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### VETERINARY AND SANITARY ASSESSMENT OF THE QUALITY OF QUAIL EGGS WHILE USING THE VERMICULITE FEED ADDITIVE

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*The article presents the results of veterinary and sanitary assessment of the quality of quail eggs while including the Vermiculite feed additive into the poultry main ration. This feed additive has been formulated using locally sourced expanded vermiculite. To conduct the experiment, three groups, each comprising 35 birds, were formed and housed in separate cages. The first (control) group of quails did not receive the feed additive, while the diets of the second and third groups included vermiculite at concentrations of 3% and 5%, respectively, relative to the dry matter of the main ration.*

*The research findings on the veterinary and sanitary assessment of quail eggs quality and morphometric indicators, while using the Vermiculite feed additive, meet the requirements outlined in regulatory documentation. In contrast to the control group, eggs from the test groups exhibited the highest weight, surpassing the control by average 5.5%. Moreover, the average shell thickness of eggs in the third group exceeded that of the control by 30.7%.*

*Concerning mineral composition, the test groups showed, on average, a 3.5% increase in calcium concentration and an 18.2% increase in iron compared to the control group. Overall, use of the Vermiculite feed additive positively influenced the overall mineral content in quail eggs.*

**Key words:** *vermiculite, feed additive, quail, veterinary and sanitary assessment, egg, safety, quality.*

### ВЕТЕРИНАРНО-САНИТАРНАЯ ОЦЕНКА КАЧЕСТВА ПЕРЕПЕЛИНЫХ ЯИЦ ПРИ ПРИМЕНЕНИИ КОРМОВОЙ ДОБАВКИ «ВЕРМИКУЛИТ»

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*В статье приведены результаты исследования ветеринарно-санитарной оценки качества перепелиных яиц при применении кормовой добавки «Вермикулит» в составе основного рациона птиц. Кормовая добавка разработана на основе местного вспученного вермикулита. Для проведения опыта были сформированы три группы птиц по 35 голов в каждой, которых содержали в изолированных клетках. В корм первой (контрольная) группы перепелов кормовую добавку не добавляли. А рационы птиц второй и третьей групп вермикулит добавляли в количестве 3% и 5%, соответственно к сухому веществу основного рациона.*

*Установлено, что полученные результаты по ветеринарно-санитарной оценке качества и морфометрические показатели яиц перепелов в корм которых добавляли кормовую добавку «Вермикулит» соответствуют требованиям нормативной документации. По сравнению с контрольной группой масса яиц опытных групп имели наибольший вес в среднем на 5,5%. Также, средний показатель толщины скорлупы яиц третьей группы на 30,7% выше чем в контрольной.*

*По минеральному составу концентрация кальция в опытных группах была выше в среднем на 3,5% и железа на 18,2% по сравнению с контрольной группой. В целом, кормовая добавка «Вермикулит» оказала положительное влияние на общее содержание минеральных элементов в яйцах перепелов.*

**Ключевые слова:** вермикулит, кормовая добавка, перепелка, ветеринарно-санитарная оценка, яйцо, безопасность, качество.

### «ВЕРМИКУЛИТ» АЗЫҚТЫҚ ҚОСПАСЫН ҚОЛДАНУ КЕЗІНДЕГІ БӨДЕНЕ ЖҰМЫРТҚАЛАРЫНЫҢ САПАСЫН ВЕТЕРИНАРИЯЛЫҚ-САНИТАРИЯЛЫҚ БАҒАЛАУ

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Мақалада бөденелердің негізгі рационына «Вермикулит» азықтық қоспасын қолдану кезінде бөдене жұмыртқаларының сапасын ветеринариялық-санитариялық бағалау бойынша зерттеу нәтижелері берілген. Азықтық қоспа жергілікті қолпайылған вермикулит негізінде дайындалған. Тәжірибені жүргізу үшін әрқайсысында 35 бастан тұратын құстардың үш тобы құрылды және олар жекелеген торларда өсірілді. Бөденелердің бірінші (бақылау) тобының негізгі азығына азықтық қоспа қосылмады. Екінші және үшінші топтағы құстардың негізгі рациондарына вермикулит сәйкесінше 3% және 5% мөлшерінде қосылды.

