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SPREČAVANJE ŠIRENJA KLASIČNE KUGE SVINJA U POGRANIČNOM REGIONU KROZ POBOLJŠANJE SANITARNIH STANDARDA I EDUKACIJU FARMERA (STOP – KKS)

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“PREVENTION OF CLASSICAL SWINE FEVER IN THE BORDER REGIONCROATIA – SERBIA (STOP – CSF)”
„SPREČAVANjE ŠIRENjA KLASIČNE KUGE SVINjA U POGRANIČNOM REGIONU HRVATSKA – SRBIJA (STOP – KKS)“

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MONITORING OF PIG IMMUNIZATION AGAINST THE CLASSICAL SWINE FEVER IN THE REPUBLIC OF SERBIA

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Abstract

Prevention of Classical Swine Fever (CSF) is the key issue of the veterinary service in many countries. Numerous strategies and programs for control of CSF are designed. However, they all can be categorized according to the character of CSF in particular countries, that is programs applied in countries in which CSF has enzootic character and those intended to maintain the disease-free status in the countries free from CSF.

In the Republic of Serbian, the strategy for control, i.e. suppression and eradication of CSF relies upon systematic vaccination with attenuated vaccine and continuous control of immune status of vaccinated pigs. This study gives an overview of the results of investigating immune status of pigs vaccinated against classical swine fever during 2010. The investigation encompassed 4,430 pigs originating from 1,315 farms and pig-keeping households and 1,516 pigs from slaughter lines in 149 slaughterhouses.

Key words: classical swine fever, vaccination, immune status, ELISA

Introduction

Vaccination as a measure of specific immunoprophylaxis is the most effective method for suppression and eradication of numerous infectious diseases. Thanks to vaccination, a number of human and animal diseases have been eradicated. Vaccination with attenuated vaccines represents one of the most effective measures for prevention of the occurrence and transmission of Classical Swine Fever (CSF) as well for suppression and eradication of the disease. First reports on immunoprophylaxis and protection against CSF date back to the beginning of XX century, i.e. year 1910. To that time, a so-called simultaneous vaccine or sero-prophylaxis was applied. Pigs were simultaneously inoculated with CSF virus and hyperimmune serum. However, this protection method was abandoned by the end of 30^{ties} and 40^{ties} of 20th century because of its role in virus transmission. In the 40^{ties} the production and application of inactivated vaccines has started; however, their protective properties were unsatisfactory. From the 70^{ties} onwards, non-pathogenic strains were produced by serial Chinese-strain passages in rabbits and by passages of GPE strain and THIVERVAL strain in cell cultures. The strains are used for vaccine production and they are the active components of attenuated vaccines (Dewulf et al.,

2001). Nowadays, several strains of CSF virus are used for vaccine production: Chinese-strain, GPE, Thiverval and PAV-250 (Dewulf et al., 2001, Van Oirschot, 2003, De Smit 2000). All aforementioned strains are believed to provide life-long protection against infection with pathogenic viruses and to prevent classical swine fever. Yet, the viruses replicate in tonsils and other lymphatic organs and are transmissible through direct contact. Changes in virulence associated with virus replication in pigs were not confirmed, thus they remained non-pathogenic (Van Oirschot and Terpstra, 1989). Live vaccines enhance good protection that may last for several years, sometimes even life-long. Full protection is achieved several days after vaccination, and as early as on day 7 in pigs vaccinated with single dose (Bironț et al., 1987, our experience).

However, besides their well-known advantages, attenuated vaccines have certain drawbacks, which limited their application and resulted in their exclusion from the strategies against classical swine fever. Besides the transmission of vaccine virus, one of the major drawbacks of attenuated vaccines is the development of immune response that is impossible to distinguish from the immune response resulting from the infection. Weakly virulent strains of CSF virus do not induce manifestation of typical disease symptoms in affected pigs. Infected animal can survive for more than a month, sometimes even longer, shedding the virus throughout the entire period. Specific antibodies are the only reliable sign of the disease; however, they are detectable also in vaccinated pigs. Application of attenuated vaccines as a protection against classical swine fever markedly reduces the diagnostic capacity, because it is unclear whether humoral immune response is infection - or vaccine-induced. It was one of the major reasons for abandoning use of attenuated vaccines in EU and other countries worldwide. Trade in pigs, pork meat and pork products, is strongly associated with the use of attenuated vaccines. Some big markets require pork products originating only from unvaccinated pigs. Nowadays, intensive research is aimed at developing novel vaccines that would produce immune response distinguishable from that induced by the infection. Classical swine fever outbreak within non-immune pig population could result in catastrophic consequences, and possible prevention measures include either depopulation (culling) or vaccination of all pig categories in the area of infection outbreak.

Commonly used methods for detection of antibodies against CSF are based on neutralization principle. Techniques such as immunoperoxidase neutralization test or immunofluorescence neutralization test are applied in West European countries, North America and some other countries. Several commercial ELISA tests were developed, which can effectively be used for detecting specific antibodies against CSF. Development of new vaccines against CSF mostly coincides with development of diagnostic protocols and tests that enable distinguishing between different types of immune response (Colijn et al., 1997).

In the Republic of Serbia, prevention of the outbreak, suppression and eradication of CSF relies on systematic and planned vaccination, control of the immune status and implementation of biosecurity measures. Moreover, in recent years, great attention is paid to the control of CSF within the population of feral pigs. Mandatory vaccination of feral pigs was abandoned in 2011, and great number of wild boars shot during hunting was controlled for the presence of the virus and

specific antibodies against CSF (Veterinary Directorate, Ministry of Agriculture, Trade, Forestry and Water Management, Regulation on program of health protection of animals 2011). Experiences from countries that eradicated CSF suggested that when vaccination has resulted in protection of 90% of pig population, the non-vaccination policy could be applied, yet with strict adherence to biosecurity measures. The goal of the Veterinary Service in the Republic of Serbia is to accomplish good protection in all pig categories at all farms and households along with simultaneous implementation of biosecurity measures in order to discontinue the vaccination of pigs against classical swine fever and shift towards non-vaccination policy (Veterinary Directorate, Ministry of Agriculture, Trade, Forestry and Water Management).

The aim of the study

The aim of this study was to present the results on the control of immune status of pigs vaccinated against classical swine fever. The control of the immune status was conducted in the second half of 2010 pursuant to the Instruction of the Veterinary Directorate.

Determination of immune status was performed by detecting specific antibodies against CSF virus employing ELISA technique. Blood samples from pigs were collected in the entire territory of the Republic of Serbia, at farms, pig-keeping households and slaughterhouses (at slaughter lines). Blood sampling was performed by representatives of epizootiological services of the scientific and specialized institutes and local veterinary service under supervision of Veterinary Inspectorate of the Republic of Serbia. The plan of sampling was designed according to the density of pig population within particular epizootiological units. The examination of samples was performed at the Scientific Veterinary Institute of the Republic of Serbia in Beograd and Scientific Veterinary Institute „Novi Sad“ in Novi Sad. Detection of antibodies was performed using commercial ELISA kit „PrioCHECK CSFV-Ab 2.0“ (Prionics Lelystad B.V., The Netherlands)

Results and discussion

Results on monitoring pig immunization in households

A concept of monitoring of pig immunization against CSF was based on investigation of pigs at farms/households and slaughterhouses in the period August – November 2010. Under supervision of the Veterinary Inspectorate of the Republic of Serbia, the epizootiology departments of scientific and specialized veterinary institutes (12) of the Republic of Serbia and Veterinary Service have designed the sampling schedule. The schedule has foreseen that samples need to be representative with respect to number of pigs and number of pig-farms/households as well as that blood samples should taken at least 35 days after vaccination. Particular attention has been paid to rural households with individual pig farming. The number of settlements in investigated municipalities was determined by using mathematic models for determining total number of epizootiological units (settlements) applying binomial distribution to calculate the prevalence, with prevalence parameters 86-87%, accuracy rate 99% and acceptable error rate 3%. According to the schedule,

blood sampling included maximum five pigs of different categories per each farm. Table 1 displays the average number of pigs per farms/households in 2010.

