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Nutrition of Ruminants (Dairy Cow)

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ABSTRACT

With the aim to review the nutrition of ruminants, this paper studies and reviews the types of nutrition method for dairy cows by the case study of dairy cow. This research is applied based on the objective, has the library type in terms of data collection, and is among the survey research based on the research methodology. The method of library documental studies was used in order to collect data and information needed for the research and the information related to the variables of research has been extracted from the relevant organizations by referring to the latest scientific resources and accessible documents of scientific studies in the field of livestock and animal husbandry in Iran. First, the anatomy of cow gastrointestinal tract is studied in the theoretical principles and then the section of Materials and Methods provides the non-nutritional factors, nutritional factors, effect of photoperiod on the performance of dairy cows and the role of feed in the ration of dairy cows by introducing Aspergillus, blocks of nutritious, buffers and the importance of using them in the ration of ruminants including the feed changes, which lead to the increased need for buffers and buffering capacity of nutrition ingredients used in livestock feed and finally the antioxidants and their methods including the role of Antioxidants in milk supply, the role of Antioxidants in preventing from the milk spoilage, and the importance of antioxidant vitamins in the livestock health. Finally, the suggestions have been provided for scientific and accurate nutrition of dairy cows according to the nutrition principles of dairy cows.

KEYWORDS: livestock nutrition, livestock ration, scientific animal husbandry, traditional animal husbandry.

INTRODUCTION

Despite the fact that the purpose of regulating the ration of farm animals is to provide the required nutrients, the results of different investigations indicate that this objective has not increased the efficiency of animals alone and some non-nutritious additives, which play an important role in improving the absorption and transferring the nutrients into the body cells, should be used as well as paying attention to the needs of nutrients in animal. Nowadays, the term "DFM" refers to the non-nutritious feed supplements containing live microorganisms which their application in the livestock and poultry feed is emphasized by the livestock and poultry professionals. In fact, these types of supplements are the Probiotics containing the beneficial bacterium (Lactobacillus) with the ability to survive and function in the animal gastrointestinal tract and are able to enhance the economic performance of animal by entering the gastrointestinal tract. By establishing the proper PH in the gastrointestinal tract, the non-nutritious feed supplements help to proliferate the beneficial intestinal microflora in the gastrointestinal tract and are able to enhance the resistance of molecular immune system against the pathogen factors entered the gastrointestinal tract. By affecting the acidity of intestine, the non-nutritious feed supplements provide the conditions for the growth and proliferation of beneficial bacterium, or reduce their pathogenicity by reducing the number of harmful microbes of intestine, and increase the rate of growth, milk supply and the efficiency of feed consumption in the dairy herds nutrition in terms of livestock feed.

If we want to have the purebred dairy cows with maximum genetic potential for milk supply, first we should provide a balanced ration of high quality hay and cereals as well as minerals and vitamins and maximize the use of this ration. Nowadays, most of the experts have considered the food programs as a major problem in poor produced milk (Sposito, GK, et. al, 2007).

Antioxidants are substances which by adding them to the food the quantitative and qualitative changes can be protected. Antioxidants are used with the aim to prevent from the oxidative decomposition of parts of food which are sensitive to oxygen. Vitamins E and C and beta-carotene are among the natural antioxidants which prevent from the oxidation of substances in the animal tissue and the foods with animal origin. Importance of antioxidants in maintaining the quality of milk and preventing the milk spoilage indicates that we will be faced with the hazardous problem of food spoilage and high deficiency of protein in the absence of antioxidant sources.

Theoretical Principles

In the theoretical principles of study, we review the anatomy of cow gastrointestinal tract as the ruminant. Gastrointestinal tract is like a tube which is began from the mouth and is continued to destination and has the tasks including the food chewing, food swallowing, digesting, absorbing and disposing. Gastrointestinal convert

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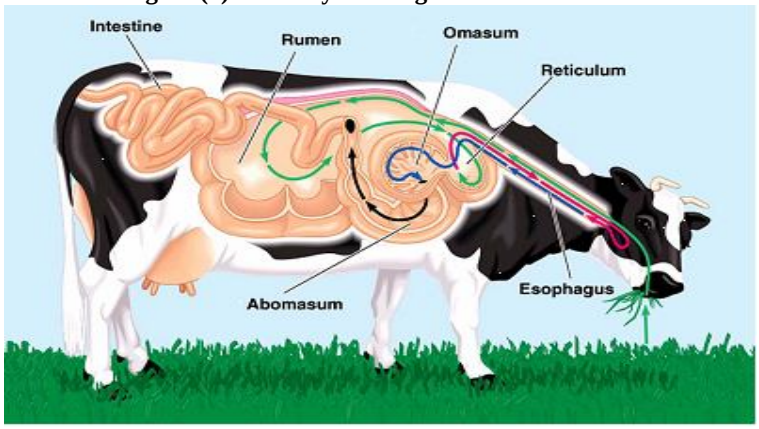
the food into the simple and absorbable combinations and use them for energy generalization and synthesis of other combinations. Gastrointestinal tract is composed the mouth (tongue and teeth), throat (pharynx), esophagus, stomach (rumen, reticulum, and omasum and abomasum), small intestine, large intestine and gastrointestinal organs (salivary glands, liver and pancreas). Figure (1) shows the anatomy of the cow gastrointestinal tract.

