate (Oldham et al., 1978; Foote, 1978; Alkass et al., 1982).

Energy level of the diet fed to breeding bulls have marked effect on fertility. A high level of energy (TDN 115% or 130% of normal diet) tends to reduce age at the onset of semen production (Flipse and Almaquist, 1961) and increases total spermatozoal output per ejaculate. However, high energy diet in adults tends to increase fat deposition and reduce sexual drive. Protein deficient bulls produced significantly smaller volume of semen and less number of sperm per ejaculate. Libido was also adversely affected by protein deficiency and bulls even failed to mount due to weakness.

Adequate ration for breeding bulls can be made up of any of the standards roughage or roughage combination provided the feeds are of good quality. It is routine management practice in most of breeding farms to give a
portion of the ration in the form of grain mixture to the breeding bulls. However, experimental evidence gained so far indicate the mature breeding bulls may be fed economical all-roughage rations without reduction in fertility without development of paunchiness or without reduction in willingness to serve (Salisbury and Van Demark, 1961).

High plane of nutrition stimulates early sexual development and to certain extent enhances the quantity and quality of semen. But very high plane adversely affected the quality of semen by influencing the volume (Milavenov and Basinov, 1965), sperm concentration, percentage of live spermatozoa etc. (Castille, 1980). Semen quality is subjected to seasonal variation and the fall of semen quality during winter could be attributable to the ration (Valge, 1970). Feeds high in calorific value through its specific dynamic action may contribute to the thermoregularity mechanism of the animals during acute winter months resulting in enhanced number of spermatozoa and improved progressive motility (Savchuk et al., 1976; Salisbury et al., 1978).

According to Bhosrekar and Rajdan (1973) bulls fed on 100% DCP level had the least abnormalities and dead spermatozoa. Different DCP level (80%, 100% and 120%) with constant energy level did not cause any significant difference in the quality of semen. However, different periods of feeding in different seasons significantly affected the semen quality and composition (Bhosrekar et al., 1986). Diet with varying energy levels (80, 100 and 120%) did not influence in morphological and biochemical attributes of semen (Bhosrekar et al., 1988) whereas, 120% energy level caused significant increase in primary sperm abnormalities (Bhosrekar et al., 1986).

Effect of Season

Season had no significant effect on the scrotum circumference, ejaculate volume, sperm concentration or sperm motility, but there were some (unspecified) seasonal differences in the incidence of sperm abnormalities (Fonseca et al., 1993). Semen quality was higher in the winter (Oct-Jan) than in other seasons. Season influenced percentages of sperm cells with abnormal head, body tail and protoplasmic droplets. In India differences in semen traits between Jersey x Hariana and Friesian x Hariana crosses in response to seasonal changes have been reported and semen traits were found to be lower during the hot dry than during the hot-humid autumn and winter season. (Goswami et al., 1991). Seasonal influences in spermatozoa morphology have also been reported for other zebu and trainer breeds (Wildeus et al., 1984; Godfrey et al., 1990). Seasonal differences exist between zebu and crossbred bull in their testicular growth and semen characteristics. Relatively better sperm motility score, sperm concentration and percentage normal sperm cells were observed in both genotypes during the dry season. Dry season is usually characterised by a relatively higher ambient temperature, longer sunshine hours and lower humidity. These may have a positive effect on testicular function and on the semen quality in bulls of these genotypes. The superior characteristics in Boran than in Boran x Friesian bulls during the dry season could also indicate the relatively better adaptive nature of zebu cattle to tropical environments (Tegegne et al., 1994).

Conclusion and Perspectives

There is considerable current interest in the influence of protein and energy nutrition on crossbred bull calves particularly in developing countries where dietary protein and energy deficiency is common. It is essential that the animals should be given adequate protein and energy during the post-weaning period to get optimum growth and early puberty. Advances in our knowledge of the
influence of nutrition on the reproduction of farm animals emanate mostly from experiments that have concentrated on only one small part of the overall reproductive cycle. Few experiments consider the implications of a nutritional effect at one point to events later on in the same breeding cycle and fewer still to the overall reproductive life-span of the animal.

Much needs to be learnt yet in understanding the precise nutritional requirements of animals for specific functions and when maintained under different environmental, food resources and management regimes. The bulls that are being procured at high cost have to be maintained on proper nutrition to obtain optimum performance. Though number of studies have been done to highlight these facts, still further studies are warranted to determine the precise effects of nutrition, season and other environmental factors and their interactions on testicular functions and semen characteristics in zebu and crossbred bulls using relatively larger number of animals. Such data could help in developing strategies to optimize the use of breeding bulls in enhancing genetic progress and in improving reproductive efficiency of cows.

REFERENCES