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INFLUENCE OF INFECTION WITH CAPRINE ARTHRITIS ENCEPHALITIS VIRUS ON MILK PRODUCTION OF FRENCH ALPINE GOATS HERDS FROM NORTHWEST CROATIA

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Summary

The objective of this study was to investigate the influence of infection with Caprine Arthritis Encephalitis Virus (CAEV) on estimated milk yield per lactation and its composition. The study was carried out on 259 goats of French Alpine breed from production farms in NW Croatia. All goats were kept under similar intensive feeding and management conditions. Milk control was preformed and milk samples were collected using the ICAR method A4 during the year 2009. At the same time, blood samples were collected and presence of CAEV antibodies in the sera was detected using enzyme-linked immunosorbent assay (ELISA). The influence of infection status on milk yield, length of lactation and milk composition (fat, protein and lactose) were tested by analysis of variance (PROC GLM). Influence of clinical form of arthritis on lactation was also investigated. CAEV was serologically confirmed in 37% of goats. In addition, 24% of CAEV positive animals were expressing clinical symptoms of arthritis. Strong influence of serological status on all recorded traits has been confirmed. Presence of clinical arthritis has confirmed influence only on protein and fat content in milk.

Key words: clinical arthritis, caprine arthritis encephalitis virus, estimated milk yield, lactation length, milk quality, goats

Introduction

Caprine arthritis encephalitis is a worldwide spread disease (Adams et al., 1984; Peterhans et al., 2004). Virus is a member of *Retroviridae* family, genus *Lentivirus*. Together with Maedi –Visnae Virus (MVV) of sheep, it is classified into group of Small Ruminant Lentiviruses (Narayan et al., 1992). The caprine virus is unique when it comes to other lentiviruses including those of sheep because it infects only monocite-macrophage lines of cells (Bertoni and Blacklaws, 2010). Consequently, organs that contain higher numbers of those cells are the target organs of this disease (Murphy et al., 2010). Inflammations caused by CAEV result in severe proliferate changes and cause symptoms like arthritis and synovitis of the joints, interstitial mastitis and indurations of the udder, chronicle interstitial pneumonia, encephalitis in young kids and general wasting (Nord and Adnoy, 1997; Blacklaws et al., 2004). Transmission of the virus is primarily via colostrum and milk, but also through cohabitation, equipment, coitus and in utero (Phelps and Smith, 1993; Rowe and East, 1997; Peterhans et al., 2004; Le Jan et al., 2005; Lara et al., 2005). Development of clinical symptoms depends on genetics of the host animal (Cheevers et al., 1997; Perry et al., 1995) as well as on the virus strain (Trujillo et al., 2004). Since first recognition made by Cork et al., (1974), it became a significant disease of goat dairy production. CAEV is causing slow but progressive non curable infections and thus far without possibility of effective vaccination (Bertoni and Blacklaws, 2010).

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Possible prevention of virus transmission can be via pasteurization of colostrum and milk, separation of kids from dames after parturition and culling of seropositive animals when possible (Rowe et al., 1992; Turin et al., 2005, Reina et al., 2009). Infected goats may stay in state of subclinical infection for life and spread the virus, or can develop various clinical symptoms. Severity of symptoms is related to number of lactations (Smith and Sherman, 2009). Symptoms related to udder can be: indurations of udder ("hard udder syndrome"), with hypogalactia and grater susceptibility to intrammamary infection (Kennedy-Stoskopf et al., 1985; Nord & Adnoy, 1997; Blacklaws et al., 2004). Although the goat dairy production in Croatia developed rapidly during the last ten years, CAEV monitoring and eradication programs have so far not been applied. However, individual studies have shown that the prevalence of CAEV had increased since its first recognition in Croatia from 7.7% (Čač et al., 1996) to over 50% in nowdays (Tariba et al., 2010). Results of researches about influence of CAEV on milk yield and lactation parameters from other countries have brought diverse results (Lerondelle et al., 1989; 1992; Smith and Cultip, 1988; Luengo et al., 2004; Turin et al., 2005; Leitner et al., 2009).

Aim

In our research we wanted to explore if there was influence of CAEV infection on estimated milk yield, length of lactation and milk composition of French Alpine goat in Croatia. Also our intention was to see if clinical form of arthritis had influence on same things.

