家禽誌 19(3) : 137~150(1992)

K.J. Poul. Sci. 19(3) : 137~150(1992)

Current Situation of Poultry Diseases in Korea

Ki-Seuk Kim

Veterinary Research Institute, Rural Development Administration

480, Anyang, Kyunggido, Korea

(Received September 20, 1992)

韓國의 家禽疾病 現況

金基錫

農村振興廳, 家畜衛生硏究所

(1992. 9. 20 접수)

초 록

韓國에 있어서 養鷄産業은 大規模의 現代化된 農場과 오래된 小規模農場이 兩立하고 있는 매우 複雜한 樣相을 나타내고 있는 狀況으로써 이러한 연유로 인해 各種 傳染性 疾病에 있어서도 혼란된 疫學的 狀況이 야기되고 있는 實情이다.

國內에서 경제적으로 重要視되고 있는 主要 家禽疾病으로는 大腸菌症, 雛白痢, 마이코플라즈마 갈리셉티쿰 感染症, 傳染性 코라이자, 傳染性 滑膜炎등의 細菌性 疾病, 뉴캣슬病, 鷄痘, 마렉病, 鳥腦脊髓炎, 傳染性 F 囊病, 傳染性 喉頭 氣管炎, 傳染性 氣管支炎 등의 바이러스性 疾病 그리고 原虫性 疾病으로써 콕시듐病을 들 수 있다.

한편으로 家禽 인플루엔자, 家禽콜레라 및 家禽티푸스는 最近 數十年間 國內發生이 報告된 바 없으며 外來性 疾病으로 간주되고 있다.

本稿에서는 國內 發生하고 있는 上記 主要 家禽疾病들의 疫學的 狀態, 經濟的 영향, 防除方案 및 最近 硏究 活動에 대해서 論하였다.

INTRODUCTION

Among the several fields of animal industry in Korea, the poultry industry showed the fast growth rate in the past 30 years. However, the poultry farming was still in a side job situation in the 1950's. In the 1960's it became a full-time job for many farmers. In order to meet the ever increasing demand for livestock products, the government has followed the Livestock Industry Promotion Plan since the early 1970's. As a result, the poultry industries in this country have rapidly developed to a modern type of enterprise.

In Korean poultry industry, chicken occupy all most of total domestic fowl and others such as ducks, geese, turkeys, pheasants and quails are being raised in small numbers. As shown in Table 1, the chicken population and production of chicken meats and eggs increased about 3

이 논문은 1992년 9월 7~13일 FFTC / ASPAC과 태국 Kasetsart 대학이 공동 주관한 국제 세미나에서 발표된 내용임.

Table 1. Chicken statistics and production record of chicken meats and eggs

Year	Total No. of chicken (×10^4)	Chicken meats Production (×10^{3}M/T)	Chicken meats Index	Eggs Production (×10^6)	Eggs Index
1970	2,363	45.2	100	2,456	100
1975	2,094	55.7	123.2	2,896	117.9
1980	4,013	90.9	201.1	4,543	185.0
1985	5,108	126.2	279.2	5,390	219.5
1986	5,932	129.4	286.3	6,029	245.5
1987	5,847	140.7	311.3	6,573	267.6
1988	6,169	149.0	329.7	7,220	294.0

times during the past 20 years.

In spite of the successful development in establishing poultry industry in the country, incidence of various diseases showed continuously increasing trend, possibly due to increase in size of farming, intensity of chicken population, and importation of the breeds from foreign countries. Table 2 shows major poultry diseases identified and reported in the country. Among them, the epidemiological status of economically important poultry diseases that prevail in fields, their economic impact, control measures and recent research activities, are discussed in this paper.

Major Bacterial Diseases

Avian colibacillosis

Avian colibacillosis is one of the most serious diseases in domestic poultry industries and particularly, causes serious economic losses in broilers and laying hens when it is complicated with respiratory mycoplasmosis or viral diseases such as infectious bronchitis, and infectious laryngotracheitis. It causes higher mortalities during rearing, reduced weight gain and poorer

Table 2. Detection and identification of poultry diseases in Korea

Year	Diseases identified and characterized
1920's	Newcastle disease, Pullorum disease, Fowl cholera
1940's	Fowl pox
1950's	Avian coccidiosis
1960's	*Mycoplasma gallisepticum* infection, Colibacillosis, Staphylococcosis, Lymphoid leukosis
1970's	Infectious coryza, Marek's disease, Avian encephalomyelitis, Infectious bursal disease
1980's	Infectious synovitis, Egg drop syndrome'76 Infectious laryngotracheitis, Infectious bronchitis, Inclusion body hepatitis

food conversion in broilers and reduced egg production due to salpingitis and peritonitis in laying chickens.