Figure (1) Anatomy of cow gastrointestinal tract



- Mouth

Mouth is used for feed crushing and mixing with saliva, but it may also be used for taking the feed and as a defense and attack organs in some species. Mouth and teeth have been surrounded by the lips, cheeks and muscles of jaws.

- Teeth

The front teeth can be seen in the mouth of large and small ruminants in the first days of their lives. These teeth are called incisors with 8 numbers and are only in the lower jaw. At different times, these teeth will grow and change into the main teeth which are important in determining the age of ruminants. From the first days, 3 molars are grown in the mouth of ruminants' neonate in each side and each jaw and there are totally 20 deciduous teeth. However, there are 32 teeth in adult ruminants and from those 6 molars in each side and each jaw and 8 incisor teeth will be gradually changed into the dermanent Teeth.

- Salivary glands

They include 3 pairs of major salivary glands and numerous small salivary glands. The main salivary glands are as follows,

1 - A pair of parotid gland,
2 - A pair of endocrine glands and sublingual glands,
3 - Some of the glands, called the serous salivary glands, have the watery secretions.

Some of them, called the Mucous Salivary Glands, have the mucus secretions and others with the same name have both the watery and mucous secretions. The saliva plays the roles in the ruminants such as increasing the fluids of rumen and reticulum in order to improve the microbial fermentation processes, regulating the PH of rumen and reticulum (between 5.8 to 7) by adding bicarbonate and phosphate, or preventing from the occurrence of flatulence by removing the spume and also for returning Urea to the rumen and reticulum in order to maintain the exchange of blood urea, rumen and saliva. Pharynx is the interface between mouth and Esophagus tube.

- Esophagus

It is a muscular and red tube which is also called as the red intestine. Esophagus is the rest of pharynx and is continued to the stomach. Esophagus secretes the mucosal fluid and leads the morsel (food) to the stomach. There is a sphincter at the beginning of the esophagus and it is normally contracted and keeps the esophagus opening close. The larynx goes up when the food passes the throat and this causes the dilatation of sphincter and the food enters the esophagus. There is another sphincter at the end of esophagus and this sphincter is expanded while swallowing the food in order to enter the food into the stomach.

- Stomach

Stomach is the main and certain organ of ruminants and its capacity in cow is 300 liters. This organ is consisted of 4 separated and related parts in ruminants. Some of the researchers have considered these different organs as a Stomach or its different parts. Therefore, the ruminants are called "Polygastric" which have 4 separate and different stomachs.

1 - Rumen

Rumen, which is also called the Grass-place, takes 90% of the ruminants' stomach volume. This organ has more filled the left side of ventricular cavity. Sphincter connects the esophagus to the rumen at the beginning of

rumen and then finally this tube is continued to Reticulum and Omasum and finally the abomasum. The wall of rumen is called "Pans". In terms of Histology, the existence of stratified membranes in the internal wall of rumen allows the materials to be fully absorbed by it. In particular, the corneum stratum of mucosa is very thin and the numerous congested capillaries, which pass below the epithelial layer, increase its absorption capacity. Papilla on the Epithel of rumen and reticulum increase their internal surface and enhance the absorption rate. As 40 percent of all digestible food in the gastrointestinal tract are digested and absorbed in the rumen. In terms of Histology, the Epithel of rumen striated cover is completely similar to the body skin, but is much thinner. One of the reasons, which the researchers provide for the absorbability of rumen mucosa, is that the amount of volatile fatty acids in the rumen is increased after the meal while it is not increased in the abomasum; thus certainly all of it is absorbed by the rumen mucous. Moreover, the blood taken from the wall of rumen has had higher amount of fatty acids.

2 - Reticulum

It is the smallest organ of the ruminants' stomach which is located on the Sternum and on the center line transversally. Its internal part is quite similar to the rumen based on the epithelial aspect and its cells are polygon and very similar to the beehive cells. The holes of reticulum and rumen are related to each other and a short wall separated them from each other. Hence, these two holes are called together the reticulum-rumen hole. The reticulum wall has the intense contractions which can force the food to the esophagus and mouth tube. Therefore, most of the external objects such as ice, wire, glass, etc, which are ingested by the ruminant, can penetrate its wall and sometimes they can hurt the heart and lead to the animal death if they are in the vicinity of heart. Therefore, this organ is always at risk of perforation and its complications in the case of heart pains caused by external objects.

Given that the level of milk compounds is different in various races, the fat and protein in milk is positively correlated with the population of dairy cows. Holstein has the lowest amount of the fat and protein in milk and Jersey and Guernsey have the highest one. Milk produced in America is purchased based on the fat and protein and solid materials in milk. This new pricing method is based on the economic value of components and compounds, which are obtained from the milk (Cheese, butter, non-fat milk, Infant formula), and it goes up or down with changing the market conditions (Aminipour, H., et al, 2010). Materials and methods of this article are explained as follows.

• MATERIALS AND METHODS

The levels of milk components have an important correlation with the herd management and the health and nutrition of cow plays an important role in generating the farm income. In fact, there are a set of factors which change the components and composition of milk. Factors affecting the milk composition are the non-nutritional and nutritional factors.