Material and methods

Research was conducted on 259 goats of French Alpine breed from NW Croatia. All animals were kept in condition of intensive milk production, had similar nutrition and were milked twice a day by machine. All were breed by natural mating. Goats were removed from the herd because of low production, incurable clinical mastitis, infertility or for the purpose of herd remount. Kids were not separated from dames because there were no possibility for replacement nutrition or even pasteurization of colostrum and milk, so they fed by suckling their dames. Goats were examined clinically, including general condition and gait, inspection and palpation of udder and joints. Clinical diagnose of arthritis was noted. Blood samples were collected from jugular vein. The enzyme immunosorbent assay (ELISA) was performed on the serum samples using CHEKIT CAEV/MVV (IDEXX, Switzerland). Milk samples were collected using the ICAR method A4 during the year 2009, and the overall lactation averages per goat were obtained for milk yield, length of lactation, lactose, protein and fat content. The influence of CAEV infection status (serological and clinical) on milk yield, length of lactation and content of milk (fat, protein and lactose) during one lactation was tested by analysis of variance using PROC GLM (SAS, 2004).

Results and discussion

The results of serological status examination showed that 37% of examined goats were infected with CAEV. Prevalence lower than the one obtained in our previous research (Tariba et al., 2010) is a characteristic of the smaller subset of data analysed in this research. Results of 24% regarding to clinical form of arthritis differ from those given by Phelps and Smith (1993) who stated that only small number of animals develops clinical sings.

Influence of clinical form of arthritis on milk production (Table 2.) was not confirmed. Good genetics, nutrition and management in these intensive dairy production herds, reflected in the good state of the immunological system as were noted by Bertoni and Blacklaws (2010).

CAEV infection decreases total milk yield per lactation, length of lactation, as well as fat and protein content (Table 1.). Similar results were obtained in previous research (Peterhans et al., 2004; Turin et al., 2005) but without measuring influence of clinical arthritis. Since goat milk in Croatia is mainly intended for cheese production, it can be suggested that the introduction of serious eradication measures will benefit the total goat dairy production in our country as was the case in other countries (Luengo et al., 2004; Peterhans et al., 2004; Reina et al., 2009).

Table 1. – INFLUENCE OF THE SEROLOGICAL STATUS (CAEV) ON MILK YIELD AND MILK COMPOSITION

	CAEV		
	Seropositve LSM±SE	Seronegative LSM±SE	P
Length of lactation (days)	239.88 ± 3.23	253.53 ± 3.86	<.001
Total milk (kg / lactation)	618.74 ± 19.61	675.23 ± 23.39	<.001
Milk (kg / day)	2.57 ± 0.06	2.62 ± 0.07	<.005
Fat (%)	3.65 ± 0.05	3.83 ± 0.07	<.001
Protein (%)	2.76 ± 0.02	2.92 ± 0.02	<.001
Lactose (%)	4.12 ± 0.01	4.13 ± 0.01	<.005

Table 2. – INFLUENCE OF CLINICAL ARTHRITIS ON MILK YIELD AND MILK COMPOSITION

	Clinical negative LSM ± SE	Clinical positive LSM± SE	P
Length of lactation (days)	248.76 ± 2.56	244.66 ± 4.34	N.S.
Total milk (kg / lactation)	648.81 ± 15.51	645.16 ± 26.28	N.S.
Milk (kg / day)	2.57 ± 0.04	2.62 ± 0.08	N.S.
Fat (%)	3.83 ± 0.04	3.65 ± 0.07	0.10
Protein (%)	2.90 ± 0.44	2.77 ± 0.74	0.01
Lactose (%)	4.13 ± 0.01	4.12 ± 0.01	N.S.

Conclusions

According to our results, infection with CAEV has a negative influence on goat dairy production and milk quality in NW Croatia. Infection with CAEV should be monitored and measures of eradication like separating kids from dames and pasteurization of colostrum and milk should be conducted. Because of a high prevalence of CAEV infection eradication measures like culling seropositive animals would cause indispensable economic loss for the farmers. In further studies subclinical mastitis should be included in examination together with milk yield and composition. Also, the strain of virus and genetics of animals with developed clinical signs of arthritis should be considered. Examination of other possible causative agents of clinical arthritis should be explored as well as the influence of number of parity.