With *Escherichia coli* antisera of 24 different 0 groups, 224(61.9%) of 326 strains isolated in the country were classified into 18 0 groups. The most prevalent 0 group was 0 128(22.7%), and followed by 0 1(7.2%), 0 124(4.5%), 0 8(3.9%), 0 2(3.6%), 0 6(3.3%) and 0 26(3.0%)(Kim *et al.*, 1983). Another survey(Kim *et al.*, 1991) conducted with 8 kinds of 0 group sera showed that 48.3% of 298 strains tested were classified into those 0 groups. The prevalent 0 groups found were F-1(13.1%), 0 78(12.1%), 0 2(7.4%) and 0 1(6.0%).

For the effective prophylactic and therapeutic treatments, many kinds of antimicrobial drugs have been used extensively for more than two decades in the country. However, incidences of the disease showed continuously increasing tendency mainly due to the increase in appearance of drug resistant strains.

Table 3 shows the prevalence of drug resistance of *E. coli* isolated from chickens with colibacillosis. The majority of the field isolates were resistant in order of prevalence to tetracycline, streptomycin and sulfonamides, and 30~10% of strains tested were resistant to ampicillin, chloramphenicol and kanamycin, respectively, while most of them were susceptible to colistin and gentamicin. The conjugal transfer test of drug resistance indicated that resistant strains possessed R plasmid being able to transfer their resistance to all tested drugs but colistin into the drug susceptible-recipient strain of *E. coli*(Kim *et al.*, 1988).

Recently laboratory trial was carried out with an autogenous polyvalent vaccine developed from 3 field isolates(F-1, F-2, and F-3) prepared with either aluminum hydroxide gel or oil adjuvant. Based on the measurements such as mortality and body weight gaint, both types of vaccines were highly effective against a challenge with each homologous strain and showed no adverse reaction. Field application of the vaccine is now being done to chickens.

Pullorum disease

The first outbreak of the disease in this country is based upon the isolation of causative agent, *Salmonella pullorum* from young chickens with white scour imported from Japan in 1924.

For the detection and elimination of carriers from the breeder flock, several varieties of sero-

Table 3. Antimicrobial drug resistance and transferable R plasmid in 346 strains of *E. coli* isolated from chicken with colibacillosis

Antimicrobial drug	No.(%) of resistant strains	No.(%) of strains transferred resistance
Tetracycline	289(83.5)	161(55.7)
Streptomycin	261(75.4)	135(51.7)
Sulfadimethoxine	249(70.0)	87(34.9)
Ampicillin	114(32.9)	90(78.9)
Chloramphenicol	105(30.3)	93(88.6)
Kanamycin	80(23.1)	40(50.0)
Colistin	25(7.2)	0
Gentamicin	1(0.3)	1(100)

logical testing methods have been employed. At the early time, macroscopic tube agglutination test was applied, but it was found that the test was unsatisfactory for field mass application. Thereafter, a stained antigen whole blood test was introduced from USA in the year of 1933 and it gave the good results of advantages in practice and economy, comparing with other tests like agglutination, precipitation or fixation test having been used at that time.

During the 2 years from 1965 to 1966, the survey on the distribution of the varient antigenic types of *Salmonella pullorum* isolated in the country was conducted by Choi *et al.*(1968). The results revealed that among 164 field isolates of *Sal. pullorum* tested, standard type was 53.1% (87 strains), and followed by intermediate type (34.2% : 56 strains), and varient type(12.8% : 21 strains) as shown in Table 4.

After that time, the polyvalent diagnostic antigen prepared with three antigenic types of *Sal. pullorum* was produced and has been being employed until now.

Thanks to practice of a national eradication program, Detection rate of positive reactors in breed stocks has dropped from 2.7% in 1964 to less than 0.4% in recent years. And clinical form of the disease has not been detected in young chicken from 1985 to present.

The antimicrobial drug susceptibility test indicated that all field isolates of 65 *Salmonella* strains(mainly *Sal. pullorum*) were susceptible to ampicillin, colistin, chloramphenicol, gentamicin, kanamicin, and trimethoprim-sulfamethoxazole. A higher percentages of them were resistant to streptomycin, sulfonamides, and tetracycline(Kim *et al.*, 1984).

Mycoplasma gallisepticum infection

Mycoplasma gallisepticum(MG) infection is commonly designated as chronic respiratory disease(CRD) of chicken and infectious sinusitis of turkey, characterized by respiratory rales, coughing, nasal discharge and frequently sinusitis in turkey. It causes severe economic losses when complicated with some respiratory virus infections such as Newcastle disease, Infectious laryngotracheitis and Infectious bronchitis, and usually colibacillosis.

In the country, clinical symptom and pathological lesions similar to those of the disease were already observed in the early 1960's but it was confirmed through the isolation of causative agent from chicken with chronic respiratiory signs(Lee *et al.*, 1967). And produced in 1970 diagnostic antigen was for the rapid serum agglutination test and has been used for field application since that time.

Serological data conducted in 1979 showed that of 2,415 breed chickens from 170 flocks, positive cases were 875(36.2%) on individual level and 112(65.9%) on flock level, respectively.