Non-nutritional factors

- Lactation Stage: The highest percentage of milk fat and protein is at the end of lactation and their lowest level is after the delivery especially in supply peak.

- Age: From the first to fifth period of lactation, milk fat is reduced 0.2% and the milk protein reduced 0.05% for each period due to the increased level of milk supply.

- Season: The percentage of milk fat and protein is reduced during the warm and humid seasons and the gradual increase in milk composition (fat and protein) can be seen during the winter. These changes are converted or increased due to the type of feed and way of feeding.

- Mastitis: Mastitis reduces the milk fat and casein, but in contrast increases the volume of blood protein (gamma globulin) in milk. Somatic cell count (SCC) of milk is reduced during the mastitis. Herds, in which there is the mastitis, the SCC reduces the price of milk 2-3 times higher. In some of the countries, a reward has been considered for the farms in order to encourage them to reduce the SCC in the milk of their herd.

- Technical mistakes: For instance, the problems in the milk cooling and tank and sampling in milk transfer can lead to the reduced fat and protein in milk.

- Genetics and Heredity: Genetics can affect the milk fat and protein in different cows up to 55%; however, the environment and interactions between the environment and genetic should not be ignored. The fat and protein in milk are heritable much higher than the milk itself and its other compounds.

Nutritional factors

Nutritional factors are the most effective factors on milk and its compounds and have a direct correlation with the management. If a change is made in ration, the milk fat is more affected than its protein. For instance, the milk fat will be changed within 7 to 21 days and the protein within 3 to 6 weeks with changing the ration.

- Origin of milk compounds: By the microbial digestion of fiber, the ration becomes the acetic acid and butyric acid in the rumen and they contribute in producing a half of milk fat after transferring to breast; another half of

fat is provided through the fat in the ration and the exchangeable fat in the body. Rumen microbes change the ration proteins to the microbial proteins which contain the essential amino acids. These amino acids are used by the mammary glands in order to produce the milk protein. Energy required for this metabolic way is provided by the glucose. Glucose is either provided by the Propionic acid, produced in the rumen, or by the glucose absorbed in the intestine wall. Therefore, the less Propionic is produced, the less amino acid is produced, and these enter the Gluconeogenesis membrane and converted into the glucose. However, the milk casein is produced from the available amino acids which are considered alone with the albumins and immunoglobulins of secreted serum in milk as the milk protein, but its quality is low due to the absence of essential amino acids in milk (Castillejos, L.S., et al, 2006).

- Effect of rumen: The existence of sufficient amounts of protein, effective fiber and fast- fermentation hydrocarbons in ration is essential for the proper performance of rumen and the maintenance of optimum level in the milk compounds.

- Management in feeding: It has two models: TMR and Non-TMR. In Non-TMR model, the components of feed are available for animal separately so that the animal has the ability to select. In TMR model, the components of feed are mixed together in a way that the animal has no opportunity to choose, so that all feed requirements of animal are provided by consuming it. The deficiency of model Non-TMR is that perhaps the animal eats one of the components of feed too much and in contrast avoids from eating the other part and this leads to the symptoms such as the acidosis, obesity syndrome, reduced milk fat, and so on. In TMR model, the feed is possibly not delicious and the animal has no desire to eat it at the full capacity of digestive system, but in such a case the supply rate is reduced depending on the consumed rate.

- Physical state: In the next lactation period for the thin and fat cows during the late pregnancy period, the milk protein and fat will be reduced. Loss weight at the beginning of lactation can increases the milk fat for a short period, but there is no potential in thin cows and the fat cows will also catch the ketosis disease.

- Ration Energy: If the energy of ration is high and the fiber is low, the milk fat will be reduced and its protein increased and vice versa. Lack of high quality forage, the lack of balanced ration in terms of protein and minerals and low concentrate in the ration are among the factors which can reduce the level of milk protein.

- Ration Protein: In the last three weeks of pregnancy and early calving, the animal requires protein in the ration more than anything else otherwise the milk protein will become severely low. Notably, too much increase of protein in the ration will not increase the milk protein and excess the extra amount of cattle requirement will be disposed. Ration protein should be balance in terms of decomposable and non-decomposable protein in the rumen, level of forage silage, soluble protein, and NPN; even for the high-producing cows the amino acids should be balanced.

- Ration Concentrate: Applying the high level of non-fiber carbohydrates (NFC) and concentrate and low level of forage in the ration will increase the supply of Propionic acid and acetic acid in the rumen, thus the milk protein is increased and milk fat reduced. Normally, if the dry substance of ration is composed of 36-38% of NFC, producing the compounds of milk will be desirable.

- Ration Forage: the dry substance of ration is composed of about 40-45% of forage and it includes the corn silage and forage with high percentage of fiber. The size of shredding the forage should not be too small which leads to the higher supply of Propionic acid compared to acetic acid; moreover, it should not be too long which makes physically limitation to eating the feed for providing the animal requirement. The size of forage should be proper in order to provide the ration as the TMR for the livestock.

Fat or added oil to the ration: When the fat should not exceed from 5% of the ration dry substance, it will be toxic to rumen microbes and will also reduce the fiber indigestible. If the consumed amount of fat (especially unsaturated fatty acids) is 6-7%, the rumen stops its own normal movement. The cause of fat spoilage should also be noted because in case of consumption, the milk fat will be reduced to its minimum level. However, according to an unproven hypothesis, if the applied fat in the ration is lower than 5%, it will increase the milk fat.

