ALEXANDER, D.J. 2000. Newcastle disease in ostriches (Struthio camelus); a review. Avian Pathology, 29: 95-100.


Reports that Newcastle Disease (ND) is caused by a filamentous negative strand RNA virus of the family Paramyxoviridae which, with the other avian paramyxoviruses, is currently placed in the genus Rebulavirus. There are nine recognised serotypes of avian paramyx-ovirus (APMV-1 TO APMV-9), ND viruses from the APMV-1 serotype. It occurs in wild birds, caged 'pet birds', racing and show pigeons and domestic poultry.


Reports on a SAPA committee meeting at Muldersdrift, South Africa in August 2006 to discuss avian influenza in a transparent manner and to seek more consensus amongst stakeholders. Proposed disease control measures are discussed.


This proceedings contains topics on trends in the European poultry and egg market and the impact of European Union enlargement. It includes a paper on marketing strategies and consumption of ostrich meat in Birmingham, UK.


Because of the fact that South Africa is a Newcastle disease virus (NDV)-endemic country, major concerns exist that the export of ostrich meat could transmit velogenic strains of this disease. The ability to transmit the virus could be reduced by effective vaccination of South African ostriches. In this study, two vaccination trials were conducted to assess serum antibody production in response to vaccination with La Sota strain NDV vaccines. To this end, a commercially available fowl anti-NDV biotin-avidin ELISA was modified for the detection of anti-NDV antibodies in ostrich serum. The results obtained with this ELISA were verified by comparison with an indirect ELISA. In the first trial, 60 ostriches were immunized subcutaneously four times with different volumes of an inactivated vaccine (Lomavac) and their immune response was determined from 2.5 months up to the ideal slaughter age of 14 months. Results indicated that ostriches responded in a dose-dependent manner and gave support for the vaccination schedule currently recommended to South African farmers. In a second trial, immunization by eyedrop with a live La Sota vaccine of 32 5-week-old ostriches did not elicit a humoral immune response. The results indicate that it is highly unlikely that ostriches that have been vaccinated according to the recommended vaccination schedule can transmit the virus.


The nucleic acid sequence of fragment 22-420 of the Newcastle disease virus (NDV) fusion protein gene could be used as the fingerprint sequence to differentiate the field strains from the vaccine strains according to the statistical analysis of the sequence divergence correlation between the genome and the fragment of 30 NDV strains by bioinformatic softwares (r=0.937). The degenerate primers were synthesized to amplify this fragment with the
established RT-PCR sequencing method. Two parameters, fingerprint sequence database and variations of the standard NDV live vaccines, were determined. Based on these results, a multifunctional automatic analysis software which could differentiate the live vaccines and field strains and predict their virulence genotypes simultaneously was developed. This new diagnostic method was useful in the analysis of the standard strains of NDV and could obtain results within 3 days. Field samples of NDV isolated from different species of poultry (goose, pigeon, ostrich and chicken) were also tested using this new method. Approximately 59% of the isolated strains of NDV represented the live vaccines.


The ostrich is susceptible to microorganisms of bacterial, fungal and parasitic origin. Anthrax, caused by Bacillus anthracis, is dangerous to other livestock and humans. Salmonella is transmitted from rodents or bird wild reservoirs. Pausterellosis caused by Pasteurella multocida results in air sac infections in ostriches. Colibacillosis is caused by Escherichia coli. Tuberculosus caused by Mycobacterium avium, is very rare in ostriches. Aspergillosis principally afflicts chicks. Zygomycosis, a secondary fungal infection of the upper gastrointestinal tract, is caused by Basidia, Mucor and Rhizopus. Leucocytozoon struthionis and Plasmodium spp. are harmless protozoa transmitted from flying arthropods. The tapeworm, Houttuynia struthionis, is dangerous in young ostriches. The adult ratite fluke (Philophthalmus gralli) is transmitted to ostriches following ingestion of infected freshwater crustaceans. Tick infestations of ostrich skin in Africa include Amblyomma spp., Haemaphysalis punctata, Hyalomma spp., Rhipicephalus turanicus and Argus spp. The ostrich quillmite (Pterolichus bicaudatus) and louse (Struthioliperus struthionus) may lower skin and leather quality via pruritis and/or excessive preening and feather loss. Nematode infections are rare.