The results of antimicrobial drug sensitivity test indicated that field isolates of MG were highly susceptible to tylocin and tetracycline,

Table 4. Antigenic type of *Salmonella pullorum* isolated in Korea

Antigenic type	No. of isolates	Percent
Standard	87	53.1
Varient	21	12.8
Intermediate	56	34.2

and followed by erythromycin and chloramphenicol while they were resistant to penicillin, streptomycin, kanamycin and furazolidone.

In recent years, live vaccine was developed by using attenuated Mg strain of heat treatment or more than 110 passage level. These types of vaccine gave protective effect to SPF chicken after challege with pathogenic MG but no significant protectivity to commercial chicken under field conditions, compared with control group(Namgoong *et al.*, 1988). More recently, An oil-adjuvanted vaccine was developed and field application of the vaccine is now being done(Namgoong *et al.*, 1990).

Infectious coryza

Infectious coryza is an acute respiratory disease of chickens caused by *Haemophilus gallinarum*. It may affect a chicken of any ages and the infection results in retarded growth and reduced production of eggs, thus giving serious economic damage to the poultry industry.

In Korea, it has quite long been suspected as one of the important factors causing chicken respiratory disease in the field but its confirmation was first made in 1979 through isolation of the causative agent(Namgoong *et al.*, 1981).

A nationwide serological survey of the disease was pursued in terms of regional and age related distribution in 1981. Efforts were also made to establish clinical evidence of the infection and its mode of transmission by introducing SPF chickens into commercial flocks as sentinel (Namgoong *et al.*, 1982). One of the salient results obtained was that serologically positive cases were 179(14.1%) out of total 1,270 blood samples collected from 103 flocks in 4 different areas(Table 5).

Test of serotyping was done on the field isolates with reference to the strain Modesto provided from USA and the strain 221 from Japan in 1982, respectively. Based on serological classification, the field strains were classified into 2 serotypes. The prototype strains, PKA1 and PS4, were then selected for vaccine production(Namgoong *et al.*, 1983).

Each of monovalent vaccines prepared with aluminum hydroxide gel adjuvant was no more than 10% its protective effect when vaccinated chickens were exposed to challenge. Meanwhile, a combined bivalent vaccine was found most satisfactory providing a favorable protection (80%) as shown in Fig. 1.

In an effort to maintain high titred antibody level for longer period, oil emulsion were in vaccine preparaion and comparison was made with the already developed aluminum hydroxide gel vaccine. The oil vaccine produced the antibody titer 3 weeks after vaccination and the antibody lasted for 15 weeks. However, the aluminum hydroxide gel vaccine induced low antibody

Table 5. Distribution of antibodies against *Haemophilus gallinallum* in chicken by age

Age (days)	No. of flocks	No. of chickens tested	No.(%) of positive
60~120	30	359	34(9.5)
150~200	32	334	33(9.9)
>300	41	577	112(19.4)
Total	103	1,270	179(14.1)

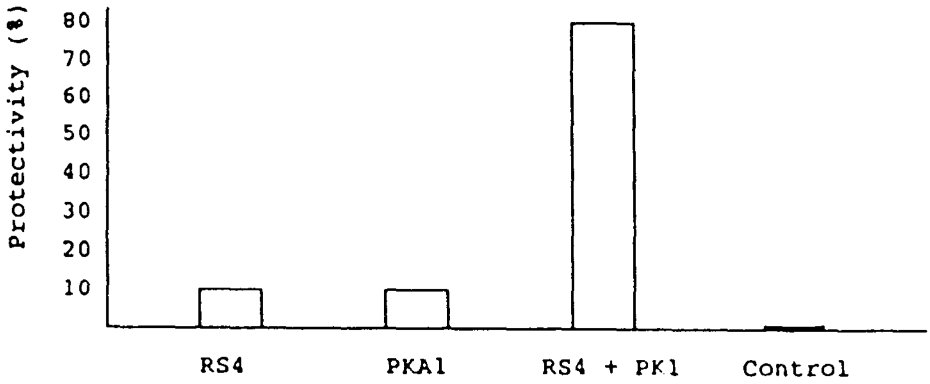

Fig. 1. Efficacy of the different types of *Haemophilus gallinarum* vaccine after challenge exposure.

responses and it was continued for only 7 weeks after vaccination.

Infectious synovitis

Infectious synovitis caused by *Mycoplasma synoviae*(MS) is characterized by lameness and retarded growth in broilers and replacement chickens, involving primarily the synovial membranes of joints and tendon sheaths producing an exudate synovitis, tenovaginitis or bursitis.

Epidemiological studies(Namgoong *et al.*, 1984) showed that out of 2,002 chicken sera collected from 218 flocks in breeding farms, 53.6% had agglutinating antibodies against MS. Eleven strains of Mycoplasma spp. could be isolated from chicken with lesions and of them, 8 strains were first identified to MS.