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REFERENCES

1. Adams D. S., Oliver, R. E., Amerghino E., De Martini J. C., Verwored D. W., Houwers D. J., Woghila S., Gorham J. R., Hillseth B., Dawson M., Trigo F. C., Mc Quire T. C. (1984). Serological evidence of caprine arthritis-encephalitis virus in eleven of fourteen countries tested. Vet. Rec. 115: 493 – 495.

2. Bertoni G., Blacklaws B. A. (2010). Small Ruminant lentiviruses and cross species transmisssion. In Desport M. (ed). Lentiviruses and macrophages: Molecular and cellular interaction. Caister Academic Press. Norfolk, UK. 277 – 306.

3. Blacklaws B. A., Berriatua E., Torsteinsdottir S., Wat N. J., de Andres D., Klein D., Harkiss G. D. (2004). Transmission of small ruminant lentiviruses, Vet. Microbiology 10 : 199–208. Cork L. C., Hadlow W. J., Gorham J. R., Crawford T. B. (1974). Pathology of virial leukoencephalomyelitis of goats. Acta Neuropatho. 29 : 281 – 292.

4. Cheevers W. P., Beyer J. C., Knowels D. P. (1997). Type 1 and type 2 cytokine geneexpression by virial gp 135 surface protein-activated T lymphocytes in caprine arthritis-encephalitis lentivirus infection. J. Viro. 71: 6259 - 6263.

5. Čač Ž., Lojkić M., Jemrešić L. (1996). Caprine arthritis-encephalitis syndrome – The first serological approvement in Croatia. Delić V. (ed). In: Zbornik sažetaka 1. Hrvatskog kongresa mikrobiologa s međunarodnim sudjelovanjem. Hrvatsko mikrobiološko društvo, Zagreb. 10-10. Kennedy–Stoskopf S., Narayan O., Standberg J. D. (1985). The mammary gland as a target organ for infection with caprine arthritis encephalitis virus. J. Com. Path. 95 : 609 – 61.

6. Lara, M. C. C. S. H., Birgel Junior E. H., Birgel E. H. (2005). Possibility of vertical transmission of caprine arthritis-encephalitis virus in neonate kids. Arq. Bras. Med. Vet. Zootec. 57(4) 553-555.

7. Leitner G., Krifucks O., Weisblit L., Lovi Y., Bernstein S., Merin V. (2010). The effect of caprine arthritis-encephalitis virus infection on production in goats, The Vet. J. 183 : 328 – 33.

8. Le Jan C., Bellaton C., Greenland T., Mornex J. - F. (2005). Mammary transsmision of caprine arthritis encephalitis virus; a 3D model for in vitro study. Repro. Nutr. Dev. 45: 513-523.

9. Lerondelle C., Fleury C., Vialard J. (1989). La glande mammarie; organe cible de l´infection par le virus de l´arthrtie de l´encephalite caprine. Ann. Rec. Vet. 20 : 5764.

10. Lerondelle C., Richard Y., Isarhal J. (1992). Factors affecting somatic cell counts in goat milk. Small Rum. Res. 8 : 129-139.

11. Luengo C., Sanchez A., Corrales J. C., Fernandez C, Contreras A. (2004). Influence of intramammary infection and non-infection factors on somatic cell counts in dairy goats. J. Dairy Res. 71: 169-174.

12. Murphy B., McElliott V., Vapniarsky N., Oliver A., Rowe J. (2010). Tissue tropism and promoter sequence variation in caprine arthritis encephalitis virus infected goats. Vir. Res. 151 (2) 177 - 184.

13. Narayan O., Clements J. E., Stranberg J. D, Cork L.C., Griffin D.E. (1980). Biological characterization of the virus causing leukoencephalitis and arthitis in goats. J.Gen.Virol. 50: 69-79.

14. Narayan O., Zink M. C., Gorell M., Crane S., Huso D., Jolly P., Saltarelli M., Adams R. J., Clements J. E. (1992). The lentivirus of sheep and goats. The Retroviridae (J.A.Levy,Ed.) 229-255. Plenum Press, New York.

15. Nord K., Adnoy T. (1997). Effects of infection by caprine arthritis encephalitis virus on milk production of goats. J. Diary Sci. 80: 2391-2397.

16. Perry L. L., Wilkerson M. J., Hullinger G. A., Cheevers W. P. (1995). Depressed CD4+ T lymphocyte proliferative response and enhaced antibody response to virial antigen in chronic lentivirus-induced arthritis. J. Infect. Dis. 171: 328-334.