«Вермикулит» азықтық қоспасы қолданылған бөденелер жұмыртқаларының сапасын ветеринариялық-санитариялық бағалау және олардың морфометриялық көрсеткіштері бойынша алынған нәтижелер нормативтік құжаттардың талаптарына сәйкес келетіні анықталды. Бақылау тобымен салыстырғанда тәжірибелі топтардың жұмыртқаларының салмағы орта есеппен 5,5%-ға көп болды. Сондай-ақ, үшінші топтағы жұмыртқалардың қабығының қалыңдығының орташа көрсеткіші бақылау тобымен салыстырғанда 30,7%-ға жоғары болды.

Минералды құрамы бойынша тәжірибелік топтардағы жұмыртқа құрамындағы кальцийдің концентрациясы бақылау тобымен салыстырғанда орта есеппен 3,5%-ға және темір 18,2%-ға жоғары болды. Қорыта айтқанда, «Вермикулит» азықтық қоспасы бөдене жұмыртқаларының жалпы минералды құрамына оң әсер етті.

**Түйінді сөздер:** вермикулит, азықтық қоспа, бөдене, ветеринарлық-санитарлық бағалау, жұмыртқа, қауіпсіздік, сапа.

**Introduction.** To date, the poultry market in our country is developing more dynamically with better prospects [1, p.197; 2, p.189]. One of the broadest areas is quail farming, as quail have high growth energy and produce dietary meat and eggs [3, p.160].

Quail eggs are a valuable, tasty, and nutritious modern food. Its benefits have long been known. [4, p.89; 5, p.225]. Compared to chicken eggs, quail eggs contain five times more potassium, 4.6 times more iron, 2.5 times more B vitamins, and more vitamin A, phosphorus, cobalt, and nicotinic acid. It is also important to note that quail eggs are superior to chicken eggs in terms of protein content, which is easily digestible by humans. And quail egg includes such essential amino acids as threonine, histidine, tyrosine, glycine, lysine [6, p.862; 7, p.136]. Quail eggs are nutritious because they contain sufficient amounts of fat and fat-soluble vitamins for the human body. Eggs contain unsaturated fatty acids, which inhibit the development of atherosclerosis and obesity. An undoubted advantage of this product is that it is practically cholesterol-free [8, p.25].

Quails are characterized by a high body temperature (42°C), which makes them resistant to infections. This eliminates the need for vaccines and antibiotics and greatly increases the nutritional value of the eggs [9, p.198].

The special need for quail eggs arose from the background of informing physicians of their beneficial properties in the rehabilitation of people affected by radiation exposure. They are also recommended for use during pregnancy to alleviate symptoms of poisoning and have a positive effect on the development of the fetus [10, p.62]. The benefits of small eggs to children are immeasurable. Eating three or four quail eggs daily can alleviate or prevent many ailments, including stomach ulcers, gastritis, bronchial asthma, pneumonia, and even headaches. A protein in quail eggs called ovomucoid has the ability to reduce allergic reactions [11, p. 1004].

The feed additive "Vermiculite" is a natural mineral that is a product of decomposition during weathering of biotite, phlogopite, some chlorites and other silicates rich in magnesium [12, p. 198; 13, p. e06160]. Vermiculite is added to livestock and poultry feed to improve growth and health indicators and reduce toxic residues. Vermiculite also improves the hygienic, sanitary, and morphological characteristics of livestock and poultry products [14, p.195].

In the work of T.B. Abdigalieva et al. the influence of vermiculite on productivity, morphometric parameters, chemical composition and fatty acid composition of eggs of laying hens has been studied. According to the results of the work, it was revealed that in the experimental groups of chickens, in whose feed vermiculite was added, egg production was higher than in the control group. Also, there was a higher content of protein, carbohydrates and energy value of eggs [15, p. 1129].

L.E. Tyurina presents an analysis of the effect of feeding a mineral complex additive based on vermiculite in feeding laying hens on the incubation qualities of eggs. It was found that the inclusion of mineral supplements in the diets contributed to a significant increase in the hatchability of chickens up to 5.4%. There was a significant increase in the incubation qualities of eggs in the experimental group compared with the control, in which maximum fertilization and hatchability of eggs were obtained [16, pp.103].