Table 1: Average number of pigs per households/farms and districts during 2010

No.	District	No. pig farms / households	No. labelled pigs	No. vaccinated pigs	No. revaccinated pigs
1.	Beograd	3,389	114,125	114,119	68,254
2.	South Banat	5,040	140,104	139,640	98,291
3.	Pomoravlje	4,835	79,113	79,113	19,694
4.	Šumadija	4,568	80,132	80,108	5,244
5.	Zlatibor	698	4,000	3,958	179
6.	Raška	1,928	45,081	45,081	2,921
7.	Moravica	2,090	41,225	41,155	343
8.	Rasina	11,559	229,861	229,861	45,171
9.	Braničevo	4,993	84,467	84,448	21,475
10.	Podunavlje	2,703	69,001	69,001	19,562
11.	Bor	3,359	17,964	17,933	7,102
12.	Zaječar	1,956	36,132	36,126	34,294
13.	West Bačka	5,484	158,007	157,517	22,931
14.	North Bačka	3,439	291,048	290,926	175,430
15.	South Bačka	6,513	445,841	445,832	324,385
16.	Central Banat	5,767	111,775	111,545	22,144
17.	North Banat	4,370	211,494	210,797	107,275
18.	Kolubara	4,187	52,586	52,568	1,080
19.	Mačva	12,822	338,664	338,622	13,943
20.	Pirot	1,526	5,986	5,986	308
21.	Toplica	974	32,079	32,026	3,688
22.	Pčinj	3,330	9,726	9,726	1,024
23.	Jablanica	9,024	48,416	48,307	8,751
24.	Nišava	5,664	53,510	53,503	5,618
25.	Srem	12,558	422,963	422,956	101,330
Total		**123.226**	**3,123,300**	**3,120,854**	**1,110,437**

Considering that pig farming is quite variable and dynamic process, particularly in rural households, Table 1 gives an overview of the average number of pigs per households and administrative districts that were encompassed by vaccination program against classical swine fever. During 2010, pig farming was done at 123,226 farms and pig-keeping households, and over 3 millions pigs were labelled and vaccinated.

Table 2 illustrates the monitoring involvement according to administrative districts, municipalities and settlements along with the obtained results. According to the data presented, out of 4,430 investigated pigs originating from 1,315 farms/households (715 settlements and 147 municipalities) positive finding of specific antibodies against CSF virus was obtained in 3,714 (83.84%) of the total investigated population, which is considered satisfactory result. However, analysis at

the level of administrative districts revealed considerable variability between particular districts: the lowest immunity was determined in Pomoravlje District, being only 61.33%, whereas immunity rate of over 90% was observed in eight districts (Beograd, Braničevo, Podunavlje, North Bačka, South Bačka, Mačva, Pirot, and Srem). In other districts immunity rate ranged from 70 to 90%. Negative immunity finding was obtained in 716 (16.16%) pigs of the entire investigated population.

Table 2: Pigs vaccinated against CSF included in the monitoring, and obtained results

No.	District	No. Municipalities	No. settlements	No. farms/ households	No. pigs	Results (%)	
						Positive finding	Negative finding
1.	Beograd	9	26	43	75	70 (93.33)	5 (6.67)
2.	South Banat	8	30	41	202	167 (82.67)	35 (17.33)
3.	Pomoravlje	6	33	40	150	92 (61.33)	58 (38.67)
4.	Šumadija	7	29	40	128	89 (69.53)	39 (30.47)
5.	Zlatibor	10	31	76	128	97 (75.78)	31 (24.22)
6.	Raška	5	29	62	152	135 (88.28)	17 (11.18)
7.	Moravica	4	28	41	121	92 (76.03)	29 (23.97)
8.	Rasina	6	31	77	111	92 (82.88)	19 (17.12)
9.	Braničevo	9	37	65	171	159 (92.98)	12 (7.02)
10.	Podunavlje	2	5	15	42	39 (92.86)	3 (7.14)
11.	Bor	3	10	23	79	62 (78.48)	17 (21.52)
12.	Zaječar	4	25	40	138	120 (86.96)	18 (13.04)
13.	West Bačka	5	11	50	230	174 (75.65)	56 (24.35)
14.	North Bačka	3	16	40	187	169 (90.37)	18 (9.63)
15.	South Bačka	6	11	26	129	117 (90.70)	12 (9.30)
16.	Central Banat	5	18	42	210	181 (86.19)	29 (13.81)
17.	North Banat	6	14	41	204	179 (87.15)	25 (12.25)
18.	Kolubara	6	43	47	155	114 (73.55)	41 (26.45)
19.	Mačva	8	48	83	395	360 (91.14)	35 (8.86)
20.	Pirot	3	30	40	128	120 (93.75)	8 (6.25)
21.	Toplica	4	40	67	187	150 (80.21)	37 (19.79)
22.	Pčinj	7	47	101	262	229 (87.40)	33 (12.60)
23.	Jablanica	6	55	85	268	207 (77.24)	61 (22.76)
24.	Nišava	9	46	62	239	189 (79.08)	50 (20.92)
25.	Srem	6	22	68	339	311 (91.74)	28 (8.26)
Total		**147**	**715**	**1,315**	**4,430**	**3,714** (83.84)	**716 (16.16)**

With an aim of better understanding of the obtained results, and having in mind the heterogeneity of pig farming in Serbia, a more comprehensive result analysis according to the type of the farm/household was necessary. The Veterinary Directorate has set the criteria pertaining to implementation of biosecurity measures, according to which farms were categorized into six types: commercial farms, family-owned farms type A, family-owned farms type B, rural farms (backyards) and households where pigs are raised at open space (free-range keeping). Table 3 displays monitoring results according to farm/household type.

The presented results indicate that monitoring was performed at 1.07% of farms and pig-keeping households. However, the monitoring encompassed mainly rural farms and households, i.e. 1,052, which make 82.51 % of the total number of

farms involved in the research. These households lack biosecurity measures, apart from vaccination, thus presenting the highest risk of CSF outbreak. In that respect, those farms have been identified as deserving particular attention. Pig farming at open space, i.e. grassland and forests, is quite common in Serbia, and implementation of biosecurity measures is difficult, as well as the blood sampling itself. However, as visible from Table 3, the monitoring encompassed pigs from 12 farms/households, which enabled a better insight in the immunity status of pigs that were most exposed to potential infection with CSF virus through contacts with feral pigs. Our research encompassed the pigs from commercial farms and family-owned farms, type A. Out of the total number of farms and households from which the blood samples were obtained, 105 farms (8%) were analyzed.

Table 3: Monitoring overview according to household type

No.	**District**	**No. farms/ households**	**No. investigated farms/ households**	**No. investigated farms/ households according to type**					
				A	**B**	**C**	**D1**	**D2**	**E**
1.	Beograd	3,389	43	0	0	1	33	9	0
2.	South Banat	5,040	41	8	6	2	22	3	0
3.	Pomoravlje	4,835	40	3	9	0	22	6	0
4.	Šumadija	4,568	40	2	0	0	24	14	0
5.	Zlatibor	698	76	0	1	0	23	52	0
6.	Raška	1,928	62	1	3	3	27	28	0
7.	Moravica	2,090	41	0	2	2	21	16	0
8.	Rasina	11,559	77	3	18	25	31	0	0
9.	Braničevo	4,993	65	3	3	16	30	12	1
10.	Podunavlje	2,703	15	1	2	3	9	0	0
11.	Bor	3,359	23	1	0	3	19	0	0
12.	Zaječar	1,956	40	1	0	0	25	14	0
13.	West Bačka	5,484	50	1	0	8	37	4	0
14.	North Bačka	3,439	40	4	1	8	19	6	2
15.	South Bačka	6,513	26	2	0	5	11	8	0
16.	Central Banat	5,767	42	6	1	2	32	1	0
17.	North Banat	4,370	41	5	2	5	22	5	2
18.	Kolubara	4,187	47	1	0	5	28	13	0
19.	Mačva	12,822	83	2	0	16	55	9	1
20.	Pirot	1,526	40	2	3	5	6	24	0
21.	Toplica	974	67	1	0	0	13	53	0
22.	Pčinj	3,330	101	0	1	0	17	81	2
23.	Jablanica	9,024	85	0	1	1	34	49	0
24.	Nišava	5,664	62	1	0	1	36	21	3
25.	Srem	12,558	68	3	1	2	43	18	1
Total		**123,226**	**1,315**	**51**	**54**	**113**	**639**	**446**	**12**

Household type: A – commercial farms, B – family owned farms type A, C – family owned farms type B, D1 – Rural farms – mixed farming, D2 – Rural farms fattening E – Pigs raised at open space

In Tables 4 and 5, the obtained results are presented according to the type of farm/household, which represents the crucial factor for the assessment of immune status from the viewpoint of implementation of biosecurity measures and possibility of CSF outbreak, as well as with respect to potential consequences.

