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Best Practices in Animal Reproduction: Impact of Nutrition on Reproductive Performance Livestock

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Abstract

The impact of nutrition on reproduction of livestock is of vital importance and is directly related to body condition of the animals, which reflects directly on reproductive performance, both female and male animals. In this short review, emphasis on the importance of nutrition on puberty, estrous cycle, fecundation, delivery and postpartum period is made.

Keywords Animal reproduction; Nutrition; Puberty; Estrous cycle; Fertilization; Season; Childbirth; Postpartum

Introduction

The impact of nutrition on reproductive performance of livestock is of paramount importance, as several studies have shown that nutritional effects are made and are reflected through complex interactions in areas such as content and use of body reserves, distribution nutrients between different systems and organs and prioritizing the use of nutrients for various functions, plus the channeling of various nutrients to the various aspects related to the reproductive performance, which is known as homeorrésis, which is reflected in body condition livestock [1-3].

The physiological changes and metabolic adjustments that occur in the female after birth, are the best example of the relationship between nutrition and reproductive performance of livestock; these physiological changes and physiological adjustments are mainly due to several interrelated events such as: maximum milk production in the first two to three weeks, whatever your specialty is dairy production; regeneration of the endometrium, uterine involution and return to estrous cycles in other words a return to cyclicity postparto [2].

The prepubescent and postpartum period are two critical stages in the life of female mammals, the effect negatively impacts the reproductive efficiency of livestock. During the prepubertal period, cattle need a lot of nutrient for growth and development to reach puberty in a timely manner. In the postpartum stage, it is vital contribution nutritional importance in quantity and quality, as they are necessary for the purposes of labor and overcome production peak in milk production, whose presentation is between five and approximately six weeks and in which it is easy for females have long periods of negative energy balance, which we call the famous BEN; whose impact is directly related to poor reproductive performance of cattle -Periods long infertilidad- responsible for great economic losses to livestock producers [3,4].

The aim of this paper is to describe the importance of nutrition in different periods are directly related to the performance and reproductive efficiency of livestock, such as puberty, estrous cycle, fertilization, pregnancy, childbirth and postpartum; whose impact is directly related to the reproductive performance of livestock and thus the profits of the farmer.

Puberty

They are numerous studies that show that the nutritional status of the animals is reflected on sexual maturity, according to the known relationship between the overall development of the individual, body growth and development of reproductive organs.
Power conditions in which animals are kept growing, represents one of the most important factors on the onset of puberty He knows that animals when they reach puberty, have only 40 to 60% of its weight they reach the adult stage [5].

For example, a model of optimal growth of rearing calves is one that allows them to develop their genetic potential for milk production at the desired age and at minimal cost. Therefore, it is vital to understand and define the model of growth as it will determine the age at first breeding and the age and body weight at first calving [3]. Proper management will allow calves reach sexual maturity to be covered at 13 months of age, be covered within 15 months and develop properly (> 575 kg) to face a full lactation before or around 24 months of age [6]. This time is very high when compared with reported ages in developed countries: 16-18 months (females) and 24-30 months (males). These inequalities are primarily determined by differences in feeding programs implemented in either region, particularly at the stage of release of the calves. The need to transform as soon as possible, an anatomical and physiological monogastric animals (non-ruminant) is raised in a functional ruminant; ie in an animal capable of consuming and efficiently transform the fodder. In cattle for example, the development and change of the different compartments occurs rapidly during the first 3-4 months of life. Rumen capacity increases 50 to 60 times during the first 16 weeks of life (0.5 to 30 liters) while the abomasum just doubled or tripled its volume (2 to 4.6 liters). These changes are influenced in a decisive way by handling different food supplies during the first months of life of the animals in general terms [7].

Nutritional status determines the body size and body weight over a lifetime of animals, commonly as body condition. Low levels of

nutrition during the prepubertal period to delay the arrival Puberty by inhibiting the development of the endocrine reproductive system [8].

Puberty usually occurs or is associated with a certain weight, relative to the weight of adult or mature. This weight can be achieved at an early age or delayed according to diet tax [7].