The purpose of the work is to study the effect of the feed additive "Vermiculite" on the quality and safety of quail eggs on the basis of a comprehensive veterinary and sanitary examination.

**Research objectives.** To study and analyze research works dedicated to the effect of vermiculite on productivity, morphological parameters, chemical composition, and fatty acid composition and on the incubation qualities of eggs;

To investigate the veterinary and sanitary assessment of the quality of quail eggs when using the Vermiculite feed additive as part of the main poultry ration developed on the basis of locally sourced expanded vermiculite;

To form three experimental groups of birds comprising six-week-old Manchurian quails kept in separate cages.

**Materials and Methods.** Research work on feeding and keeping birds was carried out on the farm of "Salem Qus" LLP (Almaty region). We have formed three groups of six-week-old quails of the Manchurian breed with 35 heads each. Feeding of birds, weight control and maintenance during the scientific experiment corresponded to the recommendations of "Salem Qus" LLP.

The first group served as a control and did not receive a feed additive. The second group received the main diet, to which the feed additive "Vermiculite" was additionally added in an amount of 3%. In the diet of the third group, a feed additive was added in an amount of 5%. They were fed 4 times a day. The duration of the experiment was four months.

Sampling and egg research were carried out in accordance with GOST 31655 - 2012 "Food eggs (turkey, guinea fowl, quail, ostrich) Technical conditions". A total of 60 egg samples were examined.

Veterinary and sanitary studies were conducted in the laboratory of the Department of Veterinary and Sanitary Expertise and Hygiene of KazNARU.

The assessment of the quality of eggs began with the determination of the condition of the shell. The purity of the eggshells was checked visually. The smell of the contents of quail eggs was determined organoleptically, the density and color of the protein - visually by pouring the egg on a smooth surface. Ovoscoping of eggs was performed using the egg quality control device «ПКЯ-10». The height and condition of the air chamber, the position of the yolk, the integrity of the shell were determined and the presence of defects was noted.

The mass of eggs, the mass of yolk and protein were determined from physical indicators. The eggs were weighed using laboratory electronic scales VM-153. Measurements of eggshell sizes were carried out using a caliper with an accuracy of 0.1 mm.

Determination of the mineral composition of eggs was carried out in the laboratories of the Research Institute "Food Safety". Sodium, potassium, magnesium and manganese were determined on a КФК-3 spectrophotometer (HB-Lab Company, Russia), in accordance with GOST 55484-2013; iron, calcium and zinc were determined using GOST 26929-94; phosphorus according to GOST 51482-99.

#### **Research Results.**

*Organoleptic studies of eggs.* To assess the quality of quail eggs when using the feed additive "Vermiculite", organoleptic studies of eggs were carried out first of all. To do this, the appearance, the color of the shell, the smell, taste and consistency of the contents of the eggs, the condition of the shell were evaluated.

Table 1 below shows the results of organoleptic studies of eggs of experimental groups of quails in comparison with the control group. In appearance and color of the contents, the eggs of all groups of quails met the requirements of sanitary quality. All groups of eggs had the color of the shell of quail eggs light yellow, mottled with bluish-black or brown spots, on the reverse side has a light blue color. The contents of the eggs were uniform in appearance and color, light yellow. The smell and taste were also specific, pleasant without foreign odors. No specific taste was observed in all groups of eggs. The consistency of the contents of the eggs is watery, without lumps and impurities of blood. Stains and other foreign substances were also not observed. The study found that all quail eggs have a clean shell, rounded shape, without stains and droppings, without damage and defects.

Table 1 – Results of organoleptic examination of eggs

| Indicators                                      | Groups   |    |     |
|---|--|----|-----|
|   | I (control)  | II | III |
| Color and condition of the shell                | Light yellow, mottled with bluish-black or brown spots. Rounded shape, without mechanical damage and contamination |    |     |
| The smell of the egg contents                   | Specific, odorless   |    |     |
| The taste of the egg contents                   | Specific, pleasant   |    |     |
| Consistency of egg contents                     | Watery, without lumps and impurities of blood  |    |     |
| The condition of the air chamber and its height | Fixed, no more than 2 mm   |    |     |
| Condition and position of the yolk              | Durable, barely visible, but the contours are not visible, occupies a central position and does not move           |    |     |
| Protein density and color                       | Dense and transparent white  |    |     |

One of the indicators of the commercial qualities of an egg is freshness, which is determined by the height of the air chamber [17, p.13]. Quail eggs with an air chamber height of no more than 2 mm are considered dietary.