Table 4: Overview of examined pigs according to farm/household type

No.	District	No. vaccinated pigs	No. investigated pigs	No. investigated pigs according to farm/household type					
				A	B	C	D1	D2	E
1.	Beograd	114,119	75	0	0	23	37	15	0
2.	South Banat	139,640	202	40	30	10	107	15	0
3.	Pomoravlje	79,113	150	15	43	0	69	23	0
4.	Šumadija	80,108	128	10	0	0	75	43	0
5.	Zlatibor	3,958	128	1	0	0	38	89	0
6.	Raška	45,081	152	5	7	15	76	49	0
7.	Moravica	41,155	121	0	10	30	61	20	0
8.	Rasina	229,861	111	8	23	30	50	0	0
9.	Braničevo	84,448	171	10	12	56	70	22	1
10.	Podunavlje	69,001	42	3	6	9	24	0	0
11.	Bor	17,933	79	5	0	16	58	0	0
12.	Zaječar	36,126	138	5	0	0	86	47	0
13.	West Bačka	157,517	230	5	0	37	168	20	0
14.	North Bačka	290,926	187	20	5	40	88	24	10
15.	South Bačka	445,832	129	10	0	25	55	39	0
16.	Central Banat	111,545	210	30	5	10	160	5	0
17.	North Banat	210,797	204	15	20	25	110	25	9
18.	Kolubara	52,568	155	4	0	19	92	40	0
19.	Mačva	338,622	395	10	0	80	259	41	5
20.	Pirot	5,986	128	10	13	22	24	59	0
21.	Toplica	32,026	187	3	0	0	41	143	0
22.	Pčinj	9,726	262	0	5	0	45	206	6
23.	Jablanica	48,307	268	0	5	20	125	118	0
24.	Nišava	53,503	239	5	0	5	148	69	12
25.	Srem	422,956	339	15	5	10	214	90	5
Total		**3,120,854**	**4,430**	**229**	**189**	**482**	**2,280**	**1,202**	**48**

As presented in the above Table, majority of investigated pigs originated from rural households (total 3,482 or 78.60%), which was expected, considering the fact that the monitoring encompassed 82.51% of the total number of rural farms and households investigated. The smallest number of pigs from free-range system was examined (only 48, i.e. 1.08%) due to quite small number of pigs in this farming system, as well as to difficulties in blood sampling. Having in mind the high risk of CSF associated with such farming system, the results obtained in this pig population are of considerable importance with respect to the assessment of immune status within the entire population. The investigation encompassed 900 pigs (20.32%) from commercial farms, family-owned farms types A and B, which is considered a representative sample for such type of farm and farming system.

Results reflecting CSF-immunity of pig population in the Republic of Serbia are shown in Table 5. The results are analyzed according to the farm/household type, which is and important factor for assessing the possibility of occurrence of CSF. As aforementioned, the immunity rate against CSF within the pig population in Serbia reaches some 80%, which is considered satisfactory. However, if analyzed according to administrative districts and farm type of origin, which is the key factor for prevention of CSF based on implementation of biosecurity measures, the results reveal high degree of heterogeneity and thus high potential risk of disease outbreak. The lowest immunity rate was observed at all farm types in Pomoravlje District,

being much below the required 90%. At rural fattening farms and households, the immunity rate was even below 50%, which is worrisome status because of lacking biosecurity measures and highly mediocre vaccination results posing high potential risk of CSF outbreak. Low immunity rate at farms type A and commercial farms in this district is alarming. Potential disease outbreak in this region would have catastrophic consequences due to weak immunity against CSF and rapid spread of the disease within a huge pig population. Immunity rates obtained in other districts averagely range between 70% and 80%. Analysis of administrative districts encompassing all types of farms and households would reveal the highest percentage of immune pigs in Srem. In this district, the average rate of immune pigs is 91.74% (according to the farm type); however, risk of the occurrence of CSF still persists because of high density of pig population and geographical location of the district, i.e. being on the border of two states. In other districts, the percentage of immune pigs, detemined according to farm/household type, ranges between 70-80%.

Table 5: Positive finding of specific antibodies against CSF virus in vaccinated and examined pigs expressed in % according to household type

No.	**District**	**No. vaccinated pigs**	**No. investigated pigs**	**Obtained results according to household type**					
				A	**B**	**C**	**D1**	**D2**	**E**
1.	Beograd	114,119	75	0	0	100	94,59	80,00	0
2.	South Banat	139,640	202	92.5	76.66	90.00	79.43	86.66	0
3.	Pomoravlje	79,113	150	80.00	65.11	0	60.86	43.47	0
4.	Šumadija	80,108	128	90.00	0	0	72.00	60.46	0
5.	Zlatibor	3,958	128	100	0	0	78.94	74.15	0
6.	Raška	45,081	152	100	71.42	93.33	85.52	93.87	0
7.	Moravica	41,155	121	0	70.00	70.00	75.40	90.00	0
8.	Rasina	229,861	111	87.50	91.30	76.66	82.00	0	0
9.	Braničevo	84,448	171	100	100	96.42	92.85	81.81	0
10.	Podunavlje	69,001	42	100	100	100	87.50	0	0
11.	Bor	17,933	79	40.00	0	37.50	93.10	0	0
12.	Zaječar	36,126	138	80.00	0	0	83.72	93.61	0
13.	West Bačka	157,517	230	100	0	94.59	70.83	75.00	0
14.	North Bačka	290,926	187	95.00	80.00	100	88.63	91.66	60,00
15.	South Bačka	445,832	129	90.00	0	80.00	94.54	64.10	0
16.	Central Banat	111,545	210	83.33	100	100	85.00	100	0
17.	North Banat	210,797	204	80.00	100	100	81.81	92.00	100
18.	Kolubara	52,568	155	50.00	0	94.73	70.65	72.50	0
19.	Mačva	338,622	395	100	0	100	89.18	82.92	100
20.	Pirot	5,986	128	80	100	100	95.83	91.53	0
21.	Toplica	32,026	187	100	0	0	70.73	82.51	0
22.	Pčinj	9,726	262	0	100	0	75.55	89.32	100
23.	Jablanica	48,307	268	0	60.00	60.00	81.60	76.27	0
24.	Nišava	53,503	239	100	0	100	77.02	76.81	100
25.	Srem	422,956	339	100	80.00	100	92.52	88.88	80,00
Total		**3,120,854**	**4,430**	**88.64**	**82.53**	**90.45**	**82.50**	**82.77**	**87.50**

Results on monitoring pig immunization obtained in slaughterhouses

Monitoring of pig immunization was carried out periodically, once a month, in the period August – November 2010. Under supervision of the Veterinary

Inspectorate of the Republic of Serbia, the epizootiology departments of scientific and specialized veterinary institutes of the Republic of Serbia and Veterinary Service have designed a schedule of sampling at slaughter lines in slaughterhouses. The slaughterhouse line samples were categorized according to the slaughterhouse type, i.e. private butcheries and industrial slaughterhouses. The slaughter in butcheries mainly implicates animals originating from rural households and free-range keeping, whilst pigs arriving to industrial slaughterhouses originate from commercial farms and family-owned farms of type A and B. Tables 6 and 7 display the results obtained in investigated administrative districts according to slaughterhouse type.

