

CHAPTER 1

Theme: Growth and reproduction of domesticated animals

1.1 Title

The effect of dietary vitamin E supplementation on semen quality of A.I. dairy bulls.

1.2 Aim

- (i) To compile a comprehensive literature study on the factors which affect the fertility and reproductive ability of bulls
- (ii) To study the effect of dietary vitamin E on the semen quality of dairy bulls at an artificial insemination centre

1.3 Motivation

An urgent need has been identified in the animal breeding industry for quantifying the effects of fat-soluble vitamins on semen quality. There is a hypothesis that the antioxidant ability of vitamin E makes a contribution towards improved semen quality. The most important function of vitamin E is as an antioxidant that protects tissue lipids from free-radical attack.

According to previous research, uncertainty with regards to about the effect of different levels of vitamin E supplementation on semen quality (Kozicki *et al.*, 1981). Current research results on the effect of vitamin E on semen properties are rare and contradicting (Kozicki *et al.*, 1981). It has also been found that bulls injected with synthetic vitamin E showed a decrease in

ejaculate volume and sperm numbers per ejaculate, but sperm survival time was increased while reaction time was not significantly affected. Bulls were fed additional vitamin E, in the form of maize and wheat, in a ration during a 100-day period, showed a reduction in ejaculate volume and sperm numbers per ejaculate. However sperm survival time and reaction time were increased (Stojanov *et al*, 1966).

These contrasting results may be due to the form in which the vitamin E was administered but it is clear that further investigation is needed to determine the true effects. The ability to manipulate certain semen characteristics with vitamins may hold potential for the cattle breeding industry. Thus, due to the uncertainty of the effects that dietary vitamin E may have, further investigation is needed.

1.4 Introduction

It is well known that vitamins are required for physiological processes in animals and play an essential role in metabolism. The effect of vitamin A deficiency on reproductive performance has been extensively studied (Boyazoglu, 1997; Bearden and Fuquay, 1997; Kozicki *et al*, 1981; Hafez, 1974), which suggests the possibility that other vitamins may also have an effect on reproduction and the supplementation of which may improve reproductive performance. It has been suggested that vitamin E deficiency may result in testicular degeneration, thereby reducing spermatogenesis (Cupps, 1987). According to McDowell *et al* (1996) vitamin E is essential for reproduction as well as growth, prevention of disease and the integrity of

tissues. Early research in male rats showed that a deficiency of vitamin E resulted in the degeneration of the testes, resulting in permanent sterility (Bearden and Fuquay, 1997). Kozicki *et al* (1981) found that doses of the AD₃EC vitamin complex does not affect the sperm volume, concentration, freezability, proportion of insertion abnormalities or the occurrence of proximal droplets. Evans and Bishop, as cited by Swenson *et al* (1993), recognised that the cause of failed reproduction in rats fed purified diets to be due to a vitamin E deficiency.

The objective was to investigate the effects of dietary supplementation of vitamin E on the semen characteristics and quality in Holstein-Friesian bulls. Semen quality is determined in terms of concentration, motility and morphology. The evaluation of the morphological characteristics represents a very important part of seminal analysis, so that, after sperm motility and concentration, sperm morphology is the third essential criterion for assessment of fertility based on ejaculate analysis (Briz, Bonet, Pinart and Camps 1995)

A satisfactory semen sample will have high concentration of sperm which is indicated by an opaque milky-white colour, 40% or more progressive motility and less than 25% abnormal sperm (Bearden and Fuquay 1997). According to Chacón *et al* (1999) a bull can be classified as sound for breeding if he was clinically normal with a minimum scrotal circumference of 30 cm at 24 months or older, with no more than 15% of abnormal sperm heads (including acrosomes and midpieces), and/or a maximum of 30% total sperm

abnormalities. A bull that is classified as not being fit for breeding has more than 30% abnormal sperm heads or with a maximum of 50% total sperm abnormalities and is without clinical problems at the time of examination. Chacón *et al* (1999) also found that bulls with a long scrotum had greater percentages of abnormal heads that they were classified as unfit for breeding. The cause of these increases abnormal heads has been suggested by Riemerschmid, Setchell and Shafik (cited by Chacón *et al*, 1999) that the venous blood flow from the testicle could be affected in bulls with a pendulous scrotum. leading to blood stagnation, thus interfering with the thermo-regulation system in the testes.

A high frequency of abnormal sperm is associated with reduced fertility. The economic impact of sub-fertility or sterility on both dairy and beef operations is without doubt enormous. Both of these industries suffer losses caused by delayed calving causing a reduction in calf crop thus depleting the number of saleable livestock or breeding stock.

1.5 References

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