18 papers are included in this issue including one on haematological and biochemical parameters of ostriches after vaccination against Newcastle disease.


A 'disease of the head' affecting horses, as described in the 17th Century is now known as Borna disease. Research over the past 100 years has established that the aetiological agent, Borna disease virus (BDV), is an unsegmented, single- and negative-stranded, enveloped ribonucleic acid (RNA) virus which represents the family Bornaviridae in the order Mononegavirales. The virus exists world-wide in horses, sheep, cattle, cats, dogs and ostriches. The infection can be fatal, but the majority of carriers are persistently infected without showing symptoms. The association with psychiatric diseases in humans led to an international explosion of research on BDV, with centres established in Germany, the United States of America and Japan. Experimental infections of tree shrews and rats served to examine the effects of persistent and overt disease, most excitingly, virus-induced behavioural changes, and emotional and learning deficits. This 'emerging' virus infection shows complex pathogenetic mechanisms in the nervous system, but also spreads through myelo-monocytic cells. Diagnosis can be made serologically, but detection of antigen markers in peripheral white blood cells, combined with nucleic acid amplification is more profitable. Comparative RNA studies reveal an unusually high genetic homology of viruses. Isolates recovered from
humans and equines suggest species-specificity. Vaccination is not an advisable strategy, but antiviral therapy, especially with amantadine sulphate, promises efficacy in human mood disorders, and is effective in vitro. Infections with BDV follow a vulnerability principle to cause disease. Although cross-species transmission of this commensal virus has not been proven, zoonotic aspects of BDV should be carefully considered.


The epidemiology, clinical signs, pathology, diagnosis and prevention of borna disease virus (BDV) infection in ostriches are discussed. The role of migratory wild birds in the transmission of the disease is also suggested.


An avian influenza vaccine (H5 and H9 serotype) was prepared by inoculating susceptible chicken embryos with A/Ostrich/Denmark/72420/96 (LPA1-H5N2) and A/chicken/Shanghai/1/98 (H9N2), respectively. The fluids of infected embryos were harvested, ultra filtrated, concentrated and inactivated with formalin. The vaccine was added with oil adjuvant and then tested for safety by intramuscular injection on 4-week-old SPF (specific pathogen free) chicken at 2 ml/bird. No systematic and local lesions were found on injected chickens. In potency test, 4-week-old SPF chickens were inoculated with one dose bird. All the inoculated chickens were protected, whereas chickens and the chickens in control group were infected or died. By determination, one dose of the product contains eight immune doses at least. In immune-interference test, two AI strains showed inhibited synergism.


In order to analyse the sequence similarity of haemagglutinins (HA) gene among avian influenza virus (AIV) subtype H5N2 isolates, the HA gene of avian influenza virus A/Ostrich/Denmark/72420/96 (LPA1-H5N1) isolate was amplified by using reverse transcription-polymerase chain reaction (RT-PCR) according to the sequence published on GenBank and then the sequences were compared with the GenBank data. It was found that the cDNA contained 1373 bp covering the whole ORF of HA gene. The HA gene sequence of the isolated strain shared about 80% nucleotide sequence identity with H5N1 isolates, but about 97% with some H5N2 isolates. The results confirmed the high frequency of recombination of eight segments of AIV genome and the high variation ability of AIV. The amino acids of cleavage site were E-T-R, which confirmed that LPA1-H5N1 was a low pathogenic strain. The amino acid sequence shared about 90% identity with H5N1 isolates and the antigens were almost the same. So the H5N2 vaccine could protect fowls from H5 subtype infection.