Table 6: Slaughterhouses encompassed by monitoring according to district and slaughterhouse type with the obtained results

No.	District	No. investigated pigs	No. slaughterhouses		Private butcheries		Industrial slaughterhouses	
			Butchery	Industrial	Positiv finding	Negative finding	Positiv finding	Negative finding
1.	Beograd	100	4	1	65	15	17	3
2.	South Banat	100	11	0	85	15	0	0
3.	Pomoravlje	63	4	1	36	12	14	1
4.	Šumadija	25	3	0	10	15	0	0
5.	Zlatibor	78	8	0	26	52	0	0
6.	Raška	52	4	1	35	12	5	0
7.	Moravica	15	2	1	8	2	2	3
8.	Rasina	78	8	0	55	23	0	0
9.	Braničevo	74	6	2	40	19	15	0
10.	Podunavlje	30	2	0	29	1	0	0
11.	Bor	95	5	1	29	46	16	4
12.	Zaječar	38	2	0	21	17	0	0
13.	West Bačka	99	9	0	73	26	0	0
14.	North Bačka	105	11	1	72	23	10	0
15.	South Bačka	80	12	3	50	10	19	1
16.	Central Banat	100	4	0	76	24	0	0
17.	North Banat	50	5	0	44	6	0	0
18.	Kolubara	60	5	0	35	25	0	0
19.	Mačva	45	7	0	30	15	0	0
20.	Pirot	30	1	0	20	10	0	0
21.	Toplica	30	5	0	26	4	0	0
22.	Pčinj	15	1	0	14	1	0	0
23.	Jablanica	35	2	1	13	7	9	6
24.	Nišava	60	2	2	24	6	24	6
25.	Srem	59	11	1	38	16	5	0
Total		**1,516**	**134**	**15**	**954**	**402**	**136**	**24**

As noticeable from Table 6, the investigation encompassed 1,516 pigs from 149 slaughterhouses. Majority of investigated animals originated from private butcheries, i.e. 1,365 (89.45%), and 160 (10.55%) from industrial slaughterhouses. Positive immune status was confirmed in 954 (70.35%) and 136 (85%) of slaughtered animals in butcheries and industrial slaughterhouses, respectively.

Data displayed in Table 7, reflecting proportional representation of positive and negative finding per slaughterhouse and per district, indicate very high

heterogeneity of immune status against CSF in investigated pigs. Analysis of the test results of blood samples obtained in butcheries revealed the lowest rate of immunity at slaughter in the Zlatibor District, being only 33.33%. Moreover, less then a half of slaughtered pigs in the Districts of Bor and Šumadija were immune to CSF. The number of butcheries with immunity rate over 90% is quite small, and limited to the Districts of Podunavlje and Pčinj. The rate of positive finding ranged between 60% and 80% in other districts. All pigs slaughtered in the industrial plants in the districts Raška, Braničevo, North Bačka and Srem were immune to CSF, and relatively high immunity rate was determined in other industrial slaughterhouses, ranging from 60-95%.

Table 7: Investigation results expressed as % of positive and negative finding in particular districts according to slaughterhouse type

No.	**District**	**No. investigated pigs**	**Private butcheries**		**Industrial slaughterhouses**	
			Pos. finding %	**Neg. finding %**	**Pos.finding %**	**Neg. finding %**
1.	Beograd	100	81.25	18.75	85	15
2.	South Banat	100	85	15	0	0
3.	Pomoravlje	63	75	25	93.33	6,67
4.	Šumadija	25	40	60	0	0
5.	Zlatibor	78	33.33	66.67	0	0
6.	Raška	52	74.45	25.54	100	0
7.	Moravica	15	80	20	40	60
8.	Rasina	78	70.51	29.49	0	0
9.	Braničevo	74	67.8	32.20	100	0
10.	Podunavlje	30	96.67	3.33	0	0
11.	Bor	95	38.67	61.33	80	20
12.	Zaječar	38	55.26	44.74	0	0
13.	West Bačka	99	73.74	26.26	0	0
14.	North Bačka	105	75.79	24.21	100	0
15.	South Bačka	80	83.33	16.67	95	5
16.	Central Banat	100	76	24	0	0
17.	North Banat	50	88	12	0	0
18.	Kolubara	60	58.33	41.67	0	0
19.	Mačva	45	66.67	33.33	0	0
20.	Pirot	30	66.67	33.33	0	0
21.	Toplica	30	86.67	13.33	0	0
22.	Pčinj	15	93.33	6.67	0	0
23.	Jablanica	35	65	35	60	40
24.	Nišava	60	80	20	80	20
25.	Srem	59	70.37	29.63	100	0
Total		**1,516**	**70.35**	**29.65**	**85**	**15**

Conclusion

The results obtained from monitoring pig immunization against CSF indicated different and highly heterogeneous immunity levels between the investigated districts. However, the average immunity level for all districts in the Republic of Serbia was 83.84%, i.e. out of 4,430 examined pigs the positive immune status against classical swine fever was determined in 3,714 pigs. Immunity control

at slaughter line revealed positive immune status in 1,090 (71.90%) out of 1,516 slaughtered pigs.

The obtained results provide a good basis for further analysis and decisions aimed at designing new programs for monitoring CSF in the Republic of Serbia, based exclusively on implementing biosecurity measures and without application of immunoprophylaxis. The research activities need to be expanded in a view of more comprehensive exploring the possibility of discontinuing the practice of vaccination against CSF and a change to a non-vaccination policy. The research must encompass much larger pig population, particularly those on village households that mostly lack proper biosecurity measures.

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MONITORING SPROVEDENE IMUNIZACIJE SVINJA PROTIV KLASIČNE KUGE U REPUBLICI SRBIJI

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Kratak sadržaj

Sprečavanje pojave klasične kuge svinja (KKS) predstavlja ključni zadatak veterinarske službe mnogih zemalja. Izrađene su razne strategije i brojni programi kontrole KKS. Međutim, svi oni se mogu sistematizovati u programe koji se primenjuju u zemljama gde KKS ima enzootski karakter i u programe kojima se održava status slobodne teritorije, odnosno države slobodne od KKS.

U Republici Srbiji strategija kontrole, odnosno suzbijanja i iskorenjivanja KKS je zasnovana na sistematskoj vakcinaciji atenuiranom vakcinom uz kontrolu imunog statusa vakcinisanih svinja. U radu su prikazani rezultati ispitivanja imunog statusa vakcinisanih svinja protiv klasične kuge tokom 2010. godine. Ispitivanjima je obuhvaćeno 4.430 svinja, koje su poticale iz 1.315 gazdinstava i 1.516 svinja na liniji klanja u 149 klanica.

Ključne reči: klasična kuga svinja, vakcinacija, imuni status, ELISA

Uvod

Vakcinacija kao mera specifične imunoprofilakse predstavlja najefikasniji metod za suzbijanje i iskorenjivanje mnogih infektivnih oboljenja. Zahvaljujući vakcinaciji mnoge bolesti u humanoj i veterinarskoj medicini su danas iskorenjene. Jedna od najefikasnijih mera u sprečavanju pojave, širenja, suzbijanja i iskorenjivanja klasične kuge svinja (KKS) je vakcinacija sa atenuiranim vakcinama. Prvi zapisi zaštite svinja od KKS u vidu imunoprofilakse datiraju iz perioda početka dvadesetog veka, odnosno 1910. godine. Tada je korišćena, takozvana, simultana vakcinacija ili sero-profilaksa. Svinjama je istovremeno aplikovan virus KKS i hiperimuni serum. Međutim, ovaj oblik zaštite svinja je krajem tridesetih i četrdesetih godina dvadesetog veka napušten, jer je utvrđeno da se njime širi virus. Iz tog razloga četrdesetih godina počinju da se proizvode i primenjuju inaktivisane vakcine, međutim i one nisu davale zadovoljavajuću zaštitu. Sedamdesetih godina prošlog veka serijskim pasažama Kina soja virusa KKS na kunićima i pasažama GPE i THIVERVAL soja na kulturi ćelija dolazi se do apatogenih sojeva, koji se koriste za proizvodnju vakcina i predstavljaju aktivnu komponentu atenuiranih vakcina (Dewulf i sar., 2001). Danas je u upotrebi nekoliko sojeva virusa KKS koji se koriste za proizvodnju vakcina, a to su pre svega Kina soj, GPE, Thiverval i PAV-250 (Dewulf i sar., 2001, Van Oirschot, 2003, De Smit 2000). Smatra se da svi navedeni sojevi kod vakcinisanih svinja podstiču doživotnu zaštitu od infekcije

patogenim virusima i da sprečavaju kliničku pojavu klasične kuge. Međutim, utvrđeno je da se ovi virusi replikuju u tonzilama i drugim limfatičnim organima i da se neposrednim kontaktom svinja mogu prenositi, ali nije dokazano da se umnožavanjem ovih virusa u svinjama menjala virulencija, dakle oni su i dalje ostajali apatogeni (Van Oirschot i Terpstra 1989). Žive vakcine podstiču dobru zaštitu koja može da traje i više godina, pa čak i doživotno. Nekoliko dana posle vakcinacije, a već sedmog dana kod jednokratno vakcinisanih svinja postiže se potpuna zaštita (Bironti sar. 1987, sopstvena iskustva).

