



Quality management in animal farming

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Abstract:

The article introduces a long-term analysis of statistics and experimental research in domestic animal farming. Dairy cattle breeding is the dominant industry in Russian livestock farming. Its annual productivity has reached 6000 kg of milk per cow, while some farms and regions have brought this indicator up to 8000–10 000 kg. Unfortunately, the quality of milk, meat, and other livestock products is often neglected in favor of productivity.

Human health is believed to depend on nutrition. However, this dependence requires more specific evidence. For instance, the exact effect of livestock product quality management on the life and longevity of the population still remains unknown. Some studies revealed that pig breeds differ in the cholesterol status of fat; other research teams invented a high-quality green alfalfa dry feed, which provides animals with biologically active substances and normalizes metabolic processes.

This review highlights some promising scientific directions in fundamental and applied knowledge that can be beneficial to human health.

Keywords: Productivity, product quality, biologically active substances, technology, Holstein cows

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A state economy is effective when the life expectancy of the local population keeps increasing. Human longevity is known to depend on such factors as healthcare, lifestyle, climate, living conditions, genetic profile, etc., and other factors might be revealed in the future. In this respect, the effect of human diet on life expectancy is a very promising research direction. Most diets include livestock products. Livestock farming, which is almost as old as humanity itself, is one of the most significant factors that affect nutrition quality and, consequently, life span. For example, blood and colostrum are universal products vital for neonatal and postnatal fetal development. Chirvinsky and Maligonov formulated this correlation as a law, according to which blood and colostrum deficiency hinders fetal development [1]. Therefore, nutrition is a top priority factor that determines life expectancy, both in animals and humans.

In Russia, increasing milk and meat productivity has long been the most popular scientific direction, probably, as a result of the long-term shortage of animal food products. For many years, agricultural science gave priority to selection. However, it takes as long as 25–30 years to create a new highly productive breed of dairy or meat cattle. All efforts being concentrated on cross-breeding,

while food quality management remained beyond the scope of scientific and industrial attention. As a result, cattle farming lacked funds to raise the quality of personnel and equipment in the sphere of milk and meat quality studies. Feeding technology, feed mixing, animal husbandry, and livestock raw material processing are important scientific areas related to product quality. Unfortunately, domestic agricultural science still fails to see them as priority areas. Nowadays, high milk yields are usually achieved by cross-breeding domestic cow breeds with Holsteins, and economic entities and government bodies tend to treat other economically important traits as insignificant. Naturally, contemporary Russian dairy and meat farming finds itself in a difficult situation: the high annual milk productivity, which exceeds 6000 kg per cow, is accompanied by the low quality of Holstein herds, where the reproduction has dropped to 76.4% calves per 100 cows and the productive longevity is as poor as 2.67 calving cycles per cow. Under such conditions, milk quality requires a comprehensive analysis, since cows' early retirement is most often associated with metabolic disorders, which inevitably affects the milk quality profile [2].

Colostrum is one of the most wholesome livestock products: it contains biologically active substances that provide newborns with vital nutrients and protect them from pathogenic microorganisms. Due to its immunomodulatory properties, expanded and long-term use of natural and frozen colostrum can improve the health of children and calves.

Colostrum composition in freshly-calved cows is known to depend on their diet. A balanced premix can double the amount of all amino acids in colostrum, compared to randomly purchased premixes. So far, no studies have featured further effects of colostrum on calves or children. Commercial livestock farming also knows selection methods that increase the productive longevity of dairy cattle. For instance, the Canadian company Immunity + has been selecting bull sires with increased immunity for 20 years and managed to increase the productive longevity in descendants.

Milk processing technology is another priority research topic. Thermal processing can be combined with other disinfecting methods or even excluded to preserve vitamins, enzymes, hormones, and other biologically active substances. Such studies open up new prospects for a more effective use of milk in children's or dietary foods.

Feed is the most effective way to change the composition and quality of milk, meat, and eggs. Unfortunately, this prospective area remains largely understudied. However, many years of production experience prove the supreme quality of Siberian milk and butter. In Siberia, cows feed on natural saline soil pastures and consume herb mix hay, which gives the resulting dairy products attractive sensory properties. Cattle that feed on monocultures grown on arable land produce livestock products of much inferior quality. Contemporary science cannot predict the exact effect of the abovementioned products on human health: this issue is a matter of some future comprehensive research.

The sensory profile of livestock products also depends on the microbial composition and count in the gastrointestinal tract of cows. The microbiota, in its turn, depends on the diet, namely, on vitamins, minerals, and easily digested carbohydrates [3].

The future of livestock farming lies with the combination of complex metabolism-regulating feed additives and breakthrough production technologies of high-quality roughage and succulent feed. In this respect, solar insolation and physical activity are the least-studied factors that affect livestock products.

Meat of young cattle, e.g., calves or foals, raised in line with a special technology, can improve children's

metabolism. According to such technologies, milk-fed calves and foals graze on natural or artificial pastures from spring to late autumn, unlimited in movement and solar exposure. Such conditions provide especially valuable meat products. Free-range farming with temporary cattle barns is applied in many Russian regions, including Yakutia, Buryatia, Khakassia, Transbaikalia, Gorny Altai, etc. Veal and young horse meat are in high demand. This method is opposed to the traditional Italian technology that presupposes zero-grazing rearing and fattening of young cattle in industrial complexes. However, the resulting beef is of poor quality.

As the production of poultry and pork keeps increasing, the quality standards are becoming stricter. The current task of modern science is to determine the nutrients that define the quality of livestock products in order to use them in feeding farm animals.

The threshold level of productivity depends on the content of metabolic energy, proteins, easily digested carbohydrates, and some biologically active substances in the diet. All these nutritional elements correlate with feed quality. However, most agricultural producers in Russia have feed composition below average, i.e., of quality class II or non-class, while others do not bother to assess the quality of their feeds at all.

The livestock industry and the food science are currently facing with the fundamental task of establishing the relationship between the feed quality, the microbial development, and the quality of milk, meat, and eggs.

Of course, it is the task of economics to determine the priorities in assessing the elements of technology for livestock products. For example, modern top quality class feeds possess excellent digestibility and are extremely effective. They involve such breakthrough technologies as artificial drying of green alfalfa in a combined aerodynamic dryer, which combines six drying methods and provides high feed quality. Although the method could revolutionize the entire domestic cattle breeding, the Voronezh Region remains the only territory in Russia to use this technology so far [4]. As an alternative, farmers can provide cattle with natural or artificial microbial or enzyme additives that facilitate feed breakdown and digestion. Unfortunately, the current lack of experimental farms, physiologic al yards, and funds makes it next to impossible to perform reliable scientific experiments in animal husbandry.

The recent geopolitical events have proved that food independence is the most urgent task Russia has to solve, and this task requires combined efforts of fundamental science, applied studies, and production.

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