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THE ROLE OF COLOSTURAL INDICATORS IN PREVENTION CORONAVIRUS AND ROTAVIRAL DIARRHEA IN CALVES

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Abstract. *One of the main conditions for increasing the productivity of animal husbandry is the protection of newborn calves from early death. The leading place among these diseases belongs to infectious diseases with the diarrhea syndrome in newborns. Gastrointestinal diseases of calves, as usually, are polyetiological in nature and caused by various infectious agents: viruses, bacteria, chlamydia, mycoplasmas, fungi, protozoa and others.*

In the presented study, indicators of the quality of colostrum and vaccination of newborn calves were measured, and such indicators in animals as proteins, fats, lactose, IgG immunoglobulin levels were analyzed. Experiments were carried out on 50 animals. The results obtained confirmed that high-quality colostrum increases the resistance of calves to diseases.

Keywords: brix index, calves, colostrum, coronavirus, diarrhea

Bovine diarrhea is a multifactorial disease, mainly due to prenatal management of pregnancy, the state of the immune system of calves, external stress factors and infection (Izzo, 2011; Cho, 2014). Although the course, clinical signs, and control measures for each cause of diarrhea are similar, identification of the pathogen is important in managing the current status of an infected farm and determining future actions. Currently, disease control and prevention includes improving the welfare of animal producers from the point of view of the consumer and increasing productivity from the point of view of the producer (Sezgin, 2012; Cho, 2014). In order to reduce infection rates for both diseases, it is considered more appropriate to prioritize preventive measures in the management system along with immunization. This includes protocols such as cleanliness in the maternity ward, immediate weaning of the calf at birth, placing the calf in individual pens, placing a newly hatched calf in a clean pen, feeding the calf with a personal teat, and not handling the calves with dirty tools (Costa, 2022).

In order to prevent the occurrence of rotavirus and coronavirus diseases, which are the most common cases of neonatal diarrhea, to obtain high-quality colostrum, which is essential for calves, care, feeding and immunization of mothers preparing for childbirth are also one of the main conditions. The slightest error in nutrition during this period can lead to the production of low-quality and insufficient amounts of colostrum, as well as cause diseases such as ketosis, hypocalcemia, displacement of the abomasum, etc. (Sezgin Ş, 2012).

Combined double doses of vaccination in the last 6th and 3rd weeks of calving in pregnant mothers and a single dose in the last - 4th weeks of calving in previously vaccinated animals lead to the formation of high titers of antibodies to these pathogens in colostrum litter (Chigerwe, 2008). A single injection of vitamin E and selenium in the last 10 days of pregnancy, along with feeding mothers with quality food in a quiet place with comfortable bedding, leads to the production of quality colostrum (Sezgin, 2012). The concentration of immunoglobulins (IgG) in colostrum is one of the main conditions for the passive transfer of antibodies to the newborn litter (Chigerwe, 2014). If the calf serum IgG level is ≥10 g/L at 1-7 days post-natal, this is considered appropriate. To achieve this level of immunity, the calf must receive 3-4 liters of good quality colostrum in the first 6 hours. At this time, the calf will receive the expected 100-200 g of IgG. The critical break point of immunoglobulin in high-quality and low-quality colostrum is 50 g/l (Morrill, 2012; Bartier, 2015; McKenzie, 2017; Giammarco, 2021).

Studies conducted on 827 samples and 67 herds in different countries and in the USA show that in 30% of animals the concentration of IgG < 50 g/l (Bartier, 2015; Giammarco, 2021). Later studies in the Netherlands showed that 65% of the colostrum was of good quality, 18% of medium quality and 17% of poor quality. For this reason, the importance of measuring the quality of colostrum given to calves by farmers has been confirmed (Bartier, 2015; Thornhill, 2015).