- High level of milk fat: If the cattle are fed with good and high quality forage along with the appropriate level of concentrate, the milk fat of cattle will be at a very appropriate level. It should be mentioned that too high fat in the milk is uneconomical due to reduced milk supply.

Findings:

Effect of photoperiod on the performance of dairy cows

Using the hormone bST, the numbers of milking more than twice a day and the photoperiod (changes of dark and light periods) are among the management tools for increasing the cow's milk supply during the lactation. The days are classified into two groups according to the duration of light period in associated with the photoperiod. If the duration of light period is less than 12 hours (about 8 hours), it is called the short day and if the duration of light period is more than 12 hours (16 to 18 hours) it is called a long day. Studies have shown that by increasing the day length from 12 hours (short day) to about 16 to 18 hours (Long day), the supply of daily milk will be increased to 2.5 kg. The hormonal mechanism, based on which the photoperiod affects the

milk supply, was unknown for several years, but the results of conducted studies in recent years indicate that the photoperiod affects the milk supply by controlling the secretion IGF-1.

Since the milk supply is increased in the photoperiod (long day), the output energy of body will be increased and in fact the demand for energy will be enhanced, thus the animal increases the feed consumption in order to provide the required energy. However, the increased dry matter intake (DMI) due to the photoperiod has not been significant an all performed experiments.

Increased prolactin secretion in cows, exposed to long-day lighting programs, has created this belief that the photoperiod affects the milk synthesis through changing the prolactin secretion. Conversely, the short day lighting programs or melatonin feeding reduces the Prolactin secretion in the animal's body. Therefore, due to the role of prolactin on milk synthesis and also its increased secretion due to the lightning program it is believed that prolactin is the main factor of effectiveness on the milk synthesis due to photoperiod. The growth hormone (GH) is the second hormone by which the photoperiod can affect the milk synthesis in cow, but there is no evidence of increased growth hormone concentration affected by photoperiod (Mozayeni, P. 1995).

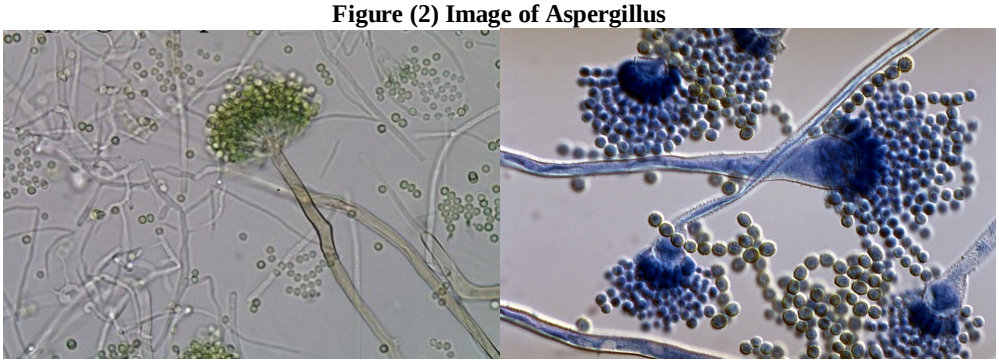
Role of feed in the dairy cows' ration

Aspergillus, block of nutrients, buffers, and the importance of using them in the ruminants' ration, antioxidants, and their function are explained in this section.

1. Aspergillus

The existence of mold in the rumen ecosystem has been understood since 1975; this understanding was obtained as the result of studies conducted by Orpin and Bocop. During the past, the placement of mold in the rumen anaerobic environment was unacceptable; the creatures, which were known previously as the semi-Protozoa, were in fact the molds that were at the zoospore stage. Figure (2) represents the image of mentioned mold.

Figure (2) Image of Aspergillus



Non-nutritious food supplements, containing the live mold microorganisms, have been as a regular supplement in the rodents' ration for several years. In general, there are three types of supplements.

- Some of the products ensure the life of yeasts and are based on different species of Saccharomyces cerevisiae.
- The supplements including pure Saccharomyces and tissue extracts provide no claim for living organisms.
- Mold supplements, which are based on the fermentation of final materials in Aspergillus, have no claim for providing live microbes.

Saccharomyces cerevisiae was able to prevent from the accumulation of produced lactic acid by competing with Streptococcus Bacillus for glucose and stimulating the absorption of lactic acid by Megasphaera. Moreover, the high rumen PH (alkaline) can create the conditions for increasing the number of cellulose-degrading bacteria in the rumen and improving the fiber digestion by fungal tissue. Furthermore, it has been shown that the yeasts stimulate the osteogenic bacteria in the presence of Methanogens and this can be led to the fermentation. Another reason for the ruminal fermentation is that the yeasts can take up excess oxygen from the rumen and create an anaerobic environment by it for the ruminal bacterium.

Output of produced milk and nutrient digestibility was higher for the cows which were under a ration with high level of concentrate and completed with three grams of Aspergillus every days at early stages of lactation. Cows, which were exposed to a ration with low-energy nutrition in middle of lactation period, showed less response to Aspergillus than the cows in the first lactation. Aspergillus fermentation extract affects the milk supply positively, but the increased response in cows in early lactation is higher than the cows in the mid lactation.

