ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

The Use Of Metabolizable Energy And Cow Productivity Depending On The Level Of Dairy Feeds Fed During Their Raising Period.

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ABSTRACT

The article contains the results of studies that prove that the level of consumption of milk fodders (whole and skimmed milk) during the raising of cows to a large extent determines the efficiency of metabolism and energy and in their adult state. When calves were given vegetable-based feeds from the age of 4 weeks old, as adults they transformed nutrient energy at the same level as their peers in the control group, and cows raised without milk feeds from 10 to 15 days of age transformed it with reduced phosphorylating efficiency. They produced less by 544 kg of milk and by 23.2 kg of milk fat for 2 lactations. The duration of their lactation reduces and reproduction functions deteriorate.

Keywords: milk fat, protein, calves, cows, gas-energy metabolism, respiratory coefficient (RC).

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ISSN: 0975-8585

INTRODUCTION

The fundamental researches conducted in our country back in 1900 by Avrorov [1] and later (1938) in Germany and in the USA (1959) convincingly proved the inconsistency of statements about the possibility of fat replacement by carbohydrates, on the grounds that fat is synthesized with carbohydrates. Animals fed on diets rich in carbohydrates but with the low fat content were characterized by a shorter term of productive service, lower resistance and died faster from infectious diseases and had more pronounced morbid phenomena than animals raised on fat-rich diets. In 1937 Leites [2], and later Afonsky [3], Kovalsky [4] established a relationship between the fat content in the blood and the functional activity of the reticulo-entodelial system, the emergence of immune globulins. The important anti-infective role of milk fat was drawn attention to by Kirchenstein [5], Syuzyumova [6]. Dmitrochenko and Oleinikova [7], Krylov [8] showed that milk fat affects the synthesis of vitamins by the microbes of the digestive tract and their absorption in the intestine. The lack of milk fat reduces the use of protein and calcium, worsens the use of vitamins, slows the growth of calves, lowers their immunoreactivity in response to vaccination against paratyphoid and colibacillosis. In carefully conducted long-term experiments, Pshenichny [9] and his students showed that the cows fed on diets with high milk fat content cows did not reduce the fat content of milk, and the bulls' sperm secretion.

They used the reserves of their body, during the periods of some shortages of feeding and maintenance, better than the animals that were raised with a small amount of milk fat being given to them.

Despite the large number of experiments, the authors did not agree on the amount of milk fat required for the successful raising of calves, and its influence on the subsequent cow productivity. Popov [10] proved that the amount of milk fat without any harmful effects can be reduced to 3 kg, according to Kuhn [11], the content in the diet of 1.0-1.5% fat satisfies the needs of calves. Demyanchuk [12] considers the optimal fat level to be 6-8 g per 1 kg of live weight. Pshenichny [13] recommends to feed replacement heifers in the first 2-3 months of life with 8-10 kg of milk fat and for the first 6 months of the postnatal development with 4-6 kg of digestible vegetable fat. He recommends to increase these norms for pedigree bulls in 1.5 times. For the last 10-15 years, due to a sharp decline in milk production and the desire to improve the marketability of dairy farms, it has become a widely practice to grow calves at reduced rates of dairy feeds, i.e. to use them only in the period when they are newborn, replacing dairy feeds in the subsequent development periods with vegetable ones in the form of various mixed feeds. In this regard, there is a direct need for an in-depth study of physiological, biological and other consequences of such calf rearing.

RESEARCH TECHNIQUE

One hundred sixteen heads of Pinzgau, Simmental calves and their cross breeds with Hereford and Jersey were involved in two series of experiments, they were raised in the control group (58 heads) on the basis of the whole-milk scheme with a total consumption of 275 kg and 700 kg of skimmed milk or 11.85 kg of milk fat and 33.4 kg of milk protein. In the diets of calves of experimental groups (58 animals) in the first series of experiments from 10-15 days, and in the second series from 25-30 days of age, the nutritive substances of the dairy feed were completely replaced: with a vegetable and animal (fish) fat mixture (1: 1 proportion), and milk protein was replaced with vegetable protein. Owing to the vegetable and animal fat, calves received 79% of the total fat (8.08 kg) and 71% of the total protein (28.8 kg) in the first series of experiments, and 51% (6.07 kg) and 66 % (21.6 kg) respectively in the second. At the same time, the level of fat and protein nutrition, like other normalized indices, was the same for calves of the compared groups.