A liquid phase blocking ELISA (LPB-ELISA) was adapted for the detection and quantification of antibodies to Newcastle disease virus. Sera from vaccinated and unvaccinated commercial flocks of ostriches (Struthio camelus) and rheas (Rhea americana) were tested. The purified and nonpurified virus used as the antigen and the capture and detector antibodies were prepared and standardized for this purpose. The hemagglutination-inhibition (HI) test was regarded as the reference method. The cutoff point for the LPB-ELISA was determined by a two-graph receiver operating characteristic analysis. The LPB-ELISA titers regressed significantly (P < 0.0001) on the HI titers with a high correlation coefficient (r = 0.875). The two tests showed good agreement (kappa = 0.82; P < 0.0001), relative sensitivity (90.91%) and specificity (91.18%), and accuracy (91.02%), suggesting that they are interchangeable.

NOVAK, I.L., SIMPRAGA, M. & MAZIJA, H. 2004. Humoral immune reaction of ostriches vaccinated against Newcastle disease by different routes. : 82-88. Proceedings of the 11th Ostrich World Congress, Island Great Brijun, Croatia, 15-17 October 2004 : 82-88. The influence of the different routes of vaccination in adult ostriches against Newcastle disease using the La Sota strain of Newcastle disease virus was investigated. The vaccine was given through occulonasal route, spraying (aerosol) and in drinking water. Regardless of the mode of application, the vaccine induced specific immune response by developing specific haemagglutination inhibition antibodies. At the same time, there were no harmful reactions of the given vaccine. Vaccination by aerosol and occulonasal routes proved to be the best routes when compared with the water application, wherein the antibodies developed earlier and reached higher titres. It is a relatively short duration of humoral specific protection against the Newcastle disease because the developed antibodies disappeared relatively soon, regardless of the mode of vaccine application. The differences are observed in the parts of immune system reached by the vaccine given through different methods. This finding corresponds to the statistically significant increase in titres of haemagglutination inhibition antibodies of the blood sera of ostriches vaccinated by the mentioned modes. The result of the investigation indicates the necessity of aerosol application of specific vaccine against Newcastle disease.

NOVAK, I.L., MAZIJA, H., SIMPRAGA, M., STOKOVIC, I., ZELENIKA, T.A. & VOJTA, A. 2008. Effects of various application routes of Newcastle disease vaccine on specific antibody titres in ostriches. Acta Veterinaria (Beograd), 58: 159-165. Newcastle disease (ND) is one of the most important diseases of poultry and other avian species. The usual mean to control ND is specific immunoprophylaxis. Although chickens are routinely vaccinated against ND, vaccination of ostriches is less well understood. We investigated the effect of vaccination against Newcastle disease via different routes on specific antibody titer in 24 adult ostriches, divided into three experimental and one control group. The vaccine was administered in drinking water to the first, by spraying to the second, and occlonasally to the third group. The results have indicated antibody production with titers sufficient for humoral immunity in all experimental groups. The strongest immune response was determined in the group vaccinated by spraying.

OLIVIER, A.J. 2006. Ecology and epidemiology of avian influenza in ostriches. OIE/FAO international scientific conference on avian influenza, Paris, France, 7-8 April, 2005: 51-57. Avian influenza is important because of its potential devastating effect on poultry health and trade. The ostrich industry of South Africa has not escaped the consequences of control and export restrictions resulting from notifiable virus infections. Ostrich farmers first observed a syndrome of green urine in the early and mid 1980s. An H7N1 subtype, causing high mortality in young ostriches but with a low pathogenicity index for chickens, was first isolated in 1991. The first highly pathogenic subtype affecting ratites was reported during the 2000 epidemic of H7N1 in Italy. Low pathogenic subtypes were isolated in South Africa from 1991 to 2004, with one HPAI isolated in 2004. International research work on ostriches with both H5 and H7 subtypes, in both low and high pathogenic pathotypes, found the severity of clinical disease was not directly correlated to the pathotype. The ecology and epidemiology of infections in ostriches is not well understood. Surveys suggest local migratory water birds may play an important role. They have direct contact with ostrich flocks through the free-range production systems. Seasonal occurrence is seen, with the wet colder months more favourable for virus survival and detection. Management, population density, immune status and age are other important determinants of the severity of disease. Surveillance and monitoring must be implemented to understand the ecology and epidemiology, which extends to the validation and standardisation of diagnostic and serological methods for ostriches. Serious consideration should be given to vaccination, education and the use of separate production zones as part of a control programme.