2. Nutrient Blocks

There are supplements for the ruminants containing the energy, urea, essential minerals and vitamins. Blocks are used for the ruminants while keeping in the barn or the ones while pasturing on the pastures with low quality. When the quality of forage is low in feeding the animal, applying the nutrient blocks will be essential.

Blocks are not used for the horse, pig, fish, poultry and rabbit. The main materials used in nutrient blocks are defined as follows.

Molasses: It is very important to not add water to the molasses. Molasses should be sticky (Mojtahedi, M., et al, 2010).

Fiber: It absorbs the water and attaches the nutrients in the block. The dry leaves of forage are the great source of fiber. Cotton-like and bagasse shell of cane is also a good source of fiber. Shredded dry forage, straw of shredded corn, crushed corn cob, soybean hulls, and wheat bran can also be used as a source of fiber (Akbarian, A., et al, 2010).

Urea: Applied Urea is the one which is used as a fertilizer. The hunks of urea should be shredded so that the animal does not eat a lot at once and not poisoned.

Cement: Applied cement is the one which is used in the construction works. Before using the cement, it should be mixed with water. The ratio of mixing with water is two buckets of cement and a bucket of water.

Lime: It is found in rock or powder. When water is added to the limestone, the stone becomes hot. It should be noted that the calcium carbonate is a good alternative to limestone.

Salt: Salt has different minerals better than common salt or sodium chloride. If the mineral salt is not available, the common salt can be used.

Bone Meal: It is a nutrient which is required for providing the calcium and phosphorus. Dicalcium phosphate can be used instead of it and it is the important source of minerals which are extracted from the phosphate rocks. If Dicalcium Phosphate and bone meal are not available, the mineral salts can be used instead of them. Phosphate ores cannot be used due to toxicity.

Construction of a block should be done based on the trial basis before making a large number of blocks in a large range. (Murad, E.V., et al, 2002).

3. Buffers and importance of using them in ruminants' ration

Ruminants have a complex system for regulating the body acid-alkali. If the rumen PH is not optimal, the dry matter intake is reduced and the incidence of acidosis can endanger the health and reduce the microbial protein supply. Real buffers are consisted of a weak acid and its salts. These compounds resists against the changes of PH. There are also other compounds which increase the PH of ruminal fluid and are known as the neutralizer or alkali-maker compounds. Proper use of food buffers may increase the consistency with the ration. Excessive accumulation of lactic acid in the rumen causes that the ruminal PH to fall from 8.6 to 5.5 or even lower falls and may even cause the animal's death. The reduction amount of ruminal PH contains the changes, under which the produced volatile fatty acids are increased equal to 30-40% in the rumen and acetate is reduced 40-50%. Due to the ruminal PH drop, the microbial population of rumen is changed and the rate of nutrients passing the rumen digestion of fiber components is reduced. Eventually, the produced lactic acid is accumulated in the rumen and it increases the acidity of the blood by absorbing into the bloodstream. The starch degrading bacterium, which are resistant to acidic conditions, are equally increased and the cellulolytic bacterium are increased. Under this condition, the relative activity of amylase to cellulase in rumen is increased. Numerous studies have concluded that the efficiency of main ruminal Microorganisms growth is dramatically variable by changing the ruminal PH. Cellulolytic and methane-producing bacteria show the quick reaction to the ruminal PH drop under 6. Ruminal Protozoa, caused by feed of high-concentrate rations, are also affected in the low PH. However, feed of small amounts of concentrate will stimulate the greater density of protozoa in the rumen. Several feed changes may increase the need for buffers and these changes are described as follows.

- Feed changes which lead to the increased need for buffers

1- Feeding high levels of grain in order to supply the energy need,
2- Changing the use of long forage to the shredded silage forage especially corn silage,
3- Tiny shredding the silage forage in order to help the mechanization
4- Feeding more acidic feeds such as corn, high-moisture forage and corn silage.

So far, numerous chemicals have been tested as the buffer in ruminants' nutrition. By adding some of these buffers such as sodium bicarbonate, potassium bicarbonate, and magnesium carbonate the acidity of rumen is only neutralized; whereas, others also increase the ruminal PH as well as above case. Buffers resist changing in pH. Real buffers prevent from increasing the acidity (decreased PH), but do not increase PH higher than the specific level. Sodium bicarbonate (NaHCo3) and Sodium bentonite are the real buffers. Alkali-making compounds reduce the acidity, but they can increase the PH. Magnesium Oxide (MgO) is an alkaline compound and is not a real buffer. Various compounds, which have been identified as a buffer, act differently in digestive system. Figure (3) shows the sodium bicarbonate network and Figure (4) represents the magnesium oxide network as follows.