17. Peterhans E., Greenland T., Badiola J., Harkiss G., Bertoni G., Amorena B., Eliaszewicz M., Juste R.A., Krassnig R., Lafont J.P., Lenihan P., Petursson G., Pritchard G., Thorley J., Vitu C., Mornex J. F., Pepin M. (2004). Routes of transmission and consequences of small ruminant lentiviruses (SRLVs) infection and eradication schemes, Vet. Res. 35: 257–274. Phelps S. I., Smith M. C. (1993). Caprine arthritis encephalitis virus infection. J. Am. Vet. Med. Assoc. 203 : 1663 - 1666.

18. Reina R., Berrituta E., Lujan L., Juste R., Sanchez A., de Andrẽs D., Amorena B. (2009): Prevention strategies against small ruminant lentivirus: The Vet. Jour., 128 (1) 31 - 37.

19. Rowe J. D., East N. E. (1997). Risk factors for transmission and methods for control of caprine arthritis-encephalitis virus infection. Vet. Clin. N. Am.: Food Anim. Pract. 13 : 25 – 53.

20. Rowe J. D., East N. E., Franti C. E., Thurmond, M. C., Pedersern N.C., Thelion, G. H. (1992). Risk factors associated with the incidence of seroconversion to caprine arthritis-encephalitis virus in goats on California dairies. Am. J. Vet. Res. 53 : 2396 - 2403.

21. SAS, 2004. SAS/STAT Software, Release 9.1.3.

22. Smith M. C., Cutlip R. (1988). Effects of infection with caprine arthritis - encephalitis virus on milk production in goats. J. Am. Vet. Med. Assoc. 193 : 63-67. Smith M. C., Sherman, D. M. (2009). The goat medicine, 2nd edition. Ames, IA, Wiley-Blackwell.

23. Tariba B., Kostelić, A., Roić, B., Benić, M., Šalamon, D. Effect of caprine arthritis-encephalitis virus on frequency of subclinical mastitis of French alpine goats in Croatia. In Samardžija D., Volarić V. (ed), Zbornik sažetaka 39. Hrvatskog simpozija mljekarskih stručnjaka s međunarodnim sudjelovanjem. Zagreb, Hrvatska mljekarska udruga, 81–82. (2010).

24. Trujillo J. D., Hotzel K. J., Snekvik K. R., Cheevers P. W. (2004). Antibody response to the surface envelope of caprine arthritis-encephalitis lentivirus: disease status is predicated by SU antibody isotype. Virology 325 (1) 129-136.

25. Turin L., Pisoni G., Giannino M.L., Antonini M., Rosati S., Ruffo G., Moroni P. (2005). Correlation between milk parameters in CAEV seropositive and negative primiparous goats during an eradication program in Italian farm. Small Rum. Res. 57 (1) 73 - 79.

UTJECAJ INFEKCIJE VIRUSOM ARTRITIS ENCEFALITISA KOZA NA PROIZVODNJU MLIJEKA U STADIMA FRANCUSKE ALPSKE KOZE SJEVEROZAPADNE HRVATSKE

Sažetak

Istraživanje je provedeno sa svrhom utvrđivanja utjecaja infekcije virusom artritis encefalitisa koza (AEK) na ukupnu količinu i sastav mlijeka u trajanju od jedne laktacije. Istraživanje je provedeno na 259 francuskih alpskih koza iz komercijalnih farmi sjeverozapadne Hrvatske. Koze su držane i hranjene na sličan način. Kontrola i uzorkovanje mlijeka provedeno 2009. godine ICAR4 metodom. Istovremeno su prikupljeni uzorci krvi za serološko testiranje na prisutnost AEK antitijela koje je provedeno imunoenzimnim testom (ELISA). Utjecaj infekcije na ukupno mlijeko , trajanje laktacije i sastav mlijeka (mast, protein i laktozu) testirano je analizom varijance (PROC GLM). Utjecaj kliničkoh artritisa na laktaciju također je testiran. AEK je serološki potvrđen u 37% koza. Nadalje, 24% AEK pozitivnih koza je imalo klinički artritis. Potvrđen je utjecaj serološkog statusa na sva istraživana svojstva. Klinički artritis utjecao je na količinu (%) proteina i masti u mlijeku.

Ključne klinički artritis, artritis encefalitis koza, ukupno mlijeko, duljina laktacije, kvaliteta mlijeka, koze

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