The first two isolates of H9N2 influenza virus were picked up from turkey and chicken hosts in May 2000, but the actual epizootic of the low pathogenicity avian influenza (LPAI) H9N2 virus started in December 2001, following a 1.5-year period of silence, during which the H10N7 and H6N3 influenza viruses were isolated sporadically. The outbreak of the H9N2 influenza began in northern Israel, from where the epizootic spread all over the country. Damage was relatively limited because of the widespread use of an inactivated vaccine. Single isolates were recorded in commercial ostrich and goose flocks, and in a wild pigeon. Apart from the routine serological tests, the diagnostics used the RT-PCR (reverse transcription polymerase chain reaction) test with type-specific primers related to the M and nucleoprotein (NP) genes, and a set of subtype-specific primers related to all the haemagglutinin (HA) and neuraminidase (NA) subtypes. All the primers were specially constructed. The part coding for N-terminus of the H1 chain of the HA gene of 61 out of 400 isolates was sequenced. The isolates showed a high rate of mutability, and differed distinctly from the H9 prototype strain; they belong to the same phylogenetic lineage divided into three sublineages, one of which exhibited a unique cleavage-site motif RSKR. The result indicates that two parallel evolutionary trends originated from the same local "prototype" isolate.


The aim of this study was to assess the efficacy and immune response to different vaccination programmes for ostriches prescribed by the European Permanent Veterinarian Committee.


Three ostriches (Struthio camelus) were immunized with commercially available live and killed Newcastle disease (ND) vaccines for chickens and the antibody responses to the ND vaccines were evaluated by a virus-neutralization (VN) test. Primary vaccination with the live vaccine, B1, by eye drop was followed with two shots of alum-precipitated killed vaccine via subcutaneous injection in the neck. As a final booster, another live vaccine, Clone 30, was used by eye drop. A VN antibody titer, more than 1:10 was observed for 6 months. This is the first report on the use of a live vaccine by eye drop as a booster in ostriches as well as evaluating responses to ND vaccines using the VN test in this avian species.


Serum samples from 191 ostriches (Struthio camelus) in Japan were tested for antibodies to Newcastle disease virus (NDV) and avian influenza virus (AIV). Twenty-two (12%) contained NDV-specific neutralizing antibodies by a virus-neutralization (VN) test without vaccination. Antibodies to AIV were not detected in the any sera by an agar gel precipitation test. Seven serum samples that had vaccinated with live NDV by eye drop were all positive by the VN test at 1 month post vaccination. A haemagglutination inhibition (HI) test for NDV seemed not to be suitable for ostriches because of non-specific agglutination of chicken red blood cells. No haemagglutinating viruses were isolated. This is the first report on detection of antibodies against NDV in ostriches in Japan.

SIMPRAGA, M. 2004. Veterinarski Fakultet Sveučilišta u Zagrebu (Faculty of Veterinary Medicine, University of Zagreb), Zagreb, Croatia, Proceedings of the 11th Ostrich World Congress, Island Great Brijun, Croatia, 15-17 October 2004.: 1-132.