Figure (3) Sodium bicarbonate Network

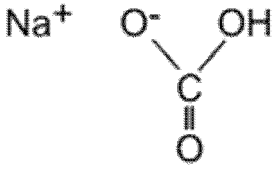
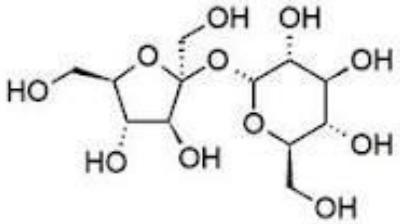


Figure (4) Magnesium oxide Network



In general, there are two mechanisms for action of buffers in the rumen and increase of fluid passing rate in the rumen. High osmotic concentration of fluids and movement of water from rumen wall is among the reasons for the increased speed of fluid movement in the rumen. A positive correlation has been reported between the total volume of rumen fluids and the amount of minerals in the feed. The more the amount of minerals dissolved in the feed is increased, the more the osmotic pressure of rumen fluid and specific weight of feed particles is increased and thus their movement from the rumen will be increased. Adding the minerals to the feed containing the forage or mix of forage and dense materials will lead to the increased rate of suspended particles movement in non-solid part of rumen contents. These particles are mainly consisted of amino acids, soluble sugars, proteins and minerals. However, aside from adding the minerals and buffers, any action, which increases the osmolarity of rumen fluid to a certain level, will prevent from adverse impact of increased feed level on the digestibility and eventually improved efficiency of feed. By increasing the osmolarity, the minerals stimulate the receptors in the rumen, increase the consumed water, and increase the passing rate of materials in the rumen. It should be noted that the change in osmolarity of rumen has been reported for the time when most of the minerals are consumed. In addition to the additives and minerals, the factors such as temperature, physical activity, and high speed of moistening the feed particles through processing are among the factors affecting the passing rate.

- Buffering capacity of feeds used in animal feeding

Rations, which are currently in use, have high levels of soluble carbohydrates and are small in terms of particle size, Furthermore, the amount of consumed fermented feeds in the rations than has been increased compared to the past years and in general they have low levels of PH and high levels of water content which are different from the traditional feeds. Moreover, the number of feeding the livestock has been reduced concurrent with these changes due to the complex management processes which increase the health problems of cattle due to the created challenges in the acid-alkali balance state in line with creating the more acidic ruminal environment. Several studies have been conducted in the field of identifying the buffers of minerals or alkaline compounds and for determining the efficiency of these compounds in reducing the acid stress caused by intensive feeding and management programs. Nevertheless, each mineral supplement, which is added to feeds, may impose the costs on ranchers. Therefore, the buffering capacity of feeds should be calculated in the buffering content of rations and the ration, in which the buffering capacity of feeds themselves is used if possible, should be formulated. Researchers determined the buffering capacity of 35 materials in the laboratory by using the ruminal fluid obtained from the cows fed by the rations containing concentrate and forage, or just rations with concentrate. Obtained results indicate that sodium and sodium-containing buffers are the best kinds of buffers. Potassium is better than calcium and calcium better than aluminum, magnesium, manganese and ammonium. Salts show very little buffering capability. Acetate, bicarbonate, carbonates and di-phosphates are the best buffer anions. Borate, citrate, lactate, and propionate are the weak anions and Microlite of modest buffers, while bentonite is the good buffer when is allowed to be solve in the rumen fluid. Buffers are also consumed in the meat supply systems based on the high-concentrate rations in order to increase or maintain a stable ruminal PH. Acid supply in the rumen has been associated with the rumen wall swelling and inflammation, lameness and liver purulent inflammation and may be resulted from rapid habituating to the high-concentrate rations. Studies have indicated that the use of buffers during the habituating has increased the efficiency. In animals, adapted to feedlot rations, a chronic or subclinical acidosis form is seen usually associated with a reduced ruminal PH within 5-5.5 due to the increased concentration of produced volatile fatty

acids and not increased supply of lactate and this is most common. In general, it should be stated that the advantages of ration supplementation is not few across the animals' nutritional duration. Therefore, rations should be formulated accurately for maintaining the stability of rumen environment, better digestion, healthy livestock and more production, and the metabolic abnormalities should be prevented by using the appropriate additives and considering the sufficient habituating period.

4. Antioxidants and their function ways

Antioxidants are the matters which prevent from the adverse feed changes caused by air oxygen. These matters reduce the damages caused by oxidation of free radicals. Free radicals are the chemicals with increased activity and are absorbed by the molecules through capturing the electron and modifying the chemical structure, thus the color and quality will be changed as the result of this process. Antioxidants are used in order to prevent from the oxidation decomposition of feeds which are sensitive to oxygen. Mentioned property became effective for fats and fat-soluble vitamins in the feed. During this process, the antioxidants are decomposed and thereby they lose their protective properties.

Role of antioxidants in milk supply

Various experiments have shown that the presence of beta-carotene and antioxidant vitamins will reduce the incidence of Mastitis. The concentration of blood beta-carotene in the cows with mastitis is not lower than the healthy cows and this deficiency is associated with impairment of immune system in host. In an experiment of using vitamin E in ration, the udder health has been maintained and the amount of vitamin E has also been increased in milk.

Role of antioxidants in preventing from the milk spoilage

Milk is a combination full of fat and phospholipids are its main fats; the milk spoilage is due to the oxidation of phospholipids. The milk health maintenance is economically so important for the ranchers. There are free radicals in milk and they are produced from various sources (bacteria, light, temperature, pollution, heavy metal pollution, etc.). Experiments have shown that there is also the antioxidant activity in milk and antioxidant vitamins can be found in milk. Betacarotene can be considered as the most important antioxidant of milk in terms of amount and the amount of cavstenoidhar in milk varies depending on the breed and it is high in Jersey and Guernsey and low in Holstein breed.