The main purpose of the research is to determine the quality indicators of colostrum in cows and heifers of the Holstein-Friesian breed, vaccinated with a combined vaccine against rotavirus and coronavirus disease (BIOBOS RESPI) in Gilan Dairy Farm LLC (GDF), located in the North-West region of the republic, taking into account of the above factors and the quality of childbirth was to determine the relationship between rotavirus and coronavirus infection of calves, morbidity and mortality. It is likely that when calves are fed colostrum with a low BRIX index (BRIX), the amount of IgG in the blood of calves will be below 10 g/l and cases of morbidity and mortality should be observed in calves.

Materials and Methodology. *Animal population.* In total, in the second half of 2021, an experimental group was created, consisting of 50 head of cattle, the birth of which was expected in the "GDF", consisting of 25 cows of the Holstein-Friesian breed of the second lactation and the older age group and 25 heifers of the same breed of the first lactation, while there was an analysis of the quality of colostrum given to born calves was carried out, as a result, cases of rotavirus and coronavirus infections, morbidity and mortality were registered.

Sample acquisition

After the first milking, colostrum samples were taken from cows immediately after calving (within 30 min) in 50 ml polypropylene tubes and frozen at -20°C (Raboisson, 2016).

Stool samples from all animals were collected and stored at -20°C.

Laboratory procedures

Dry matter (BRIX) was checked on the farm using a portable optical reflectometer (KERBL, Germany). The content of fat, protein, lactose and minerals (ash) was also checked using the Lactoscan milk analyzer. Immediately after birth, the navels of the calves were disinfected with betadine and, after drying for half an hour on clean hay, they were placed in individual cages, and each calf was injected with 38 ^{0}C colostrum at 5 % of its body weight for the first 2 hours and 10 % for the next 6 hours. To test colostrum samples, 50 ml of the first colostrum milked during the first 2 hours was taken. Calves were kept under control for 21 days after birth, and patients with diarrhea were checked using rapid tests. For this purpose, a set of TMR Nutrition "calf test-5" rapid test strips was used in accordance with the following sequence.

1. Stool samples were taken from calves that showed clinical symptoms in the first two hours.
2. The stool sample is fitted to a standard spoon
3. The stool sample is placed in a special solvent.
4. Sample dissolves in solvent
5. The cap on the mouth of the solvent pipette was closed .
6. Pipette cap was broken off and opened
7. 3 drops of a solution in which a stool sample is dissolved are added to each test cell
8. The it was expected when the test kit is absorbed on a flat, level surface
9. A slot that appears on both control lines is considered positive for this disease.
10. Only the slot is considered negative when the control line changes color.

Note. If the color of the control line does not change, then the slot is considered negative.

Results. As a classic veterinary care for sick animals, liquid, electrolyte therapy and other measures were carried out. The conversion of colostrum dry matter to IgG was performed using the following standard conversion (table 1).

Table 1.

Colostrum quality categories

Brix (%)	IgG Conc. (g/L)	Colostrum Quality
<15	0-28	Poor
15-20	28-50	Fair
20-30	50-80	Good
> 30	> 80	Very Good

The table presents the results of the study of the dry matter level of colostrum and the level of IgG per liter of its composition. According to this table, if the dry matter of colostrum obtained from an animal is below 15, then the amount of IgG in colostrum is estimated to be between 0-28 and poor quality colostrum, if it is in the range of 15-20, then the amount of IgG is estimated to be between 28-50, which is an average, and if it is in the range of 20-30, then IgG is equal to 50-80 and is considered good, but if the indicator is above 30, then the corresponding IgG value is regarded as above 80, which is a very good result.

The results obtained show that the colostrum of 33 heads (66%) of the vaccinated animals was of high quality, the colostrum of 9 heads (18 %) of the animals was of medium quality, and the colostrum of 8 heads of animals, i. e. 16% of the animals were of poor quality. 25 heads of cows of two or more lactations were cows with high-quality cow colostrum, and 8 heads were heifers of the first lactation. All samples of medium and low quality were obtained from 9 heifers. All 8 low quality samples were taken from heifers.