Thereafter diagnostic reagent antigen was developed for serum plate agglutination test in 1986. As its sensitivity and specificity were 97.3% and 95.4%, respectively, compared with standard product imported, its excellency was recognized. In recent years, the incidence of the disease tends to increase rapidly in especially replacement chicken in this country.

Major viral disease

Newcastle disease

Newcastle disease is the most destructive di: ease in the Korean poultry industry. The diseas was first reported from the United Kingdom i 1926, while an epidemic similar to Newcast disease was observed the next year from thos chickens raised in the central part of Kore. The infection of unknown cause was spread ra idly and its mortality reached about 100% of tl affected of any ages. It was so destrutive th the infection was called Korean fowl plague u til identified as the Asian type of Newcastle di ease in 1934 according to clinical manifestation

To control the disease, several attempts ha been made to develop effective vaccines(Tat 6). The first used was a formalin-inactivat prototype vaccine prepared from infect organs and tissues of chicken. Such a wet va cine induced immunity in a considerable degr when applied intravenously. This type of vaccine was further improved by using embryo tissues and amnio-allantoic fluid following successful adaptation of the virus to a chicken embryo in 1942.

Table 6. The development of Newcastle disease vaccine

History of vaccines developed	Years 1938	1942	1954	1956~1958	1966~1969	1986
Inactivated vaccines						
−Formalin treated						
infected visceral organ	○					
infected chicken embryo		○				
−$Al(OH)_3$ gel mixed			○			
−Oil emulsified						○
Attenuated vaccines						
−B1(intranasal)				○		
−B1(drinking water)					○	
−La Sota					○	

Efforts were continued to avoid the intravenous application of vaccine since the early 1950's. Developed was a vaccine in which infected chicken embryo tissues were inactivated and absorbed to the aluminum hydroxide gel(Lim *et al.*, 1954). This vaccine was proved most effective, maintaining its stability for 10 months when kept at 5℃ in dark(Lim *et al.*, 1962). With the ease in intramuscular administration, the vaccine was extensively used from that time. Further improvement was achieved with use of allantoic fluid to reduce the tissue content in vaccine. Its use has been widely practiced for the control of the disease since the late 1970's.

In the meantime, a modified live virus vaccine was developed by using the B1 strain of Newcastle disease virus introduced from Philippine in 1952(Mun *et al.*, 1957). This vaccine was first produced in frozen state but was improved as a freeze-dried type in 1958. Keeping the stability for 12 months storage at 5℃, this vaccine has been used for primary immunization in young chickens. Also developed in 1981 was the La Sota strain live vaccine and its use has been limited to those chickens over 4 weeks of age due to mild respiratory distress following vaccination in younger chickens.

In the late 1980's researches were conducted on the production of oil emulsion vaccine to extend the duration of immunity, and the combined vaccine for simultaneous protection against EDS'76 infection and Infectious bursal disease was also developed(Rhee *et al.*, 1986). This combined vaccine is being employed nationwide for the control of Newcastle disease.

More recently, to protect chicken from the infection in early stage of life, developed was concurrent administration method that vaccinate one-day-old chicken with B1 live vaccine by eye drop and oil adjuvanted vaccine by intramuscular injection(Kim *et al.*, 1989). The method gave satisfactory protective effect as long as 8 weeks against challenge, with no more addition of vaccination(Fig. 2). The method was also proved to be highly effective control measure even under the field conditions where Newcastle disease was endemic.

Fowl pox

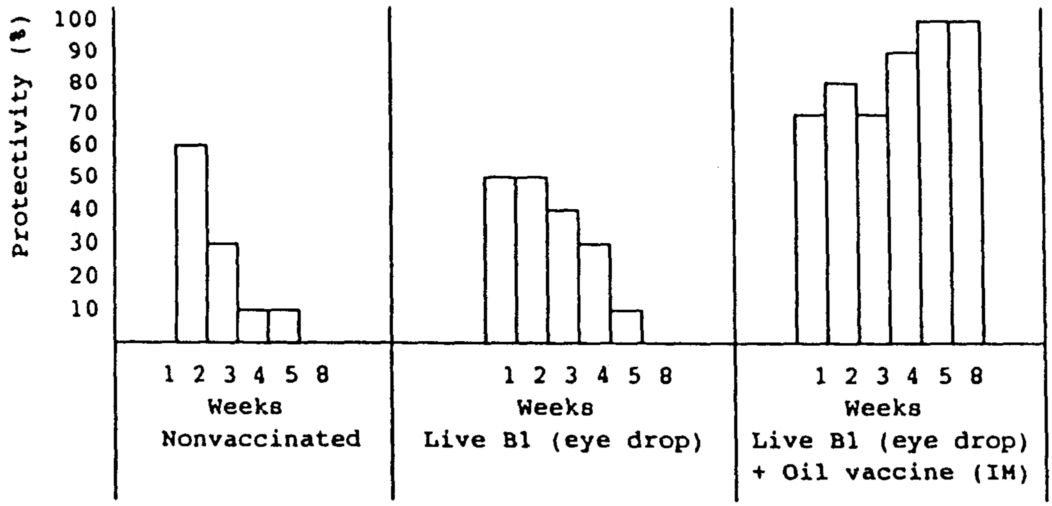

Fig. 2. Percentage protection in broilers with maternal antibodies vaccinated at 1 day and challeged at the indicated days after vaccination.