The study found that all groups of quail eggs had an air chamber height from 1 to 2 mm. They can be classified as "dietary". The condition and position of the egg yolk of all groups is solid, barely visible, but the contours are not visible. occupies a central position and does not move. The egg whites were dense and translucent white.

The results of the conducted studies show that the quality of quail eggs of the control and experimental groups of quails corresponds to the data of GOST 31655-2012.

According to the veterinary and sanitary examination, quail eggs of experimental groups of quails are considered dietary and are allowed to be sold without restrictions.

*Morphometric indicators of eggs. Morphometric indicators of eggs are the main economically important parameters of poultry farming* [18, pp.41].

In this study, the diet of quails based on vermiculite feed additive caused a significant change in the morphometric parameters of eggs (Table 2). The average weight of an egg with a shell in the control group was  $11.23 \pm 0.93$  g, and in the second group –  $11.72 \pm 1.02$  g, in the third group –  $12.06 \pm 0.82$ g ( $p > 0.05$ ). Compared with the control group, the average egg weight in the third group increased by 6.9%, and compared with the second group – 2.8%. According to the results obtained, it can be noted that the average egg weight of the experimental groups is greater than in the control group. According to the study of the mass of protein and yolk, it can also be noted that in all the test groups of quails fed with vermiculite, the weight was significantly higher than in the control group. The protein mass in the egg of the first experimental group was greater by 0.18g (2.7%), in the second experimental group the protein mass was greater by 0.37 g (5.6%) compared to the control group. And the yolk mass of the first experimental group was 0.09g (2.7%) more, in the second experimental group it was 0.17g (5.2%) more ( $p > 0.05$ ).

The determination of the egg mass showed that the quail eggs of the control and experimental groups meet the requirements of the state standard and have a mass of at least 10g. It was found that the average egg weight ranged from 11.23 g to 12.06 g.

Table 2 - Morphometric and qualitative indicators of quail eggs that received different amounts of feed additive

| Indicators                         | Group, n=20      |                    |                    |
|------------------------------------|------------------|--------------------|--------------------|
|                                    | I (control)      | II                 | III                |
| Egg weight with shell, g           | $11,23 \pm 0,93$ | $11,72 \pm 1,02^*$ | $12,06 \pm 0,82^*$ |
| Protein weight, g                  | $6,55 \pm 0,58$  | $6,73 \pm 0,46$    | $6,92 \pm 0,31^*$  |
| Yolk weight, g                     | $3,26 \pm 0,24$  | $3,35 \pm 0,31^*$  | $3,43 \pm 0,12$    |
| Shell weight, g                    | $1,42 \pm 0,11$  | $1,64 \pm 0,26$    | $1,71 \pm 0,39^*$  |
| Shell thickness, mm                | $0,9 \pm 0,02^*$ | $1,2 \pm 0,01^*$   | $1,3 \pm 0,02^*$   |
| Egg density ( $\text{g cm}^{-3}$ ) | 1,094            | 1,094              | 1,095              |
| * - $p > 0.05$                     |                  |                    |                    |

Quail eggs of third group which added 5% vermiculite to the main diet had the highest weight, as well as its thickness and density ( $p>0.05$ ). The eggshell weight of the second group was 0.22g (15.1%) more, and the third group was 0.29g (20.4%) more than in the control group.

The strength of eggshell is a key indicator of egg quality. The thickness of the shell in the control group averaged  $0.9\pm 0.02$  mm, in the second group, where 3% vermiculite was used,  $1.2\pm 0.01$  mm. This indicator is 0.3mm or 25% more compared to the control group. In the third variant, the shell thickness was  $1.3\pm 0.02$  mm, this indicator is 30.7% higher than in the control group, this study shows that the thickness and density of eggshells increased significantly in birds fed with vermiculite. In production conditions, these indicators become economic factors. These data allow us to regard the vermiculite diet as a preventive measure to preserve the production of defective eggs, and to increase the efficiency of egg production.