The results obtained when measuring colostrum with the Lactoscan apparatus are clearly visible in the diagram, which accordingly affects the quality, so that the total BRIX value is expressed as a number close to the sum of such coefficients as fat, protein, galactose and ash content in milk, on the basis of which it was registered a corresponding increase in colostrum protein relative to IgG.

In total, out of 50 cases of childbirth in cows, 49 calves were healthy and one heifer gave birth to a dead calf. One cow gave birth to twins, and thus 50 calves were obtained from 50 cows. Diarrhea was observed in 5 out of 8 calves (62.5 %) receiving low-quality colostrum. From Table 2, it is clear that all of the calves that had the disease were calves in first low-quality lactation heifers. 2 of them (40 %) were diagnosed with rotavirus and 1 heifer was diagnosed with coronavirus. Both calves suffered a serious illness. A calf diagnosed with coronavirus died despite treatment

Table 2

Indicators of colostrum and other data of cows used in the experiment

No.	Reference number	Number of lactations	Amount of colostrum obtained during the first milking was, liters	Colostrum dry matter, % (BRIX)	Fats %	Protein %	Minerals	Lactose percent (%)	Ig conversion	Standard error
1	19101	1	6	24.4	6.5	14.1	1.2	2.6	50-80	0.08
2	1990	1	7	24	6.8	13.7	1.0	2.5	50-80	0.005
3	19103	1	9	22	5.7	13.8	1.1	1.4	50-80	0.004
4	1992	1	6	19	5.4	10.3	0.6	2.7	28-50	0.007
5	19111	1	8	24	6.3	14.5	1.5	2.5	50-80	0.005
6	19118	1	7	32	9	20.1	2	1.9	80<	0.006
7	1999	1	8	31.4	7	19.3	2.1	2	80<	0.005
8	1997	1	6	26	5.9	16.3	1.2	2.6	50-80	0.003
9	19119	1	5	19.6	5.1	11.1	0.6	2.7	28-50	0.006
10	19120	1	8	19	5	10.6	0.8	2.6	28-50	0.007
11	1980	1	7	31.9	6.6	21.8	1.1	2.4	80<	0.005