The disease in Korea was first reported to occur in 1939. The disease may be classified into 2 different forms, the skin form and the diphtheric form. The skin form is characterized by the appearance of typical pox lesions on the unfeathered part of the head such as eye lids, combs, wattles and corners of beak. In severe cases, these may spread to the feet, legs and skins.

In the diphtheric form, small caseous white patches appear in the oropharynx at the sides of tongue, on the palate and around the epiglottis. Nowadays, this form of fowl pox occurs rarely in the country, but once infected, death may result from suffocation by occlusion of the larynx with cheese-like plug.

In the late 1950's, vaccine production against the disease was first attempted with Nakano strain of embryo-adapted pox virus(Lim *et al.*, 1962). Chorio-allantoic membranes infected with the virus were ground and applied to chickens with the methods of sticking and brushing. The sticking method was found less satisfactory than the brushing method that induced solid immunity 10 days after application even when the chicken showed only one pock.

A pigeon pox virus strain was introduced in 1963 from the University of Minnesota in order to improve the efficacy of vaccine. The Minnesota strain vaccine was produced experimentally and compared with other kinds of vaccine in terms of safety and efficacy(Jeon *et al.*, 1965). It was demonstrated that the experimentally produced vaccine induced firm immunity without adverse postvaccinal reactions. This type of wet vaccine maintained high potency for 7 months when kept at 2℃ Later, it was improved as lyophilised form that was found stable for 12 months at 5℃.

Marek's disease

Marek's disease had been regarded as a type of avian leukosis before difference in etiology was evidence in 1962 and isolation of the

Marek's disease virus was eventually achieved in 1967.

In Korea, causative agent virus of the disease was first confirmed in 1969 by kim through cell culture studies of Marek's disease etiologic agent. On the basis of breederline and chicken age, the incidence of avian leukosis and Marek's disease in commercial chicken flocks was investigated in the early 1970's. The result showed that among the total 5,387 chicken observed, the average incidence rate of Marek's disease was very variable from 0 to 8%, depending on the breederline(Kim *et al.*, 1971).

To control the disease, the development of vaccine against the disease was encouraged and a vaccine strain, Herpesvirus of turkey(HVT) FC-126, was provided from USDA. Studies were conducted to propagate HVT in tissue culture and in various degrees of storing temperature to develop Marek's disease vaccine(Kim *et al.*, 1976). Replication of the vaccine virus was found more satisfactory in chicken embryo fibroblast cells than in duck embryo fibroblasts, and the potency of the vaccine was maintained most effectively through gradual freezing to −75℃ and subsequently complete freezing in liquid nitrogen. Agar gel diffusion tests revealed that antibodies to the virus were detected 2 weeks after vaccination in day-old chicken, along with the appearance of viremia.

The vaccine was also applied in field for evaluation of its safety and efficacy. The results showed that incidences of the disease in vaccinated and non-vaccinated groups were 0.25% and 4%, respectively. And its protective effect was found prominent as an average of 93.8% in vaccinated groups(Kim *et al.*, 1976).

During in 1980~1982, the cell-associated HVT vaccine was reevaluated under field condition and it was revealed that 3 to 60 times of the vaccine dosage used for an antibody-free chicken were required for inducing the corresponding degree of immunity in the progeny possessing maternal antibodies to the HVT virus(Choi *et al.*, 1982). It was also recognized in this regard that the vaccine was less effective than the CVI 988 MDV vaccine provided from the Netherlands, as shown in Table 7(Choi *et al.*, 1983).

Avian encephalomyelitis

Avian encephalomyelitis(AE) is an infectious viral disease characterized by high mortality in young chickens following incoordination and by reduced egg production with lowered hatchability in breeders.

In Korea, typical cases of the infection had been frequently observed from the young chickens submitted for post-mortem examination since the early 1970's. It was later confirmed as AE through pathological findings and virus isolation(Choi *et al.*, 1975).

For the development of vaccine against the infection, the vaccine strains, 0596 and Van

Table 7. Comparison of immune efficacy between HVT vaccine and MDV vaccine in chickens possessing maternal antibodies to HVT vaccine

Vaccine	No. of chickens vaccinated	No.(%) of chickens died due to MD
HVT	6,065	87(1.4)
MDV	5,864	50(0.9)

Roekel, were imported and the field isolates were employed for challenge tests. A vaccine of chicken embryo origin was first introduced in 1974. In its preparation, 4-day old chicken embryos were infected with the strain 0596. Infected brains were harvested and made in 10% suspension with a stabilizing medium before frozen at −30℃.