Quail eggs contain a certain amount of macro and microelements in their composition [19, p.20]. The results of determining the mineral composition of quail eggs when using the feed additive "Vermiculite" are presented in Table 3.

Table 3 – Results of a comparative analysis of the mineral composition of quail eggs of the control and experimental groups

| Name of indicators, mg/100g | Groups (n=5)  |               |               | regulatory documentation |
|-----------------------------|---------------|---------------|---------------|--------------------------|
|                             | I (control)   | II            | III           |                          |
| potassium                   | 131,6±2,6     | 133,2±4,2*    | 134,5±3,3*    | ГОСТ 55484-2013          |
| calcium                     | 62,6±2,5      | 64,1±3,4*     | 65,6±1,8*     | ГОСТ 26929-94            |
| magnesium                   | 10,4±1,2      | 10,8±2,3      | 10,9±1,6      | ГОСТ Р 55484-2013        |
| sodium                      | 141,5±4,2     | 142,5±3,8     | 142,8±4,1     | ГОСТ Р 55484-2013        |
| phosphorus                  | 221,2±2,7     | 224,1±6,2     | 226,3±4,4*    | ГОСТ Р 51482-99          |
| iron                        | 3,23±0,5      | 3,80±0,2      | 4,43±0,8*     | ГОСТ 26929-94            |
| manganese                   | 0,0037±0,0002 | 0,0039±0,0005 | 0,0042±0,0001 | ГОСТ Р 55484-2013        |
| zinc                        | 1,32±0,1      | 1,34±0,3      | 1,59±0,1      | ГОСТ 26929-94            |

\* -  $p>0.05$

The data obtained showed that a large proportion of macronutrients falls on phosphorus, which, in an average amount of  $226.3\pm 4.4$ mg/100g, is contained in the third group of eggs, where 5% vermiculite was applied to the main diet of quails ( $p>0.05$ ). Sodium is in second place in terms of content and its main part is in the second and third groups, i.e. within 142.5 mg/100g. Potassium is more contained in the eggs of the third group (134.5 mg /100g). The calcium content in the control group averaged  $62.6\pm 2.5$  mg/100g, which is 9.5% less than in the third group ( $p>0.05$ ). The amount of magnesium in all groups of quail eggs was within 10 mg/100g of the product.

The amount of iron in the quail egg of the control group is on average exactly  $3.23\pm 0.5$  mg/100g. This indicator is 15% less compared to the second group, and compared to the third group ( $4.43\pm 0.8$  mg/100g) it is 27% less ( $p>0.05$ ). Zinc takes the second place among trace elements. Its content in the eggs of the third group was  $1.59 \pm 0.1$  mg/100g, which is 16% more than in the control group. Manganese is mainly concentrated in the eggs of the third group (0.0042 mg/100g) and only 0.0037 mg/100g in the eggs of the control group.

In general, the introduction of the feed additive "Vermiculite" into the diet of quails of experimental groups had a positive effect on the total content of minerals in the composition of eggs.

**Discussion.** When analyzing the quality and safety of eggs, it was found that quails in the main diet, which were introduced with the feed additive "Vermiculite" comply with the requirements of regulatory documentation. During the veterinary and sanitary examination of the qualitative characteristics, violations were also not detected. The protein is dense, light and transparent; the air chamber is stationary, the height does not exceed 2 mm; the yolk is durable, occupies a central position and does not move.

There was also an increase in the total weight of eggs in the experimental groups, in relation to the control group by almost 7%. Studies for the presence of defects were carried out by the organoleptic method, with the help of ovoscopy – defects were not detected. The thickness of the shell mainly determines the strength and, consequently, the resistance to mechanical destruction of the egg [20, p.60]. In our work, the shell thickness of the experimental groups was higher by an average of 0.35 mm (28%) compared to the control group.

According to the results of our study, an increase in calcium in the experimental groups was found by an average of 3.0 mg/100g and phosphorus – 5.1 mg/100g compared with the control group. The concentration of manganese in the egg samples ranged from 0.0037 to 0.0042 mg/100. However, the concentration of zinc in the third group was the highest (1.59 mg/100 g) compared to the study groups, where a feed additive of 5% was used to the main diet of birds.