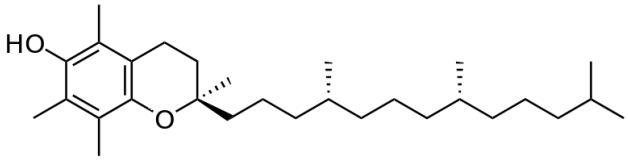
Importance of antioxidant vitamins in animal health

If the antioxidant vitamins are not used higher than the recommended level by NRC, they can stimulate the immune system and improve the quality of livestock supply. During the recent years, several studies have shown that prescribing vitamin E more than the requirement of a bird has the stimulant effect on the antibody especially a stimulant effect on the supply of immunoglobulin; they stimulate the activity of immune system Phagocytosis and the immune effect of vitamin E is done by the help of two factors. Natural antioxidants, which have been studied in this research, include the vitamins E and C. Betacarotene. Artificial ethoxyquin, BHA, and BHT can be named as other kinds of antioxidants. This group of antioxidants is not discussed in this article due to their widespread.

3-1) vitamin E

Due to the positive effect of vitamin E In reproduction, it is called as the anti-sterility vitamin. It was previously known with the names Alpha-Tocopherol and Factor x. Like most of the fat, Mazhavi salts are required for the absorption of vitamins E, when the vitamins E, absorbed in the blood Beta- lipoprotein section, is transferred. Vitamin E is a yellow, soluble-in-alcohol and fat solvents, and insoluble-in-water combination. This vitamin is unstable in front of the heat, light (particularly UV light) and alkali and decomposed. Vitamin E is shown in Figure (5).

Figure (5) vitamins E Network



Vitamin E tasks= Vitamin E acts as an antioxidant in cell; its existence in the lipid membrane prevents from the creation of peroxides and free radicals. Unsaturated fatty acids with several double bonds are extremely sensitive to above peroxidation; when the peroxidation reaction is begun, a chain reaction takes place and affects a large proportion of unsaturated fatty acids with double bonds. By giving a hydrogen atom in a free zone, vitamins E prevents from the creation of peroxidation free base. It has been clear that the deficiency of vitamin E will lead to the unsaturated fatty acids with several double bonds in body tissues. Other metabolic functions of vitamin are as follows,

- Synthesis of coenzyme Q [A compound which is involved in the mechanism of cellular respiration].
- Synthesis of vitamin C

- Protecting the cell structure from oxidation

Vitamin E Metabolism= Vitamin E is not stored in the animal's body for a long time and in large extent and thus existence of a proper source of this vitamin in ration is essential regularly. Seed of cereals is the rich source of this vitamin. Vitamin E mainly acts as a natural antioxidant in the animal's body. Along with the enzyme Glutathione peroxidase, which contains selenium, this vitamin prevents from the oxidation and cell destruction by free radicals. Free radicals are created at the time of cell metabolism and are able to destruct the cell membranes, enzymes and nuclear materials of cell. Thus, in order to survive the animal, these compounds should be converted into the materials with less active. Animal follows two major mechanisms in order to prevent the oxidative destruction. First, the radicals are cleared by vitamin E, and second, the glutathione peroxidase destructs the peroxides before their damage on the cells. These two defense mechanisms are complementary. Vitamin E also plays an important role in the development and function of body immune system. The study of different species has shown that the use of vitamin supplement in the ration prevents from the contamination by the pathogens.

Symptoms of vitamin E deficiency = Selenium and vitamin E both protect the cells from the effects of peroxidation, but in different ways. Vitamin E is created in the components of cell membranes and prevents from the creation of free base. Vitamin E deficiency has been almost reported in different types of domestic animals. Vitamin E deficiency affects the natural function of muscular tissue. In most of the animals, both cardiac and muscular tissues are affected by the Vitamin E deficiency. Selenium and vitamin E both are able to prevent these complications. Vitamin E has often introduced as the sexual power booster, but it is not worth taking too much of it. Vitamin E deficiency leads to impaired fetus growth.

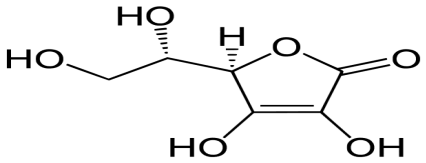
Sources of vitamin E= vegetable oils- colostrums and Embryo of cereal are the richest sources of Vitamin E.