12	19121	1	8	32.8	6.7	22.7	1.2	2.2	80<	0.004
13	19122	1	6	31.8	6.5	21.9	1.1	2.3	80<	0.005
14	19104	1	8	31	6.7	20.8	1.2	2.4	80<	0.006
15	19105	1	7	19.2	5.2	10.5	0.8	2.7	28-50	0.004
16	19103	1	8	30	6.2	21.4	1.1	2.5	80<	0.004
17	1916	1	6	30.7	6.2	20.4	1.3	2.5	50-80	0.005
18	1912	1	7	31.1	6.7	20.8	1.2	2.4	80<	0.004
19	19127	1	6	19.3	5.5	10.1	1	2.7	20-50	0.006
20	1974	1	6	31.6	6.7	21.32	1.2	2.4	80<	0.005
21	1902	1	7	31.5	6.7	21.3	1	2.5	80<	0.006
22	1956	1	6	19.8	5.5	11.1	0.7	2.7	20-50	0.005
23	1908	1	8	32.3	6.8	22.9	1.3	2.3	80<	0.007
24	19125	1	6	31.5	6.6	21.3	1.2	2.4	80<	0.006
25	1901	1	7	30.8	6.6	20.5	1.2	2.5	80<	0.005
26	18129	2	7	31.6	6.6	21.5	1	2.5	80<	0.005
27	17130	3	6	31.2	6.8	21.8	1.1	2.3	80<	0.006
28	18100	2	7	32.4	6.7	22.2	1.2	2.3	80<	0.007
29	18101	2	5	19.7	6.0	10.1	1.0	2.6	20-50	0.005
30	1887	2	7	30.7	6.6	20.7	1.2	2.5	80<	0.006
31	18115	2	6	32.1	6.8	22	1.1	2.2	80<	0.004
32	18124	2	8	31.2	6.1	21.6	1.0	2.4	80<	0.005
33	18120	2	6	27.8	6	17.6	0.9	2.6	50-80	0.004
34	18109	2	7	31.8	6.7	21.1	1.3	2.5	80<	0.006
35	18141	2	6	26.8	6.2	16.3	1	2.7	20-50	0.006
36	1809	2	6	30.7	6.6	21.2	1	2.5	80<	0.005
37	18112	2	7	30.9	6.6	20.7	1.2	2.4	80<	0.004
38	1854	2	5	27	5.6	17.4	0.9	2.7	50-80	0.005
39	18002	2	6	30.2	6.7	20	1.1	2.4	80<	0.006
40	18120	2	7	32	6.8	21.8	1.1	2.3	80<	0.005
41	1865	2	6	23.9	6.3	14.1	0.9	2.6	50-80	0.004
42	18113	2	7	32.7	6.7	22.4	1.3	2.3	80<	0.007
43	18121	2	8	31	6.6	21	1.1	2.4	80<	0.005
44	1839	2	7	30.5	6.7	20.2	1.1	2.5	80<	0.008
45	17100	3	6	31.5	6.7	21.1	1.1	2.4	80<	0.007
46	17109	3	7	32.2	6.6	22.1	1.2	2.3	80<	0.005
47	17114	3	5	19.3	6.2	9.7	0.7	2.7	20-50	0.004
48	17001	3	7	31.6	6.7	21.3	1.2	2.4	80<	0.004
49	1788	3	6	30.7	6.6	19.9	1	2.5	80<	0.005
50	17127	3	8	31.7	6.7	21.5	1.2	2.3	80<	0.006