The feed with a mineral supplement in the diet of quails had a positive effect on the iron content in the eggs. The iron content was higher in the meat of the experimental groups than in the control group, where

the highest concentration was found in the meat of group III (4.43 mg), which was 1.2 mg higher than in the control group (3.23 mg). From these data, it can be concluded that the mineral elements in the composition of vermiculite play a vital role in the body of birds. Since iron is involved in the synthesis of hemoglobin, the redox process, zinc is involved in the formation of bone tissue, the metabolism of nucleic acids and protein synthesis, the formation of eggshells [21, p.111].

After analyzing the obtained indicators of the mineral composition of quail meat in the feed, which was added to the feed additive vermiculite, we came to the conclusion that the total content of minerals in the composition of quail eggs of the experimental groups was higher.

It was found that among the studied groups, the highest concentration of mineral elements was observed in the eggs of the third group, where the diet of quails included vermiculite in an amount of 5% of the dry matter of the main diet.

**Conclusion.** The analysis of the conducted studies allows us to conclude that feeding the feed additive "Vermiculite" during the growing and egg-laying period of quails contributes to an increase in the weight of the egg and its morphological parts. Positive veterinary and sanitary qualities and morphology of eggs were noted. The quality of the shell has improved, the thickness has increased, and the egg fight has decreased.

The results of the studies indicated that the inclusion of vermiculite in the diet of quails contributes to the improvement of egg quality indicators and a more complete realization of the biological possibilities of poultry productivity.

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### ҚАРАҒАНДЫ ОБЛЫСЫ ШАРУАШЫЛЫҚТАРЫ ЖАҒДАЙЫНДА СИЫР ЕТІ МЕН СҮТІНІҢ САПАСЫНА ҚОРШАҒАН ОРТА ФАКТОРЛАРЫНЫҢ ӘСЕРІН ЗЕРТТЕУ

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Ұсынылып отырған жұмыста Қарағанды облысының әр аудандарында сиыр еті мен сүтінің сапасы мен қауіпсіздігін бағалаудың нәтижелерін көрсеткен. Зерттеу барысында келесі көрсеткіштер өткізілген: органолептикалық және физико-химиялық; жалпы уыттылық пен ауыр металл қосылыстарының қалдық мөлшерлері анықталған; зерттеуге жүгіндірілген аумақтардағы әр аудандардан алынған малшаруашылығы өнімдерінің сапасы мен қауіпсіздігіне баға жасалған; сиыр сүті мен етінің органолептикалық және физико-химиялық көрсеткіштері зерттелген; сүт пен етте ауыр металл қосылыстарының қалдық мөлшерлері жинақталуы динамикасы маусымдық сипатта анықталған.

Тағам өнімдері қауіпсіздігін қамтамасыз ету денсаулықты қорғаудың ұлттық және халықаралық бағдарламаларының құрамдас бөлігі болып табылады. Зерттеу нысандары микроорганизмдердің токсиндері, уыттық элементтер (ауыр металл элементтері), антибиотиктер, пестицидтер, нитраттар, нитриттер, диоксиндер мен диоксин тәрізді қосылыстар, радионуклеидтер т.б.

Экологиялық ахуалы жағынан алғанда Қарағанды облысы еліміздің экологиялық сау емес аумақтарының бірі болып табылады. Бұл аталған өңірде қара және түсті металлургия орындарының, энергетикалық кешендердің және «АрселорМиттал Теміртау» мен «Қазақмыс» тәрізді өзге өнеркәсіп нысандарының жоғары шоғырлануымен түсіндіріледі.

Сол себептен қоршаған орта факторларының Қарағанды облысы жағдайында сиыр еті мен сүтінің сапасына әсерін зерттеу практикалық және теориялық маңызға ие әрі аса өзекті мәселе болып келеді.

**Түйінді сөздер:** Ветеринариялық-санитарлық қауіпсіздік, шектік жіберілетін концентрация, жануар текті өнімдер, ауыр металдар, контаминация, уыттылық.

### STUDY OF THE INFLUENCE OF ENVIRONMENTAL FACTORS ON THE QUALITY OF BEEF AND MILK IN THE FARMHOUSES OF KARAGANDA REGION

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