When animals have low body energy reserves, are more likely to suffer diseases, metabolic disorders, reduced milk production and impaired reproductive performance, increasing the age at first birth and puberty. The main factor affecting the length of postpartum anoestrus is the nutritional status and breastfeeding. Inadequate intake of protein and energy during pregnancy leads to low body condition at calving, this adds that the decrease in food intake during early lactation (undernourishment) and increased glucose requirements for production dairy, mark the appearance of BEN, a situation that leads to increase in the percentage of females in anoestrus and increased calving interval as the animal organism tries to maintain homeostasis through the mobilization of its reserves of lipids and proteins, generating low body condition and therefore a state of complete anoestrus [9].

On the other hand, it is important to take into account the negative effect they have parasites on reproductive performance of the animals; whose indirect nutrition and metabolism of the animal are evident [10].

Estrous Cycle

Overall, cattle specialized in milk production during the last weeks of gestation and early lactation, may have a period of negative energy balance (BEN) [3]; This may occur because the milk production peak is reached within 4 to 6 weeks postpartum and nutrient intake especially not worth the energy required for milk production.

When females are in BEN, blood concentrations of free fatty acids increase; whereas IGF-1, glucose and insulin are low. This change in blood levels of these metabolites and hormones is generally associated with a disorder of ovarian function and therefore fertility.

A delay in the postpartum ovulation is directly related to the energy consumption of the greatest female -How is the BEN, the greater the time until the first postparto- ovulation.

The delay in the first postpartum ovulation is associated with adverse effects on subsequent reproductive efficiency in all female animals of economic importance to man; therefore, early postpartum return to cyclicity is of great benefit to the reproductive efficiency of female farm.

During the BEN there is loss of body condition (CC) This decrease in DC, it is directly associated with the delay in the first postpartum ovulation and increased days open, severely affecting the reproductive performance of females [11].

Fecundation

Most chronic determine nutritional deficiencies, first, a decrease in growth rate; in adult animals, loss of muscle condition, weakness and death. So that infertility nutrition, can occur in cases such as: if the amount of food available is limited during the phases of growth of heifers from weaning until puberty, at the end of pregnancy and during the first days after delivery, when the pastures or fodder crops are grown on land that have insufficient minerals considered essential for reproduction. The most common minerals are: cobalt, copper, manganese, phosphorus and selenium.

The effect of metabolic changes caused by BEN, caused by poor diet energy provided to high producing cows, causing low fertility; which is caused when administered diets with high protein content, in relation to energy consumption. Diets crude protein content of 17-19%, can cause decreased fertility; it has been shown that cows fed in this way have high concentrations of urea and ammonia in blood and uterine fluids, which affects the viability of sperm, oocytes and embryos [12].

In the case of cows, blood urea concentrations greater than 20 mg / dl are associated with low fertility. Under in vitro conditions, it has been observed that equivalent concentrations than would cows consuming diets high in protein, affecting embryonic development, which is reflected in a reduction of the proportion of embryos reaching the blastocyst stage. So you can say that proper nutrition in quantity and poor quality, is a major cause of decreased reproductive efficiency in livestock, mainly tropical areas and / or subtropical. On the other hand, research on postpartum reproduction, estimates indicate that DC is a useful indicator of nutritional status and the reproductive performance of the animals, the effect is clearly seen in reproductive efficiency, where the role of some micronutrients is also decisive, as shown in the following Table [13]:

Micronutrient	Function	Consequence-deficiency
Vitamin A	Maintain the integrity of the reproductive tract and favors the reproductive process in females and males.	Stops puberty in both females and males; predisposes to low rates of fertilization and embryo mortality, as well as placental retention and reduces male sexual desire.
Vitamin E	It promotes and maintains the reproductive life.	Placental retention and predisposes males to malformations and low sperm count in the ejaculate.
Selenium	It acts as cofactor cell peroxidase enzyme system responsible for the intra and extra glutathione oxidation of the cell membrane of the cells that make up the reproductive tract.	Predisposes to low fertility; placental retention and disposition to ovarian cysts; in males, reduced sperm motility and concentration.
Copper	It promotes hormonal physiology and prostaglandin synthesis.	Predisposition to low fertility; estrous cycle disorders, embryonic and fetal death; abortions and placenta retention.
Zinc	It promotes the function of several metabolic enzymes and hormone function in males and females.	Predisposition to low fertility, prolificacy and retained placenta; in males, spermatogenesis and harms the development of secondary sexual organs.