Međutim, pored svih dobrih osobina, utvrđeno je da atenuirane vakcine imaju i nedostatke, što je uzrokovalo njihovu ograničenu upotrebu i eliminaciju iz programa zaštite svinja od klasične kuge. Pored transmisije vakcinalnog virusa, jedan od glavnih nedostataka atenuiranih vakcina je razvoj imunog odgovora, koji ne može da se razlikuje od imunog odgovora koji je nastao kao posledica infekcije. Poznata je činjenica da slabo virulentni sojevi virusa KKS kod inficiranih svinja ne dovode do ispoljavanja tipičnih simptoma bolesti. Inficirana životinja opstaje više od mesec dana, pa i duže, ali ipak završava uginućem, a da za sve to vreme izlučuje virus. Jedini pouzdani znak bolesti predstavljaju specifična antitela, ali specifična antitela se detektuju i kod vakcinisanih svinja. Prema tome, mogućnosti dijagnostikovanja bolesti se značajno umanju, ako se u zaštiti svinja od klasične kuge koriste atenuirane vakcine, jer razvijeni humoralni imuni odgovor nije moguće razlikovati i definisati i reći da je on vakcinalnog ili infektivnog porekla. Ovo je bio jedan od ključnih razloga zbog kojeg je prekinuta upotreba atenuiranih vakcina u zemljama Evropske unije i drugim zemljama u svetu. Promet svinja, svinjskog mesa i prerađevina od svinjskog mesa danas je uslovljen upotrebom atenuiranih vakcina. Velika tržišta zahtevaju proizvode od svinjskog mesa samo ako potiču od nevakcinisanih svinja. Danas se ulažu veliki napori za razvoj vakcina koje će podstaći razvoj imunog odgovora, a da se pri tome razlikuje od imunog odgovora koji nastaje nakon infekcije. U slučajevima izbijanja klasične kuge u neimunoj populaciji svinja nastaju katastrofalne posledice, a mera sprečavanja širenja bolesti mogu biti ili depopulacija svinja (neškodljivo uklanjanje), ili vakcinacija svih kategorija svinja oko žarišta infekcije.

Najčešće korišćene metode za utvrđivanje antitela protiv virusa KKS se baziraju na principu neutralizacije. U zapadnoevropskim zemljama, severnoameričkom kontinentu i nekim drugim zemljama primenjuju se tehnike neutralizacije imunoperoksidaze ili neutralizacija imunofluoresecencije. Razvijeno je nekoliko oblika komercijalnih ELISA testova kojima se takođe veoma efikasno mogu da utvrde specifična antitela protiv virusa KKS. Razvoj vakcina protiv KKS prati i razvoj dijagnostičkih protokola i testova kojima se može razlučiti poreklo imunog odgovora (Colijn i sar. 1997).

U Republici Srbiji kao mera sprečavanja pojave, suzbijanja i iskorenjivanja KKS bazira se na sistematskoj i planskoj vakcinaciji, kontroli imunog statusa i implementaciji biosigurnosnih mera. Takođe, tokom poslednjih nekoliko godina poklanja se velika pažnja kontroli KKS u populaciji divljih svinja. Obavezna mera vakcinacije divljih svinja ukinuta je 2011. godine, a veliki broj odstreljenih svinja podvrgava se pregledu na prisustvo virusa i specifičnih antitela protiv virusa KKS (Ministarstvo poljoprivrede, šumarstva i vodoprivrede, Uprava za veterinu, Pravilnik o utvrđivanju programa mera zdravstvene zaštite životinja za 2011). Iskustva

mnogih zemalja koje su iskorenile KKS ukazuju da kada se vakcinacijom postigne zaštita kod 90% od ukupne populacije svinja se može prestati sa vakcinacijom, ali uz strogu primenu biosigurnosnih mera. Cilj veterinarske službe u Republici Srbiji je da se postigne dobra zaštita kod svih kategorija svinja u svim gazdinstvima uz istovremenu implementaciju biosigurnosnih mera, kako bi se prekinulo sa vakcinacijom svinja protiv klasične kuge (Ministarstvo poljoprivrede, trgovine, šumarstva i vodoprivrede, Uprava za veterinu, 2012).

Cilj rada:

Cilj ovoga rada je da se prikažu rezultati kontrole imunog statusa kod vakcinisanih svinja protiv klasične kuge. Kontrola imunog statusa je sprovedena u drugoj polovini 2010. godine prema Instrukciji Uprave za veterinu.

Utvrđivanje imunog statusa vršeno je utvrđivanjem specifičnih antitela protiv virusa KKS ELISA tehnikom. Prikupljanje uzoraka krvi svinja sprovedeno je na celoj teritoriji Republike Srbije u gazdinstvima i klanicama na liniji klanja. Uzorkovanje krvi vršeno je od strane epizootioloških službi naučnih i specijalističkih instiuta i terenske veterinarske službe uz nadzor Republičke veterinarske inspekcije. Prema gustini populacije svinja u epizootiološkim jedinicama izrađen je prvo plan uzorkovanja, a potom je organizovano prikupljanje uzoraka. Ispitivanja su vršena u Naučnom institutu za veterinarstvo Srbije iz Beograda i Naučnom institutu za veterinarstvo „Novi Sad“ iz Novog Sada. Za utvrđivanje antitela korišćen je komercijalni ELISA set kit „PrioCHECK CSFV-Ab 2.0“ (Prionics Lelystad B.V., The Netherlands)

Rezultati i diskusija

Rezultati monitoringa imunizacije svinja u gazdinstvima

Koncepcija monitoringa imunizacije svinja protiv KKS se zasnivala na ispitivanju svinja u gazdinstvima i klanicama, koje se sprovelo u periodu od avgusta do kraja novembra meseca 2010. godine. Epizootiološke službe naučnih i specijalističkih veterinarskih instituta (12) Republike Srbije i terenska veterinarska služba, uz koordinaciju sa Republičkom veterinarskom inspekcijom izradili su plan i program uzorkovanja krvi svinja, na taj način da uzorkovanje bude reprezentativno u pogledu broja svinja, gazdinstava u kojima se svinje uzgajaju i da je od vakcinacije proteklo najmanje 35 dana. Posebna pažnja bila je posvećena seoskim gazdinstvima sa individualnim odgojem svinja. Broj naselja po opštinama, koja su bila uključena u ispitivanje određivan je primenom matematičkog modela kojim se određuje ukupan broj epizootioloških jedinica (naseljena mesta) i to primenom binomne distribucije za izračunavanje prevalence sa parametrima prevalence 86-87%, pouzdanošću ispitivanja 99% i prihvatljivom greškom od 3%. Planom i programom je predviđeno da se u svakom odabranom gazdinstvu uzorkuje krv od najviše 5 svinja različitih kategorija. U tabeli 1 dat je prikaz prosečnog broja svinja po gazdnistvima tokom 2010. godine.

Tabela 1: Prikaz prosečnog broja uzgoja svinja po gazdinstavima u okruzima tokom 2010. godine

R. br.	**Okruzi**	**Br. gazdin. sa uzgojem svinja**	**Br. obelež. svinja**	**Br. vakcin. svinja**	**Br. revak. svinja**
1	Grad Beograd	3.389	114.125	114.119	68.254
2	Južnobanatski	5.040	140.104	139.640	98.291
3	Pomoravski	4.835	79.113	79.113	19.694
4	Šumadijski	4.568	80.132	80.108	5.244
5	Zlatiborski	698	4.000	3.958	179
6	Raški	1.928	45.081	45.081	2.921
7	Moravički	2.090	41.225	41.155	343
8	Rasinski	11.559	229.861	229.861	45.171
9	Braničevski	4.993	84.467	84.448	21.475
10	Podunavski	2.703	69.001	69.001	19.562
11	Borski	3.359	17.964	17.933	7.102
12	Zaječarski	1.956	36.132	36.126	34.294
13	Zapadnobački	5.484	158.007	157.517	22.931
14	Severnobački	3.439	291.048	290.926	175.430
15	Južnobački	6.513	445.841	445.832	324.385
16	Srednjebanatski	5.767	111.775	111.545	22.144
17	Severnobanatski	4.370	211.494	210.797	107.275
18	Kolubarski	4.187	52.586	52.568	1.080
19	Mačvanski	12.822	338.664	338.622	13.943
20	Pirotski	1.526	5.986	5.986	308
21	Toplički	974	32.079	32.026	3.688
22	Pčnjski	3.330	9.726	9.726	1.024
23	Jablanički	9.024	48.416	48.307	8.751
24	Nišavski	5.664	53.510	53.503	5.618
25	Sremski	12.558	422.963	422.956	101.330
Ukupno		**123.226**	**3.123.300**	**3.120.854**	**1.110.437**

S obzirom da je uzgoj svinja dosta dinamičan i promenljiv, posebno u seoskim gazdinstvima u tabeli 1 dat je prosečan broj uzgoja svinja po gazdinstvima prema administrativnim okruzima, koja su bila obuhvaćena vakcinacijom protiv klasične kuge svinja. Kao što može da se vidi tokom 2010. godine uzgoj svinja se odvijao u 123.226 gazdinstava, a obeleženo je i vakcinisano preko tri miliona svinja.