Table 3

Newborns. Data on calves and the results of registration of cases of rotavirus and coronavirus infection and death, which they observed with diarrhea during the first 21 days

No.	Mother identification number	Calf identification number	Birth weight	Calf gender	The amount of colostrum he/she received	Health condition	Causative agent of the disease	Result
1	19101	21009	35	Heifer	3.5	Healthy	-	Recovered
2	1990	21607	38	Bull calf	3.8	Healthy	-	Recovered
3	19103	21610	40	Bull calf	4.0	Healthy	-	Recovered
4	1992	21603	36	Bull calf	3.6	Diarrhea	Rotavirus	Recovered
5	19111	21111	34	Heifer	3.4	Healthy	-	Recovered
6	19118	21112	37	Heifer	3.6	Healthy	-	Recovered
7	1999	21005	35	Heifer	3.4	Ill	-	Recovered
8	1997	21613	39	Bull calf	3.8	Healthy	-	Recovered
9	19119	21615	41	Bull calf	4.1	Healthy	-	Recovered
10	19120	21618	40	Bull calf	4.0	Healthy	Other	Recovered
11	1980	21119	34	Heifer	3.3	Ill	-	Recovered
12	19121	21122	36	Heifer	3.4	Healthy	-	Recovered
13	19122	21620	41	Bull calf	4.1	Healthy	-	Recovered
14	19104	21125	35	Heifer	3.4		-	Recovered
15	19105	21627	38	Bull calf	3.9	Healthy	Other	Recovered
16	19103	21126	36	Heifer	3.5	Healthy	-	Recovered
17	1916	21507	40	Bull calf	4.1	Healthy	-	Recovered
18	1912	21506	43	Bull calf	4.2	Healthy	-	Recovered
19	19127	21630	44	Bull calf	4.3	Healthy	Koronavirus	Dead
20	1974	21140	35	Heifer	3.2	Ill	-	Recovered
21	1902	21503	42	Bull calf	4.1	Healthy	-	Recovered
22	1956	21048	37	Heifer	3.8	Healthy	Rotavirus	Recovered
23	1908	21507	39	Bull calf	3.8	Healthy	-	Recovered
24	19125	21649	43	Bull calf	4.3	Healthy	-	Recovered
25	1901	2102	35	Heifer	3.3	Ill	-	Recovered
26	18129	216100	41	Bull calf	4.0	Healthy	-	Recovered
27	17130	21701	40	Bull calf	3.9	Healthy	-	Recovered
28	18100	21304	36	Heifer	3.7	Healthy	-	Recovered
29	18101	21305	34	Heifer	3.3	Healthy	-	Recovered
30	1887	21633	43	Bull calf	4.2	Healthy	-	Recovered
31	18115	21710	44	Bull calf	4.3	Healthy	-	Recovered
32	18124	21315	38	Heifer	3.7	Healthy	-	Recovered
33	18120	21313	35	Heifer	3.4	Healthy	-	Recovered
34	18109	21651	41	Bull calf	4.0	Healthy	-	Recovered
35	18141	21307	36	Heifer	3.8	Healthy	-	Recovered
36	1809	21660	42	Bull calf	4.3	Healthy	-	Recovered
37	18112	21662	40	Bull calf	4.1	Healthy	-	Recovered
38	1854	21318	36	Heifer	3.5	Healthy	-	Recovered
39	18002	21657	41	Bull calf	4.0	Healthy	-	Recovered
40	18120	21335	38	Heifer	3.7	Healthy	-	Recovered
41	1865	21329	34	Heifer	3.2	Healthy	-	Recovered
42	18113	21670	43	Bull calf	4.3	Healthy	-	Recovered
43	18121	21663	41	Bull calf	4.0	Healthy	-	Recovered
44	1839	21150	35	Heifer	3.4	Healthy	-	Recovered
45	17100	21650	40	Bull calf	3.9	Healthy	-	Recovered
46	17109	21360	37	Heifer	3.6	Healthy	-	Recovered
47	17114	21361	35	Heifer	3.4	Healthy	-	Recovered
48	17001	21663	42	Bull calf	4.1	Healthy	-	Recovered
49	1788	21370	35	Heifer	3.3	Healthy	-	Recovered
50	17127	21667	41	Bull calf	4.2	Healthy	-	Recovered

Discussion. According to other sources, a Brix refractometer can be used to determine if good quality colostrum is positive in calves. For this reason, when discussing the results, reference is made to studies on the use of refractometry in calves.

The concentration of IgG in colostrum is traditionally considered a marker for assessing the quality of colostrum before feeding calves (Thornhill, 2015). The concentration of IgG in the mother's colostrum significantly affects the acquisition of passive immunity; thus, accurate measurement is important for the correct use of maternal colostrum on the farm (Raboisson, 2016).