Table 1: Micronutrients function in animal reproduction.

Pregnancy

Possible causes, due to nutritional problems; whose effects are the famous BEN and is directly related to body condition of the animals; so that female animals of economic importance to man cannot

maintain a pregnancy are not present estrus or heat, do not ovulate and fertilization or oocyte fertilization cannot take place or certainly early embryonic deaths occur, so regulate within the first 12days after crossing natural or artificial insemination.

The liver, central organ of metabolism is responsible for capturing the metabolic needs of all body tissues, and respond adjusting to each, so it plays a key role in coordinating the flow of nutrients to meet the needs of the pregnancy and lactation [5].

The conception and establishment of pregnancy are interrelated events as follicular development resulting in ovulation, fertilization of the oocyte, transportation and development of the embryo, maternal recognition of pregnancy and implantation. Hypothetically, ammonia, urea or other toxic breakdown product of protein can intercede in one or more of these steps to impair reproductive efficiency. Ammonia is a metabolite of protein escapes detoxification of urea cycle hepatic system. Another metabolite of dietary protein is urea, which is formed by NH4 detoxification by the liver. The level of urea in plasma or serum reflects the amount and degradability of protein consumed the severity of BEN and the combination of protein and BEN consumption in ruminants [2]; which severely impairs or favors the maintenance of pregnancy.

Partum

As a result of numerous factors such as nutritional deficiency in general and in particular the deficiencies in vitamins and minerals, there may be retained placenta (RP) in various species, mainly in the cow; which represents the failure of the placenta within 12 to 24 hours after the expulsion of the fetus; however the RP is considered multifactorial. Its impact is directly related to the decrease in reproductive activity of females, such as longer day's open and calving interval [14].

The need to improve production efficiency of livestock production units, led to implement different management practices, including for example, provide service to heifers 15 months old. However, its implementation requires careful medical and nutritional management. Flaws in the selection and management of this category added to the increase in body size of breeding and neglect in the use of appropriate services for early heifers bulls, can cause problems with dystocia in Animal Production Units (UPAS) [15], which represents losses for farmers.

It is known that cattle fertility is directly related to levels of protein and energy consumed before and postpartum; severely diminishing ovarian activity of females and males in sperm quality; thus negatively it is affecting reproductive efficiency of animals in UPAS [2,5,16].

Postpartum

In the postpartum period, metabolic changes increased to care for the initiation and maintenance of milk production. Part of the increase in demand for nutrients is offset by the rise in food consumption; however, this does not accompany proportion to sudden increase in milk production; therefore, in the first weeks postpartum females, usually they enter BEN; especially in specialized animal milk production, where the nutrient requirements are: 7 kg / day of lipids, 3 kg / day of glucose and 330 g / day of amino acids [4,6].

Uptake and esterification of free fatty acids on the one hand and decreased liver capacity for synthesis and secretion of lipoproteins, resulting in an accumulation of fat in the liver. In extreme cases excessive accumulation, with consequent adverse effects on the reproductive performance of the animals presented. Carbohydrate metabolism postpartum is associated with large requirements of glucose by the mammary gland for lactose synthesis, which are estimated at approximately 1800 g / day in the case of cows producing 30 kg of milk per day. However, assuming that all propionate and amino acids available for the synthesis of glucose, these substrates only contribute 66% of the requirements (1200 g / day glucose).

Other sources are glycerol from glucose lipolysis of triglycerides and lactate endogenous or diet. It is also known that an option for the synthesis of glucose are variable muscle protein reserves, estimated between 500-600 g / day of amino acids in the first week of lactation for a cow producing 30 kg of milk per day [4].

Postpartum major source of amino acids for milk synthesis is skeletal muscle through protein catabolism. In contrast, in the liver increased protein synthetic activity and the efficiency of utilization of amino acids. The changes start at the end of pregnancy and after delivery significantly increase. It also increases the liver mass and size and functional capacity of other digestive organs that are required to maximize feed intake and increased digestive capacity. Increased protein synthesis in the liver, occurs when the dry matter intake and absorption of amino acids is low in the first week of lactation, especially in high milk producing females. This is a clear example of the homeorrética response that comes from -compartimentalización homeorrésis concept fisiológicos- nutrients in different stages [2].

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