U tabeli 2 dat je prikaz obuhvaćenosti ispitivanja monitoringa prema administrativnim okruzima, opštinama naseljenim mestima sa rezultatima ispitivanja. Kao što može da se vidi od 4.430 ispitanih svinja iz 1.315 gazdinstava i 715 naselje, odnosno 147 opština pozitivan nalaz na prisustvo specifičnih antitela protiv virusa KKS utvrđen je kod 3.714, odnosno 83,84% od ukupnog broja ispitanih svinja, što se može prihvatiti kao zadovoljavajući rezultat. Međutim, analizirajući administrativne okruge zapažaju se velike varijacije, tako je najmanje imunih svinja utvrđeno u Pomoravskom okrugu, svega 61,33%, a preko 90% imunih svinja je utvrđeno u 8 okruga (Grad Beograd, Braničevski, Podunavski, Secernobački, Južnobački, Mačvanski, Pirotski i Sremski). U ostalim okruzima rezultati imunosti su iznosile između 70 i 90%. Od ukupno ispitanih svinja negativan nalaz imunosti utvrđen je kod 716, odnosno 16,16%.

Tabela 2: Prikaz obuhvaćenosti monitoringom vakcinacinisanih svinja protiv klasične kuge svinja sa rezultatima ispitivanja

Br.	Okruzi	Broj opština	Broj naselja	Broj gazdin.	Broj svinja	Rezultati ispitivanja (%)	
						Pozit. nalaz	Negat. nalaz
1	Grad Beograd	9	26	43	75	70 (93,33)	5 (6,67)
2	Južnobanatski	8	30	41	202	167 (82.67)	35 (17,33)
3	Pomoravski	6	33	40	150	92 (61,33)	58 (38,67)
4	Šumadijski	7	29	40	128	89 (69,53)	39 (30,47)
5	Zlatiborski	10	31	76	128	97 (75,78)	31 (24,22)
6	Raški	5	29	62	152	135 (88,28)	17 (11,18)
7	Moravički	4	28	41	121	92 (76,03)	29 (23,97)
8	Rasinski	6	31	77	111	92 (82,88)	19 (17,12)
9	Braničevski	9	37	65	171	159 (92,98)	12 (7,02)
10	Podunavski	2	5	15	42	39 (92,86)	3 (7,14)
11	Borski	3	10	23	79	62 (78,48)	17 (21,52)
12	Zaječarski	4	25	40	138	120 (86,96)	18 (13,04)
13	Zapadnobački	5	11	50	230	174 (75,65)	56 (24,35)
14	Severnobački	3	16	40	187	169 (90,37)	18 (9,63)
15	Južnobački	6	11	26	129	117 (90,70)	12 (9,30)
16	Srednjebanatski	5	18	42	210	181 (86,19)	29 (13,81)
17	Severnobanatski	6	14	41	204	179 (87,15)	25 (12,25)
18	Kolubarski	6	43	47	155	114 (73,55)	41 (26,45)
19	Mačvanski	8	48	83	395	360 (91,14)	35 (8,86)
20	Pirotski	3	30	40	128	120 (93,75)	8 (6,25)
21	Toplički	4	40	67	187	150 (80,21)	37 (19,79)
22	Pčnjski	7	47	101	262	229 (87,40)	33 (12,60)
23	Jablanički	6	55	85	268	207 (77,24)	61 (22,76)
24	Nišavski	9	46	62	239	189 (79,08)	50 (20,92)
25	Sremski	6	22	68	339	311 (91,74)	28 (8,26)
Ukupno		**147**	**715**	**1.315**	**4.430**	**3.714 (83,84)**	**716 (16,16)**

U cilju što boljeg sagledavanja dobijenih rezultata monitoringa imunosti, a ceneći način odgoja svinja u Republici Srbiji, za koji se može reći da je veoma heterogen, neophodno je analizirati rezulate i prema tipu gazdinstava iz kojih se vršilo uzorkovanje. Uprava za veterinu je izradila kriterijume prema implementaciji biosigurnosnih mera, po kojima su sva gazdinstva bila klasifikovana u 6 tipova i to: komercijalne farme, porodične farme tipa A, porodične farme tipa B, seoska gazdinstva i gazdinstva u kojima se svinje uzgajaju na otvorenom prostoru. U tabeli 3 dat je prikaz sprovedenog monitoringa prema tipu gazdinstava.

Prema prikazanim rezultatima zapaža se da je od ukupnog broja gazdinstava na kojima se obavlja uzgoj svinja, monitoring sproveden na 1,07% gazdinstava. Međutim, monitoringom je ipak najviše bilo obuhvaćeno seoskih gazdinstava, 1.085, što čini 82,51% od ukupnog broja monitoringom obuhvaćenih gazdinstava. Na ovim gazdinstvima biosigurnosne mere se ne sprovode, osim mere vakcinacije, pa ta gazdinstva predstavljaju i najveći rizik za pojavu KKS i zbog toga je njima bila posvećena najveća pažnja. Odgoj svinja u Republici Srbiji se odvija i na otvorenom prostoru, odnosno na pašnjacima i u šumama, na kojima je veoma teško sprovesti mnoge mere zaštite pa i uzorkovanje krvi. Međutim, kao što se vidi u tabeli 3 iz 12 gazdinstava su bile obuhvaćene svinje monitoringom, što značajno doprinosi boljem uvidu u imunost svinja koje su najpodložnije kontktu sa divljim svinjama i

potencijalnom infekcijom virusa KKS. U ispitivanja su bile uključene svinje sa komercijalnih farmi i sa porodičnih farmi tipa A, ukupno 105 gazdinstava, ili 8%, je analizirano od ukupnog broja gazdinstva iz kojih je vršeno uzorkovanje za ova ispitivanja.

Tabela 3: Prikaz monitoringa prema tipu gazdinstva

Br.	**Okrug**	**Br. gazdi-nstava**	**Br. ispit. gazdin.**	**Br. ispitanih gazdinstva prema tipu**					
				A	**B**	**C**	**D1**	**D2**	**E**
1	Grad Beograd	3.389	43	0	0	1	33	9	0
2	Južnobanatski	5.040	41	8	6	2	22	3	0
3	Pomoravski	4.835	40	3	9	0	22	6	0
4	Šumadijski	4.568	40	2	0	0	24	14	0
5	Zlatiborski	698	76	0	1	0	23	52	0
6	Raški	1.928	62	1	3	3	27	28	0
7	Moravički	2.090	41	0	2	2	21	16	0
8	Rasinski	11.559	77	3	18	25	31	0	0
9	Braničevski	4.993	65	3	3	16	30	12	1
10	Podunavski	2.703	15	1	2	3	9	0	0
11	Borski	3.359	23	1	0	3	19	0	0
12	Zaječarski	1.956	40	1	0	0	25	14	0
13	Zapadnobački	5.484	50	1	0	8	37	4	0
14	Severnobački	3.439	40	4	1	8	19	6	2
15	Južnobački	6.513	26	2	0	5	11	8	0
16	Srednjebanatski	5.767	42	6	1	2	32	1	0
17	Severnobanatski	4.370	41	5	2	5	22	5	2
18	Kolubarski	4.187	47	1	0	5	28	13	0
19	Mačvanski	12.822	83	2	0	16	55	9	1
20	Pirotski	1.526	40	2	3	5	6	24	0
21	Toplički	974	67	1	0	0	13	53	0
22	Pčnjski	3.330	101	0	1	0	17	81	2
23	Jablanički	9.024	85	0	1	1	34	49	0
24	Nišavski	5.664	62	1	0	1	36	21	3
25	Sremski	12.558	68	3	1	2	43	18	1
Ukupno		**123.226**	**1.315**	**51**	**54**	**113**	**639**	**446**	**12**

Tip gazdinstava: A – komercijalne farme, B – Porodične farme tipa A, C – Porodične farme tipa B, D1 – Seoska gazdinstva mešovita, D2 – Seoska gazdinstva tovna i E – Svinje koje se drže na otvorenom

U tabelama 4 i 5 dat je prikaz rezultata ispitivanja prema tipu gazdinstva, što predstavlja ključni faktor u proceni imunog statusa sa aspekta implementacije mera biosigurnosti i mogućnosti pojave KKS, kao i procene potencijalnih posledica.