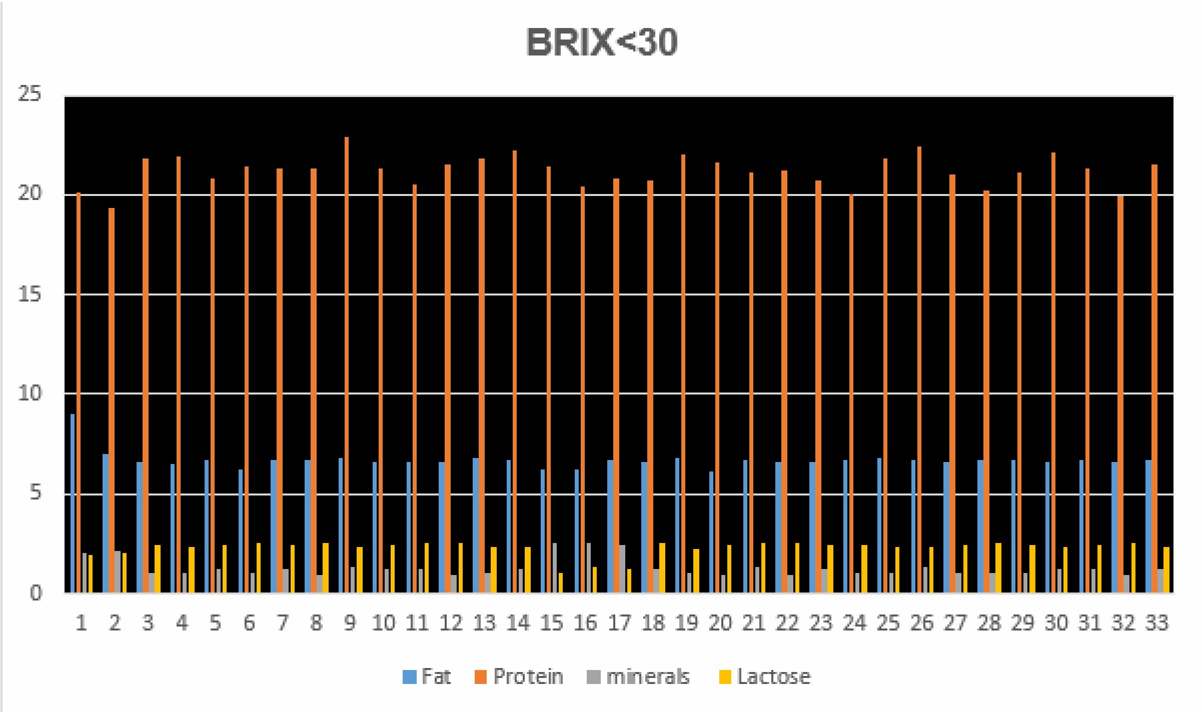

Fig. 1. Quality scores on the BRIX <30 scale

In the present study, the mean serum IgG concentration was above <80, which is considered a very good value.

Thus, as a result of the research, it was found that, despite the vaccination of Holstein-Friesian animals against rotavirus and coronavirus diseases, low-quality colostrum is recorded mainly in cows from the first lactation, and cases of infection with both diseases can be recorded in calves fed with this colostrum. The analysis of colostrum with a reflectometer and the corresponding assessment of the obtained colostrum are of practical importance, and based on the results obtained from these measurements, it is possible to develop protocols for oral milk feeding, which are extremely important in animal husbandry (Buczinski, 2016). In two experiments, when using colostrum with a BRIX value below 20, when measured with a reflectometer, 62.4 % of cases of diarrhea are observed in babies, and 40 % of them are infected with rotavirus, 20 % are infected with coronavirus, the remaining 40 % are infected with pathogens of various origins. For this reason, it is not recommended to use low-quality colostrum in feeding newborns.

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РОЛЬ КОЛОСТРАЛЬНИХ ПОКАЗНИКІВ У ПРОФІЛАКТИЦІ КОРОНАВІРУСНОЇ ТА РОТАВІРУСНОЇ ДІАРЕЇ У ТЕЛЯТ

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Резюме. *Однією з головних умов підвищення продуктивності тваринництва є захист новонароджених телят від ранньої загибелі. Серед цих захворювань провідне місце займають інфекційні захворювання з синдромом діареї у новонароджених. Шлунково-кишкові захворювання телят, як правило, носять поліетіологічний характер і викликаються різними інфекційними агентами: вірусами, бактеріями, хламідіями, мікоплазмами, грибами, найпростішими та ін. У представленому дослідженні вимірювали показники якості молозива та вакцинації новонароджених телят, а також аналізували такі показники у тварин, як білки, жири, лактоза, рівень імуноглобулінів IgG. Досліди проводили на 50 тваринах. Отримані результати підтвердили, що якісне молозиво підвищує стійкість телят до інфекційних хвороб.*

Ключові слова: індекс Брікса, телята, молозиво, коронавірус, діарея

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