The efficacy of the vaccine was evaluated through laboratory tests and field application. The vaccine was proved safe and highly immunogenic when given orally to 8-week-old SPF chickens(Kim *et al.*, 1977).

To detect the antibody against AE virus in chicken sera, agar gel diffusion method is used as acreening test, and ELISA method using purified viral antigen is available for more rapid and sensitive serologic test in Korea(Kwon *et al.*, 1988).

Infectious bursal disease

Infectious bursal disease(IBD), also called Gumboro disease is of economic importance for broilers and pullet growers as in somecases it may cause mortality up to 30%. In addition, it retards the growth of a chicken and destroys its immune capacity when the infection occurs at an early critical age. Affected chicken, immunologically compromised, become highly susceptible to other infectious diseases and are liable to manifest a latent or inapparent in fection with complicated clinical illness. This disease is also incriminated as a cause of vaccination failure under field conditions.

A serological survey on the disease was conducted nationwide in the 1970's(Rhee *et al.*, 1981) and the result, as shown in Table 8, revealed that status of breeder stocks against the disease was not enough for the maternal antibodies to be transferred to their progeny, suggesting the necessity of booster vaccination to breeders so that their progeny could maintain high titred immunity during the early age.

For this reason, oil-adjuvanted vaccines were imported and have been widely applied to the breeders of 18~20 weeds of age since 1980. An inactivated vaccine has been developed as an aluminum hydroxide gel-adsorbed type or an oil-adjuvanted form in the country(Kim *et al.*, 1983). Meanwhile, commercial vaccine producers in Korea have developed a live attenuated vaccine in 1982 and its safety and immunogenicity in chicken was evaluated. The vaccine induced a slight bursal atrophy in chickens, however, it afforded a good immunity in chickens younger than 6 weeks and its use in field was recommended for primary immunization of the chicken over 3 weeks of age(Rhee

Table 8. Incidence of IBD virus infection in breeders

Age(week)	Incidence*	
	Individual	Flock
3~< 8	43/ 119	4/ 9
8~<16	119/ 354	19/ 25
16~<24	203/ 442	19/ 30
24~<50	430/ 874	40/ 63
>50	59/ 73	7/ 7
Total	934/1862	89/134

*No. positive/No. tested.

et al., 1984).

Infectious laryngotracheitis

Infectious laryngotracheitis is considered one of the exotic poultry diseases in Korea as its first outbreak took place in the island of Kangwha in February, 1982(Kim and Choi, 1984). The infection was so acute, showing characteristic signs of respiratory depression, gasping, and expectoration of bloody exudate and spread rapidly throughout the country. Vaccines were immediately imported and distributed to farmers for its prevention and control of the devastating disease.

Researches were initiated in May, 1982 on the development of vaccine against the infection and on the establishment of proper vaccination program. Adaptation of a vaccine strain was successfully achieved through the serial passage on the SPF chicken embryos. The strain was proved safe when dropped into the eyes of chicken with as much as 2×10^5 TCID 50 for a chicken. No serious postvaccinal reactions were observed other than swelling of the eye lid. The strain was selected for vaccine production and has been used extensively in the field.

Recently, further studies were conducted to improve the safety of vaccine together with research on the interference of Newcastle disease vaccine virus on the efficacy of the infectious laryngotracheitis vaccine.

Infectious bronchitis

Infectious bronchitis(IB) is an acute, highly contagious viral disease characterized by tracheal rales, coughing, and sneezing. And in laying flocks there is usually a drop in egg production.

In Korea, the disease has been already suspected through the serological survey since 1960's but its confirmation was first made at the end of 1985, based on serological findings and virus isolation by Rhee *et al.* in 1986.

Though the domestic isolates of IB virus were not completely belonged to any serotype as known until that time in the world, fortunately, satisfactory vaccinal immunity of the Massachusetts strain against challenge of the domestic isolates was recognized.

For this reason, both live and inactivated virus vaccines of the Massachusetts strain have been widely used throughout the country. Currently rapid and sensitive diagnostic tests are available using specific monoclonal antibody. Indirect FA test is used for the differentiation of IB viral antigen in fresh tissues between Massachusetts strain and field strains.

Major Protozoan Disease

Avian Coccidiosis

Coccidiosis remains one of the most expensive and common diseases of poultry production in Korea.

The incidence rate in broiler was 28.8% on individuals and 75.1% on flocks among 5,390 chickens from 321 flocks, respectively. In most cases, broiler flocks were mixed-infected with 4 or more than species of *Eimeria*(Choi *et al.*, 1984). More recent survey showed that 66.9% of 556 farms was contaminated with Eimerian oocysts(Kim *et al.*, 1987).

When anticoccidial drug susceptibility test was carried out, sulfonamides was most effective for chemotherapy and nicarbazin, for preventive medication. However, some isolates of coccidia showed complete or partial resistance to some kinds of other drugs.