Papers cover ostrich rearing, including egg incubation and hatching; ostrich farming in Germany, Australia, China, Korea and Japan; chick rearing and diseases; nutrition; borna disease virus infection; control and prevention of hatchery-related infectious diseases; digestive and genital tract anatomy; meat inspection and quality; humoral immune response by Newcastle disease vaccination; the occurrence of lybiostrongylosis in Croatian ostrich farms; commercial ostrich flock insurance; the most common ostrich diseases in Croatia; avian influenza in Thailand; breeder management and husbandry practices and husbandry and nutritional practices in ostrich chick rearing.


Background and Purpose: Although chickens are routinely vaccinated against Newcastle disease, vaccination of ostrich is less well understood. To assess the effect of vaccination on the health of ostriches, key biochemical parameters and differential blood count were monitored after vaccination by La Sota strain of the Newcastle disease virus, which is widely used in chickens. Materials and Methods: The investigation was performed in 24 adult ostriches divided into three study groups and a control group, each comprising six ostriches. In the study groups birds were vaccinated via different routes: drinking water oculo-nasally or by spraying. Blood samples were collected immediately before the vaccination and on days 7, 14, 21 and 28. Total erythrocyte counts, hemoglobin concentrations, hematocrit values, as well as total and differential leukocyte counts were assessed. Total albumins and globulins in serum were quantitated spectrophotometrically. Results: Erythrocyte count, hemoglobin concentration, hematocrit values and total leukocyte count were not significantly changed in any group. Only leukocyte differentiation yielded a significant decrease in eosinophiles in all groups and a significant monocyte increase in groups vaccinated via drinking water and oculo-nasally. While the lower eosinophil count could be attributed to the experimental stress, increased monocyte percentage indicates successful immunological reaction against the vaccine virus. In all groups, total serum proteins were elevated within physiological boundaries, with albumin to globulin ratio suggesting stimulation of antibody production. Conclusion: The results did not indicate any adverse health effects. Therefore, the vaccine which is already routinely used for chickens can be safely applied in ostrich.


Seven adult ostriches (Group I) were vaccinated with 0.2 ml of anthrax vaccine (R1190), while another 6 ostriches (Group II) were inoculated with 0.3 ml of the vaccine. The immune response was assessed with the Mancini and zinc sulfate precipitation tests using blood samples collected 3 weeks postvaccination in both groups, and in the second group 5 months postvaccination. A vaccine dose of 0.3 ml/adult bird was able to induce satisfactory immune response against anthrax. Quantifiable and protective antibody levels were reached 3 weeks postvaccination. However, a booster should be given at least 4 months after the first dose to promote continuous immunity.


Seven adult ostriches (Group I) were vaccinated with 0.2 ml of anthrax vaccine R1190, while another 6 ostriches (Group II) were vaccinated with 0.3 ml. Blood was sampled 3 weeks and 5 months postvaccination, and the sera subjected to antibody testing by liquid medium precipitation test. The use of 0.3 ml of the R1190 anthrax vaccine from Romania is recommended, to be repeated after not more than 4 months after initial vaccination. The
liquid medium precipitation test was a fast and reliable method for monitoring the immune response of ostriches based on the formation of anti-anthrax antibodies.


The current state of ostrich farming in Greece was examined by collecting data through a questionnaire survey on the characteristics of ostrich enterprises and their owners along with their farm management practices. A total of 30 ostrich farms were recorded in the spring of 2001 and most of them were located in west (20%) and central (17%) Greece. The average number of reproductive trios (one male and two females) was 7 and the average size of ostrich flocks was 79 birds. Most of the ostrich enterprises were operated as limited partnerships (67%) belonging to a sole owner (53%). The mean age of operation was 2 years. The majority of the ostrich enterprises (63%) employed at least one administrative employee. The profile of the ostrich farm owners was that of a man, 30-44 years old (50%), whose education level was mostly technical school (33%). The average surface area of the ostrich farms was 18 hectares and the average number of buildings on the farm was 2. The majority of farmers (40%) slaughtered ostriches by themselves. Vaccines and medicines were used in 80% of the farms and anthelmintics in 53% of the farms. The most common groups of anthelmintics used were imidazothiazoles (10%) and avermectins (10%). Selection of anthelmintics was based mostly on the advice of a veterinarian (63%).