Kao što se prikazanoj tabeli vidi najveći broj svinja je ispitan iz seoskih gazdinstva, ukupno 3.482, ili 78,60%, što je i očekivano, s obzirom da je u monitoring bilo uključeno 82,51% od ukupnog broja ispitanih seoskih gazdinstava. Najmanje svinja je ispitano iz otvorenih gazdinstava, svega 48 (1,08%), ali treba imati u vidu mogućnosti uzorkovanja krvi, kao i veoma mali broj svinja koji se odgaja u ovakvim gazdinstvima, međutim rezultati ispitivanja kod ovih svinja i te kako su značajni u proceni imunosti ukupne populacije svinja od pojave KKS, s obzirom na rizik njihovog uzgoja. Iz komercijalnih farmi, kao i porodičnih farmi tipa A i tipa B ukupno je ispitano 900 svinja (20,32%), što zaista predstavlja

reprezentativni uzorak za ove tipove gazdinstava i uslove uzgoja svinja na ovim tipovima farmi.

Tabela 4: Prikaz ispitanih svinja prema tipu gazdinstva

Br.	**Okrug**	**Br. vakcin. svinja**	**Br. ispit Svinja**	**Br. ispitanih svinja prema tipu gazdinstva**					
				A	**B**	**C**	**D1**	**D2**	**E**
1	Grad Beograd	114.119	75	0	0	23	37	15	0
2	Južnobanatski	139.640	202	40	30	10	107	15	0
3	Pomoravski	79.113	150	15	43	0	69	23	0
4	Šumadijski	80.108	128	10	0	0	75	43	0
5	Zlatiborski	3.958	128	1	0	0	38	89	0
6	Raški	45.081	152	5	7	15	76	49	0
7	Moravički	41.155	121	0	10	30	61	20	0
8	Rasinski	229.861	111	8	23	30	50	0	0
9	Braničevski	84.448	171	10	12	56	70	22	1
10	Podunavski	69.001	42	3	6	9	24	0	0
11	Borski	17.933	79	5	0	16	58	0	0
12	Zaječarski	36.126	138	5	0	0	86	47	0
13	Zapadnobački	157.517	230	5	0	37	168	20	0
14	Severnobački	290.926	187	20	5	40	88	24	10
15	Južnobački	445.832	129	10	0	25	55	39	0
16	Srednjebanatski	111.545	210	30	5	10	160	5	0
17	Severnobanatski	210.797	204	15	20	25	110	25	9
18	Kolubarski	52.568	155	4	0	19	92	40	0
19	Mačvanski	338.622	395	10	0	80	259	41	5
20	Pirotski	5.986	128	10	13	22	24	59	0
21	Toplički	32.026	187	3	0	0	41	143	0
22	Pčnjski	9.726	262	0	5	0	45	206	6
23	Jablanički	48.307	268	0	5	20	125	118	0
24	Nišavski	53.503	239	5	0	5	148	69	12
25	Sremski	422.956	339	15	5	10	214	90	5
Ukupno		**3.120.854**	**4.430**	**229**	**189**	**482**	**2.280**	**1.202**	**48**

U tabeli 5 dati su rezultati koji prezentuju imunost populacije svinja u Republici Srbiji protiv KKS, ukoliko se analiziraju sa aspekta tipa gazdinstava, kao veoma bitnog faktora za procenu eventualne pojave KKS. Već je rečeno da je prosečna imunost svinja protiv KKS u Republici Srbiji oko 80%, što se može smatrati zadovoljavajućim. Međutim, ukoliko se ti rezultati analiziraju prema administrativnim okruzima i tipu gazdinstva iz kojeg ispitivane svinje potiču, što predstavlja ključni faktor u pogledu prevencije KKS zasnovane na implementaciji biosigurnosnih mera, može se utvrditi velika heterogenost, ali i potencijalna opasnost od eventualne pojave bolesti. U Pomoravskom okrugu utvrđena je najslabija imunost u svim tipovima gazdinstava i ona je daleko od potrebnih 90%. U seoskim gazdinstvima tovnog tipa imunost vakcinisanih svinja je čak ispod 50%, što svakako zabrinjava, jer na takvim gazdnistvima implementacija biosigurnosnih mera se ne sprovodi, a vakcinacijom svinja nije postignut ni blizu očekivani rezultat, što predstavlja veliki potencijalni rizik za pojavu KKS. U ovom okrugu, takođe zabrinjava slaba imunost i na farmama A tipa, kao i na komercijalnim farmama. Ukoliko bi došlo do pojave bolesti u ovom okrugu, posledice bi mogle biti katastrofalne, jer postoji mogućnost da oboli veliki broj svinja i da se bolest brzo širi, s obzirom na slabu imunost svinja prema klasičnoj kugi. U ostalim okruzima

prema tipu gazdinstva rezultati imunosti svinia iznose u proseku od 70-80%. Ukoliko bi analizirali administrativni okrzi u kojima su ispitivanjima bile obuhvaćene svinje iz svih tipova gazdinstava, onda bi se moglo reći da se najveći broj imunih svinja nalazi u Sremskom okrugu. U ovom okrugu procenat imunih svinja u proseku, prema tipu gazdinstva, iznosi 91,74%, međutim, imajući u vidu broj i gustinu populacije svinja u ovom okrugu, kao i teritorijalni položaj okruga, da se graniči sa dve države, ipak postoji mogućnost da se pojavi KKS. U ostalim okruzima procenat imunih svinja se u proseku, prema tipu gazdinstva kreće između 70 i 80%.

Tabela 5: Prikaz pozitivnog nalaza specifičnih antitela protiv virusa klasične kuge svinja kod vakcinisanih i ispitanih svinja izražen u % prema tipu gazdinstva

Br	**Okrug**	**Br. vak. svinja**	**Br. ispit. svinja**	**Rezul. ispitivanj prema tipu gazdinstva**					
				A	**B**	**C**	**D1**	**D2**	**E**
1	Grad Beograd	114.119	75	0	0	100	94,59	80,00	0
2	Južnobanatski	139.640	202	92,5	76,66	90,00	79,43	86,66	0
3	Pomoravski	79.113	150	80,00	65,11	0	60,86	43,47	0
4	Šumadijski	80.108	128	90,00	0	0	72,00	60,46	0
5	Zlatiborski	3.958	128	100	0	0	78,94	74,15	0
6	Raški	45.081	152	100	71,42	93,33	85,52	93,87	0
7	Moravički	41.155	121	0	70,00	70,00	75,40	90,00	0
8	Rasinski	229.861	111	87,50	91,30	76,66	82,00	0	0
9	Braničevski	84.448	171	100	100	96,42	92,85	81,81	0
10	Podunavski	69.001	42	100	100	100	87,50	0	0
11	Borski	17.933	79	40,00	0	37,50	93,10	0	0
12	Zaječarski	36.126	138	80,00	0	0	83,72	93,61	0
13	Zapadnobački	157.517	230	100	0	94,59	70,83	75,00	0
14	Severnobački	290.926	187	95,00	80,00	100	88,63	91,66	60,00
15	Južnobački	445.832	129	90,00	0	80,00	94,54	64,10	0
16	Srednjebanatski	111.545	210	83,33	100	100	85,00	100	0
17	Severnobanatski	210.797	204	80,00	100	100	81,81	92,00	100
18	Kolubarski	52.568	155	50,00	0	94,73	70,65	72,50	0
19	Mačvanski	338.622	395	100	0	100	89,18	82,92	100
20	Pirotski	5.986	128	80	100	100	95,83	91,53	0
21	Toplički	32.026	187	100	0	0	70,73	82,51	0
22	Pčnjski	9.726	262	0	100	0	75,55	89,32	100
23	Jablanički	48.307	268	0	60,00	60,00	81,60	76,27	0
24	Nišavski	53.503	239	100	0	100	77,02	76,81	100
25	Sremski	422.956	339	100	80,00	100	92,52	88,88	80,00
Ukupno		**3.120.854**	**4.430**	**88,64**	**82,53**	**90,45**	**82,50**	**82,77**	**87,50**