Recently, *E. tenella* and *E. acervulina* were used to produce attenuated lines by selection for precociousness, and the pathogenicity and immunogenicity of these lines were studied under laboratoty trials. Each precocious lines were much less pathogenic in infected chickens than the parent lines and as highly immunogenic as parent lines, giving complete protection to challenged infection.

Now, these live protozoan vaccines are being applied in field for evaluation of its safety and efficacy.

SUMMARY

Poultry production in Korea is a very complex situation. Large modernized farms and old styles of small farming coexist with one another. This gives rise to a tangled epidemiological situation in terms of infectious diseases.

The main poultry diseases of economic importance are colibacillosis, pullorum disease, *Mycoplasma gallisepticum* infection, infectious coryza, infectious synovitis, Newcasyle disease, fowl pox, Marek's disease, avian encephalomyelitis, infectious bursal disease, infectious laryngotracheitis, infectious bronchitis and coccidiosis.

Avian influenza, fowl cholera and fowl typhoid have not been reported for a few decades, and these are rated as exotic diseases.

REFERENCES

1. Choi, C.O., S.J. Kim, J.H. Kwon, J.H. Kim, K.S. Park and C.K. Lee. 1982. Comparison of efficacy of HVT and MDV vaccines against Marek's disease. Research Reports of the Office of Rural Development 24(L&V) : 146-153.
2. Choi, C.O., S.J. Kim, J.H. Kim, J.H. Kwon and K.S. Park 1983. Comparison of efficacy of herpesvirus of turkeys and Marek's disease virus vaccines against Marek's disease in the field. Research reports of the Office of Rural Development 25(L&S) ; 105-109.
3. Choi, C.O., S.J. Kim, K.S. Park and K.R. Oh. 1975. Outbreak of avian encephalomyelitis in chicks raised in Korea. Research Reports of the Office of Rural Development 17(V&S) : 15-21.
4. Choi, J.Y., S.Y. Lee and C.K. Lee. 1968. A survey on antigenic types of *Salmonella pullorum*. Research Reports of the Office of Rural Development 11, 5:47-51.
5. Choi, S.H., K.S. Kim and Y.H. Kim. 1984. Epizootiological study on the coccidiosis of broiler chicken in Korea. Research Reports of the Office of Rural Development 26, 2:44-52.
6. Jeon, Y.S., S.J. Kim and Y.S. Chung. 1965. Comparative studies of fowl and pigeon virus strains for the preparation of fowl pox vaccine. Korean Journal of Veterinary research 5, 1:37-41.
7. Kim, J.H. and C.O. Choi. 1984. Outbreaks of ILT in Korea and comparison of efficacy of ILT vaccines. Proceedings in the 4th Congress of the FAVA. pp. 166-171.
8. Kim, J.H., Y.O. Rhee, C.S. Song, J.H. Kim and S. Namgoog. 1989. Early vaccination of one day old broiler chicks against Newcastle disease using inactivated oil or gel adjuvant vaccine, and/or live B1 vaccine. Research Reports of the rural Development Administration 31, 1(V):12-18.
9. Kim, K.S., H.J. Youn, S.H. Choi and S. Namgoong, 1987. Contamination and drug sensitivity of field isolates of coccidia from broiler farms. Korean Journal of Veterinary Public Health 11, 2:41-47.
10. Kim, K.S., H.S. Lee. S.H. Kim, K.S. Kim and S. Namgoong. 1991. Studies on the de-

velopment of avian *E. coli* autolgenous vaccine. Research Reports of the Veterinary Research Institute, pp. 216-221.