The current approach in the RSA towards NDV, an OIE List A disease, is not on a par with the standards required by the World Trade Organisation. This has major implications for the commercial poultry and ostrich industries. The significant economical effects of NDV outbreaks on commercial as well as the socio-economic effects of NDV epizootics in rural poultry, are further reasons to initiate a well- co-ordinated, national strategy against NDV 14.


Scientific knowledge of ostrich diseases is incomplete and very fragmented, with specific details on technical aspects of diagnostic and/or screening tests completely absent in most cases. Salmonella Typhimurium is common in multispecies collections and causes mortality in chicks younger than three months on commercial farms, but is rarely found in chicks older than six months, or slaughter birds of twelve to fourteen months in southern Africa. Campylobacter jejuni and Chlamydia psittaci are occasionally reported, mainly in young ostriches, but both remain a diagnostic challenge. Crimean-Congo haemorrhagic fever is transmitted to domestic animals including ostriches, principally by ticks of the genus Hyalomma. In the ostrich, the disease causes no clinical symptoms during a viraemia of approximately four days. Spongiform encephalopathy has not been reliably reported in ostriches, while anthrax has occurred rarely in modern times but was reportedly an important cause of death approximately 100 years ago in South Africa. Salmonella Gallinarum and S. Pullorum are unknown in ostriches. Pasteurella multocida occurs but is easily contained with antibiotics. Mycoplasma spp. are regularly found in an upper respiratory disease syndrome complicated by opportunistic bacterial pathogens. Ostriches of all ages are susceptible to challenge by velogenic Newcastle disease virus (NDV), but standard inactivated La Sota poultry vaccines can stimulate protective immunity lasting over six months. The viraemic period in vaccinated slaughter ostriches is between nine and eleven days and there are no indications of a carrier state or presence of the virus in the meat or any other tissues after this period, with peak immunoglobulin G response reached on day fourteen post infection. Haemagglutination inhibition tests are significantly less sensitive and less specific than enzyme-linked immunosorbent assays. Cloacal and choanal swabs used for direct virological screening in clinically affected cases (field and experimental) could not detect NDV. All avian influenza isolates reported from ostriches have been non-pathogenic to poultry, even the H5 and H7 subtypes. Some of the latter have been associated with mortality of ostrich chicks in localised outbreaks during periods of inclement weather and with significant wild bird (waterfowl) contact. Borna disease causes a nervous syndrome in ostrich chicks, but to date, has only been reported in Israel. Eastern and Western equine encephalomyelitides cause fatal
disease in ostriches and other ratites, with mortality ranging from less than 20% to over 80% in affected flocks. These diseases are present in North, Central and South America where the associated ornithophilic mosquito vectors occur. Equine and human vaccines are apparently safe and efficacious in ratites. Wesselsbron disease, infectious bursal disease (type 2), adenovirus and coronavirus infections have been reported from ostriches but the significance of these diseases is unclear. Due to the paucity of data regarding ostrich diseases and the unvalidated state of most poultry tests in this unique group of birds, strict observation of a pre-slaughter quarantine of thirty days is strongly advised, whilst live exports and fertile eggs should be screened through the additional use of sentinel chickens and/or young ostriches.


Two 3-month-old ostriches (birds 4 and 5) were inoculated with Newcastle disease (ND) vaccine II and 3 ostriches were unvaccinated controls. Haemagglutination inhibition (HI) antibody titre to ND were measured in serum samples. All birds were then infected with virulent ND virus. All control birds died after infection. One of the vaccinated birds showed clinical signs of ND but survived and the other vaccinated bird showed no clinical signs.