In the experiment a milk-substituting feed mix, the most widely used in the practice of feeding calves, was applied consisting of cream free milk - 12-19%, wheat flour - 40.5-44.4, pea flour - 14.5-20.0, sunflower meal - 13, 5-14,6, oat flour - 6,7-7,2, oil (fish vitaminized) - 2,4-2,5, table salt - 2,0-2,2, tricalcium phosphate - 2,0- 2,2, glauber salt- 0,4-0,5%. Zinc sulphate -36-40 mg was added to 1 kg of the mixture, cobalt chloride -10-12 mg, PVC (protein-vitamin concentrate) (up to 2 months old) 1.0-1.5 g. One kilogram of this mixture contains 1.28-1, 32 ECU and 188-196g of digestible protein.

RESEARCH RESULTS

The study of the gas-energy metabolism performed seven times (at 3, 6, 9, 12, 15, 18 months and 3-4 months of lactation) made it possible to establish that the animals of the Simmental breed and its crossbreeds

with Hereford sharply responded to the replacement of milk fat and protein. They are characterized by significantly higher consumption indices (the oxygen content per unit of the body weight and organic substances) of oxygen (P <0.001) and the release of carbon dioxide (P <0.001), that is, more organic substances are utilized per unit of time. At the same time, the efficiency of metabolic processes was low, because they lost a greater part of the energy released in the oxidation process than in the animals of the control group in the form of heat production (P <0.05-0.001) A significant share of energy losses was due to (according to the RC) the protein decomposition. The growth of animals slowed down. The marked changes were less expressed in animals of the Pinzgau breed, while in Simmental Jersey crossbreeds they did not manifest themselves at all. Consequently, the Simmentals and their crossbreeds with the meat cattle adapt themselves worse than the crossbreeds with the dairy breeds and animals of the Pinzgau breed to the " milk" substitute feed unusual for them during this period.

It is characteristic that while replacing the components of the feed to 51% milk fat and 66% milk protein, the changes in the substances subjected to oxidation in the ratio of the qualitative composition in the Simmental breed calves are manifested at the end of the transition period. The animals of the experimental groups had, judging by the respiratory coefficient (RC), the protein-carbohydrate type of metabolism (RC = 0.88-0.93), while the animals in the control groups had the carbohydrate-protein type of metabolism (RC = 0.96-99). When there was an increase in the replacement of milk fat to 79% and protein to 71%, similar changes in metabolism and energy are already observed at the lactotrophic stage of development. If milk fat and protein are replaced in the diet, from the age of 25-30 days these changes in the protein-carbohydrate metabolism, high intensity of gas metabolism and low efficiency of metabolic processes in calves reliably manifest themselves only up to 6 months of age, if the replacement of dairy feeds is carried out from the age of 10-15-days, they remain even in the period of reaching maturity. Apparently, in this case there are more persistent neurohormonal shifts, which cause activation of metabolic processes with the low phosphorylation efficiency.

The marked difference in the time of inclusion of a significant amount of protein in the energy metabolism and the different duration of the manifestation of changes in the carbohydrate and fat metabolism in experimental animals at different levels of milk fat and protein replacement in their diet is determined by the peculiarities of the formation and course of rumenal digestion. Rearing without milk feeds from the age of 25-30 days did not affect the time of formation and the level of rumenal digestion, but affected the ratio of fermentation acids formed - the formation of propionic acid (a source of glucose in ruminants) decreased but acetic acid production increased. The earlier replacement of milk feeds accelerated the formation of the metabolic maturity of the digestive organs and increased the formation level of the final fermentation products (FFP).

At this time, the body tissues, apparently, were not fully adapted yet to cover their energy needs due to the oxidation of VFA and ketone bodies. According to Reytman’s data [14], the energy value of glucose absorbed by the tissues exceeds the energy value of acetate by 15 times in calves up to 2 months of age. Under these conditions, there was a certain lack of carbohydrates, especially for the functioning of the tissues of the nervous system. In the first case, due to the small amount of propionic acid entering the body, and in the second because of relatively early and relatively higher intake of VFA, which could not but cause shifts in the carbohydrate metabolism. Lack of glucose as a source of energy causes the excitation of hypothalamus, the impulses of which are transmitted to the suprarenal glands, the hormones of which play an important role in adapting the organism to changes in the external environment. The suprarenal glands intensify the secretion of adrenaline and glucocorticoids into the blood. The target organ for the action of hormones is the liver, through which the body receives the required amount of glucose. The function of corticosteroids in this case is schematically shown in Figure 1.