11. Kim, K.S. and R.B. Tak. 1983. Studies on pathogenic *Escherichia coli* isolated from chicken with colibacillosis. 1. Biochemical and serological investigations of *Escherichia coli* isolated from chicken with colibacillosis. Korean Journal of Veterinary Public Health 7, 2:113-120.
12. Kim, K.S. and S. Namgoong. 1988. Studies on Characterization of avian *Escherichia coli.* 2. Antimicrobial drug resistance pattern, distribution and incompatibility group of transferable R plasmid, colicin-producing ability and transfer of Col plasmid, and hemagglutination activity. Korean Journal of Veterinary Public Health 12, 1:63-83.
13. Kim, K.S., S. Namgoong, I.P. Mo and S.K. Park. 1984. Antimicrobial drug susceptibility of *Salmonella* isolated from chicken in Korea. Korean Journal of Veterinary Public Health 8, 1:11-14.
14. Kim, S.J., C.O. Choi, J.H. Kwon, J.H. Kim and K.S. Park. 1983. Studies on efficacy of infectious bursal disease killed vaccine. Research Reports of the Office of Rural Development 25(L&V):86-90.
15. Kim, S.J., J.O. Choi, K.S. Park, U.H. Kim and C.H. Lim. 1971. Studies on avian leukosis and Marek's disease. 1. Survey on leukosis and Marek's disease in commercial chicken flocks. Research Reports of the Rural Development 14(V):11-16.
16. Kim, S.J., K.S. Park, B.M. Yoo and C.K. Lee. 1977. Preliminary studies on avian encephalomyelitis vaccine. Research Reports of the Office of Rural Development 19(V&S):13-18.
17. Kim, S.J., S.H. Choi, K.S. Park, B.M. Yoo and C.K. Lee. 1976. Preliminary studies on Marek's disease vaccine. Research Reports of the Office of Rural Development 18 (V&S):35-44.
18. Kim, U.H. 1969. Cell culture studies of Marek's disease etiological agent. Korean Journal of Veterinary Research 9:23-62.
19. Kwon, J.H. and S.J. Kim. 1988. Detection of antibodies to avian encephalomyelitis virus in chicken by enzyme-linked immunosorbent assay. Research Reports of the Rural Development 30, 1:62-70.
20. Lee, C.K., S.J. Kim and S. Namgoong. 1967. Serological survey of avian chronic respiratory disease and preparation of diagnostic antigens. Research Reports of the Veterinary Ressearch Institute, pp. 164-177.
21. Lim, Y.M. and E.S. Pyun. 1962. Experimental studies on fowl pox vaccine. Bulletin of the Veterinary Research Laboratory, Office of Rural Development 8, 1:44-61.
22. Lim, Y.M. and H.T. Oh. 1954. Research on aluminum hydroxide gel added Newcastle disease vaccine. Reports of the National Institute of Veterinary Research 8:135-142.
23. Lim, Y.M. and H.T. Oh. 1962. Studies on the Newcastle disease vaccine included aluminum hydroxide gel. Bulletin of the Veterinary Research Laboratory, Office of rural Development 8, 1:38-43.
24. Mun, J.B., J.K. Kim and N.S. Lee. 1957. Experimental studies on a living virus of Newcastle disease. Reports of the National Institute of Veterinary Research 5:15-25.
25. Namgoong, S., H.J. Youn, U.Y. Lee and K. S. Kim. 1988. Studies on development of *Mycoplasma gallisepticum* live vaccine. Research Reports of the Veterinary Research Institute. pp. 234-238.
26. Namgoong, S., H.J. Youn, U.Y. Lee, K.S.

Kim, J.H. Kim, E.S. Joo and Y.T. Kim. 1990. Studies on development of *Mycoplasma gallisepticum* vaccine. Research Reports of the Veterinary Research Institute, pp. 48-57.

27. Namgoong, S., K.S. Kim, I.P. Mo and K.S. Park. 1983. Studies on *Haemophilus* infection in chickens. Ⅲ. Biological and serological characteristics of *Haemophilus gallinarum* isolated from chickens affected with coryza. Korean Journal of Veterinary Research 23, 2:159-163.
28. Namgoong, S., K.S. Kim, I.P. Mo and Y.O. Rhee. 1984. Epidemiological studies on infectious synovitis in Korea. Research Reports of the Veterinary Research Institute, pp. 235-239.
29. Namgoong, S., S.H. An, K.S. Kim, I.P. Mo and K.S. Park. 1982. Studies on *Haemophilus* infection in chickens. Ⅱ. Epidemiological and serological studies on infectious coryza in Korea. Research Reports of the Office of Rural Development 24(L&V):119-123.
30. Namgoong, S., S.H. An, K.S. Kim, I.P. Mo, Y.O. Rhee, K.S. Park and K.R. Oh. 1981. Studies on *Haemophilus* infection in chickens. I. Isolation of *Haemophilus gallinarum* from chickens affected with infectious coryza. Korean Journal of Veterinary Research 21, 2:93-97.
31. Rhee, Y.O., J.H. Kwon, C.O. Choj, J.H. Kim and S. Namgoong. 1984. Safety and Immunogenicity of live IBD vaccine in chicken and immune status of breeder hens to IBDV. Research Reports of the Office of Rural Development 26(L&V), 1:80-84.
32. Rhee, Y.O., J.H. Kim, I.P. Mo, H.J. Youn, S.H. Choi and S. Namgoong. 1986. Outbreaks of infectious bronchitis in Korea. Korean Journal of Veterinary Research 26, 2:277-282.
33. Rhee, Y.O., J.H. Kim, J.H. Kim and S. Namgoong. 1986. Studies on development of oil adjuvanted triple vaccine(Newcastle disease, EDS'76 and infectious bursal disease). Research Reports of the Veterinary Research Institute, pp. 197-203.
34. Rhee, Y.O., S.J. Kim, S.B. Kim, C.O. Choi, W.S. Jhun and K.S. Park. 1981. Incidence of infectious bursal disease virus(IBDV) infection in breeder chickens and biological characteristics of field isolates. Research Reports of the Office of Rural Development 23(L&V):136-142.