Role of selenium and vitamin E in the mammary gland health= Concentration of selenium and vitamin E in plasma has the positive correlation with the consumption of these nutrients; moreover, under the vitamin E deficiency and selenium, particle-eating (bacteria-killing) of neutrophils is decreased. At the condition of selenium and vitamin E deficiency, the incidence and severity of mastitis is increased in the herd of dairy cows, thus the mammary gland health is correlated with the concentration of selenium and vitamin E and plasma. As a part of enzyme selenium in Glutathione peroxidase, selenium plays the important role in protecting the tissues from damage by radical oxygen. Moreover, vitamin E and Glutathione peroxidase enzyme, an enzyme with selenium, are the main components of antioxidant system in most of the mammalian cells. Increased concentration of selenium and vitamin E in the ration will increase the concentration of these matters in the blood. Effect of vitamin E of feed on its concentration in Plasma in dry cows is 5 times more than its effect in plasma of dairy cows and it is probably because of excreting tocopherol through the milk and goltroum. By adding the supplements with selenium and vitamin E to the dairy cows' ration, it can be observed that the incidence of mastitis has been reduced significantly. Therefore, it can be found that the there is a negative correlation between the incidence of clinical mastitis with the selenium and vitamin E concentration correlation and there is a mutual effect between vitamin E and selenium of ration because the cattle fed by high doses of selenium tend to develop clinical mastitis. Selenium supplements in cows, fed by it, create a very rapid flow of neutrophils into the milk and kill the broken bacteria. In parous dairy cows with several births, the concentration of plasma in vitamin E has been reduced from 7 days before calving and it has been continued from 7 to 14 days after calving and this will lead to the deficiency of neutrophils activity and increased intramammary infection. Thus, the subcutaneous injection of vitamin E, 5 to 10 days before calving, can increase the concentration of Alpha-Tocopherol neutrophils during the periods and neutralize the decreased bacteria-killing property activity of neutrophils (often seen in at the time of calving); on the other hand, vitamin E and selenium enhance the animal's defense against infection by improving the activity of particle-eating cells (neutrophils). In animals with the selenium deficiency, the defensive power of body immune system is decreased (Gordon, A., 2004).

3-2) vitamin C

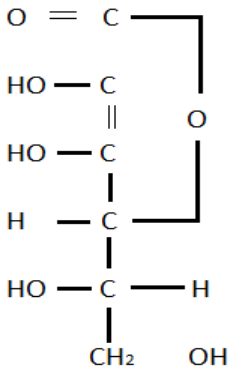
Other names of vitamin C are the ascorbic acid, Hexuronic acid and anti-scurvy vitamin. Most of the animals are capable to biosynthesize the vitamin C sufficiently. The exceptions are the humans, monkeys, guinea pig, some of the types of fish, Red vented bulbul bird and Indian Fruit Bat. There are numerous compounds with vitamin C properties, but "Ascorbic Acid" is the most important one. Ascorbic Acid is resistant to the acids and is decomposed in the alkaline environment. Temperature and light also can deactivate this vitamin. It can be well dissolved in water, but is partially insoluble in alcohol and acetone. Ascorbic acid is insoluble in ether, chloroform and benzene. Sometimes vitamin C is used as the anti-oxidizing agent (antioxidant) for storing the food. Figure (6) shows the vitamin C network as follows.

Figure (6) Vitamin C network



Sources of vitamin C= Fruits and citrus are the richest sources of this vitamin, but vegetables, green plants, potato and tomato are also the excellent sources of vitamins C. Vitamin is acidal-ascorbi based on the chemical and has the structure as shown in the following figure. The acidal network of ascorbic Acid is shown in figure (7) as follows.

Figure (7) Ascorbic Acidal Network



Conclusion

Loss of appetite is the first sign of protein deficiency in the ration of dairy cows. Loss of appetite may be led to the insufficient consumption of energy. Hence, the protein and energy deficiencies often occur together and cause the growth failure; moreover, they can be as the risk factors for animal's disease and death. Reduced supply of milk is another sign of protein deficiency which can lead to a huge economic loss in beef cow growth. These symptoms are very important for the rancher because all fattening plans can make the trouble.

Numbers 1 to 7 represent the anatomy of cow's digestive system, Aspergillus image, sodium bicarbonate network, magnesium oxide network, Vitamins E Network, vitamins C network, and Ascorbic acidal network, respectively. Eventually, the following suggestions are provided according to the contents and methods in this article.

Suggestion

- Appropriate supply of milk and its compounds is achievable in terms of ratio adjustment chemically and physically proportional to all requirements of livestock. Regular testing of energy, protein and minerals of forage, regular testing of TMR in terms of providing all requirements of livestock, examining the forage and TMR size, evaluating the previous records of milk compounds and physical inspection of livestock body for proper feeding programs in the cattle are among the ways which can lead the cattle manager to the above objective.
- Applying a dark period during the day for the cow. The cow shows the sensitivity to the photoperiod just when the darkness and light periods are alternately applied. Photoperiod of long day, compared to the short day, increases the growth of udder parenchymal tissue and decreases the amount of fat in mammary glands. As the result of a long-day photoperiod, the milk supply is increased, so the output energy of body and the demand for energy are increased. Long-day photoperiod stimulates IGF-1 and short-day photoperiod stops the secretion of IGF-1. Short-day light program or Melatonin feeding decreases the prolactin secretion in the animal's body.
- It is recommended adding the non-nutritious food supplements containing live microorganisms such as toxic molds particularly Aspergillus, which produces the poison aflatoxin, as a DFM and supplement. Using the fermented extract of Aspergillus equal to recommended amount 0 to 3 percent has the advantages such as increased concentration of acetate, Propionate and volatile fatty acids, increased digestibility of DM, CP, NDF and ADF, increased milk supply and nutrient digestibility for the cows exposed to high-concentrate ration at the

beginning of lactation, decreased rectal temperature, decreased blood urea nitrogen concentration, increased milk protein supply and SNF, and finally decreased ruminal PH and increased VFA.

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