Rezultati monitoringa imunizacije svinja ispitanih u klanicama

Monitoring imunizacije svinja sprovodio se periodično, svakog meseca od kraja avgusta pa do kraja novembra meseca 2010. godine. Epizootiološke službe naučnih i specijalističkih instituta su uz koordinaciju Republičke veterinarske službe izradili plan i program uzorkovanja na liniji klanja u klanicama. Izvršena je raspodela uzorkovanja prema tipu klanice, na zanatske i industrijske klanice. U zanatskim klanicama uglavnom se obavlja klanje svinja poreklom iz seoskih gazdinstava i svinja koje se uzgajaju na otvorenom prostoru, dok se u klanicama industrijskog tipa vrši klanje svinja iz komercijalnih farmi i porodičnih farmi tipa A

i B. U tabelama 6 i 7 dat je prikaz sprovedenih ispitivanja sa dobijenim rezultatima, prema administrrativnim okruzima i tipu klanice.

Tabela 6: Prikaz monitoringom obuhvaćenih klanica po okruzima, tipu klanica sa rezultaima ispitivanja

Br.	**Okrug**	**Br. isp. svinja**	**Br. obuh. klanica**		**Zanatske klanice**		**Industrijske klan.**	
			Zanat.	**Indust.**	**Poz.nal.**	**Neg nal.**	**Poz.nal.**	**Neg.nal.**
1	Grad Beograd	100	4	1	65	15	17	3
2	Južnobanatski	100	11	0	85	15	0	0
3	Pomoravski	63	4	1	36	12	14	1
4	Šumadijski	25	3	0	10	15	0	0
5	Zlatiborski	78	8	0	26	52	0	0
6	Raški	52	4	1	35	12	5	0
7	Moravički	15	2	1	8	2	2	3
8	Rasinski	78	8	0	55	23	0	0
9	Braničevski	74	6	2	40	19	15	0
10	Podunavski	30	2	0	29	1	0	0
11	Borski	95	5	1	29	46	16	4
12	Zaječarski	38	2	0	21	17	0	0
13	Zapadnobački	99	9	0	73	26	0	0
14	Severnobački	105	11	1	72	23	10	0
15	Južnobački	80	12	3	50	10	19	1
16	Srednjebanatski	100	4	0	76	24	0	0
17	Severnobanatski	50	5	0	44	6	0	0
18	Kolubarski	60	5	0	35	25	0	0
19	Mačvanski	45	7	0	30	15	0	0
20	Pirotski	30	1	0	20	10	0	0
21	Toplički	30	5	0	26	4	0	0
22	Pčnjski	15	1	0	14	1	0	0
23	Jablanički	35	2	1	13	7	9	6
24	Nišavski	60	2	2	24	6	24	6
25	Sremski	59	11	1	38	16	5	0
Ukupno		**1.516**	**134**	**15**	**954**	**402**	**136**	**24**

Kao što se može da vidi u tabeli 6, ispitivanjima je bilo obuhvaćeno 1.516 svinja u 149 klanica. Najveći broj ispitanih svinja poticao je iz zanatskih klanica, 1.356 (89,45%), a iz industrijskih klanica ispitano je 160 (10,55%). Pozitivan imuni status utvrđen je u zanatskim klanicama kod 954 (70,35%), a u klanicama industrijskog tipa kod 136 (85%) zaklanih svinja.

Prema podacima prikazanih u tabeli 7, u kojoj je dat procenatualni odnos pozitivnog i negativnog nalaza po klanicama u okruzima, zapaža se velika heterogenost imunosti svinja prema klasičnoj kugi. Analizirajući rezultate ispitivanja dobijenih iz uzoraka krvi uzorkovanih u zanatskim klanicama zapaža se da je najmanje imunih svinja zaklano u Zlatiborskom okrugu, svega 33,33%, međutim i u Borskom kao i u Šumadijskom okrugu manje od polovine zaklanih svinja je bilo imuno na klasičnu kugu. U industrijskim klanicama, u Moravičkom okrugu, takođe, manje od polovine zaklanih svinja je bilo imuno na klasičnu kugu. Malo je klanica zanatskog tipa u kojima su zaklane svinje bile imune sa više od 90%, to su klanice u Podunavskom i Pčinjskom okrugu, kod klanica u ostalim okruzima procenat pozitivnog nalaza se kretao između 60 i 80%. U industrijskim klanicama koje se nalaze u Raškom, Braničevskom, Severnobačkom i Sremskom okrugu sve zaklane

svinje bile su imune na klasičnu kugu svinja, međutim i kod ostalih klanica industrijskog tipa utvđen je visok procenat imunosti i on se kretao od 60 do 95%.

Tabela 7: Prikaz rezultata ispitivanja u procentima pozitivnog i negativnog nalaza u okruzima prema tipu klanice

Br.	**Okruzi**	**Broj. isp. svinja**	**Zanatske klanice**		**Industrijske klanice**	
			Poz. nalaz %	**Neg. nalaz %**	**Poz. nalaz %**	**Neg. nalaz %**
1	Grad Beograd	100	81,25	18,75	85	15
2	Južnobanatski	100	85	15	0	0
3	Pomoravski	63	75	25	93,33	6,67
4	Šumadijski	25	40	60	0	0
5	Zlatiborski	78	33,33	66,67	0	0
6	Raški	52	74,45	25,54	100	0
7	Moravički	15	80	20	40	60
8	Rasinski	78	70,51	29,49	0	0
9	Braničevski	74	67,8	32,20	100	0
10	Podunavski	30	96,67	3,33	0	0
11	Borski	95	38,67	61,33	80	20
12	Zaječarski	38	55,26	44,74	0	0
13	Zapadnobački	99	73,74	26,26	0	0
14	Severnobački	105	75,79	24,21	100	0
15	Južnobački	80	83,33	16,67	95	5
16	Srednjebanatski	100	76	24	0	0
17	Severnobanatski	50	88	12	0	0
18	Kolubarski	60	58,33	41,67	0	0
19	Mačvanski	45	66,67	33,33	0	0
20	Pirotski	30	66,67	33,33	0	0
21	Toplički	30	86,67	13,33	0	0
22	Pčnjski	15	93,33	6,67	0	0
23	Jablanički	35	65	35	60	40
24	Nišavski	60	80	20	80	20
25	Sremski	59	70,37	29,63	100	0
Ukupno		**1.516**	**70,35**	**29,65**	**85**	**15**

Zaključak

Prema dobijenim rezultatima ispitivanja iz monitoringa imunizacije svinja protiv KKS može se zaključiti da se utvrđeni nivo imunosti razlikuje od okruga do okruga i da je veoma heterogen, međutim prosečan nivo imunosti, posmatran na nivou Republike Srbije, za sve okruge, iznosi 83,84%, odnosno od 4.430 ispitanih svinja pozitivan nalaz imunosti svinja protiv klasične kuge utvrđen je kod 3.714 svinja. Kontrolom imunosti svinja na liniji klanja, od 1.516 ispitanih svinja pozitivan imuni status je utvrđen kod 1.090 (71,90%) zaklanih svinja.

Dobijeni rezultati predstavljaju dobru osnovu za potrebne analize i zaključke u vezi izrade novih programa nadzora KKS u Republici Srbiji, koji će se bazirati isključivo na implementaciji biosigurnosnih mera, bez primene imunoprofilakse. Istraživanja treba proširiti u cilju svestranijeg sagledavanja mogućnosti prestanka vakcinacije svinja protiv klasične kuge. Ispitivanjima mora biti obuhvaćeno više svinja, posebno iz seoskih gazdinstava u kojima se mere biosigurnosti uglavnom i ne sprovode.