ISSN: 0975-8585

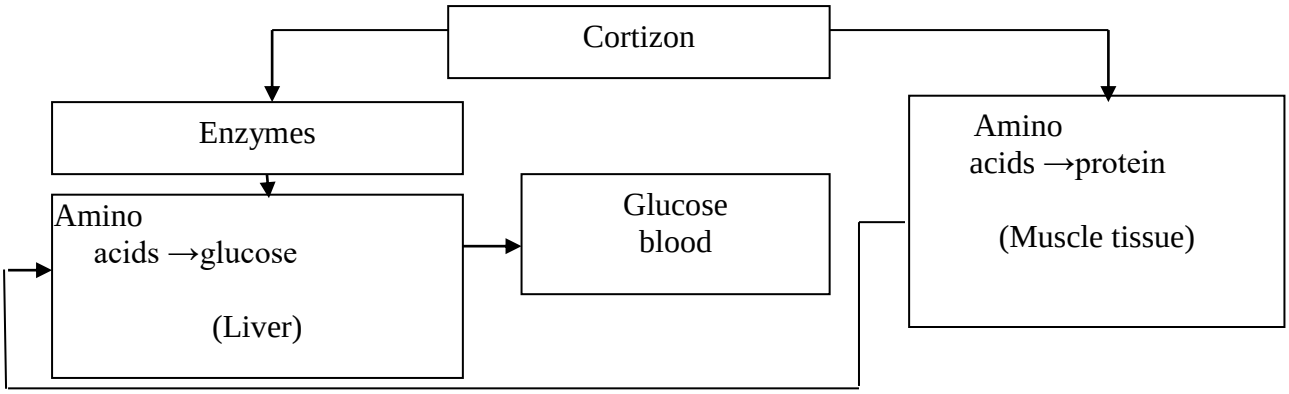

Fig 1: Diagram of cortizon influence on the synthesis of protein.

Cortisone inhibits the intensity of protein synthesis in many tissues, because of which the excess of amino acids is used to form glucose in the process of gluconeogenesis in the liver. Along with this, cortisone, as known, stimulates the synthesis of a number of enzymes in the liver that enhance the processes of gluconeogenesis.

This specific feature of protein-carbohydrate metabolism seems to take place in the organism of calves due to their being fed on vegetable feeds instead of dairy feeds. It is one of the many and significant causes of their lagging behind in weight gain and linear growth at the lactotrophic and transitional periods of development. The decrease of the body weight gain in the animals of the experimental groups was determined by their higher heat losses of the digestible energy of the feed. It is obviously associated with the hyper-function of the thyroid and suprarenal glands. The hormone thyroxine is capable of “separating” the reactions of the oxidizing phosphorylation and adrenalin activates metabolic processes with lower phospholyrating efficiency. As a result of this oxidation “separation” a significant part of the energy released in the organism of animals that were raised without milk beginning from 10-15 days of age turns into the heat energy which is not used by the organism for productive purposes. At the same time in the animals of the Pinzgau breed as better adapted phylogenetically to the early consumption of vegetable feeds, the use of metobalizable energy of the feed to a lesser extent depends on the level of milk feeding than in animals of other breeds. In the theoretical aspect this prerequisite found by us in the course of the study represents an absolutely new approach to the problem solution of early stimulation pregastric digestion and allows us to assume that there is an age limit in this respect connected with the genotype of the breed.

The studies of gas and energy metabolism during the hardest period for the organism of cows, the period of lactation (3-4 months) showed that the cows reared from 4-week age without milk fat and protein, transform the energy of nutrients in the diet at the same level as their peers in the control group. The cows raised without milk fat and protein from the age of 10-15-days transform it with less phosphorylating efficiency, i.e. they cope with such a hard functional load as calving and lactation with difficulty. It was found that they had greater ($P<0,05$) oxygen consumption indices (by 10,6%), released carbonic gas, they had losses in metabolizable energy in the form of heat production and a smaller share of using it for the live weight gain and milk secretion. They produced less by 544 kg of milk and by 23,2 kg of milk fat for 2 lactations. Over the years such cows developed a tendency to reduce the duration of lactation. In milk yield increase rates, the lactation permanency coefficient, the level of milk productivity and expenses for feeds they are inferior to the cows raised on the full diet of dairy feeds.

CONCLUSION

The level of milk feeding of heifers during the raising period, as we see, largely determines the economical efficiency of metabolism and energy in an adult animal. The data obtained on the metabolizable energy use give the ground to assert that certain amounts of milk fat, protein and such a "structural" carbohydrate as lactose are the only reliable way of forming economical metabolism of substances and energy, especially in cattle of highly specialized meat production.

ISSN: 0975-8585

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