
A SNAPSHOT OF THE HEALTH OF THE AUSTRALIAN MEAT CHICKEN FLOCK

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I have no special insight into the health of the Australian poultry¹ flock but I was interested to look at this topic from over the fence. At the November 2011 meeting of the AVPA Dr Balkar Bains gave us a snap shot of the health of the industry in the latter half of the last century (c1960-85). This really brought home to me just how much the health of the industry and health issues have changed in the last two decades. There have been many structural changes over this time. We have had major consolidation of the poultry companies and the development of the free range sectors. We now have access to international vaccines (Rispen, Paracox, CAV), genetic stock from international breeding programmes with large health programmes including genetic selection to solve health problems (Ascites, Leg problems, Leucosis control programmes) and better diagnostics.

How has this all affected health? For example, with industry development multiage breeder sites are being phased out and are less common probably explaining why BLS is no longer the number one problem in breeders. In fact our problems (especially after genetic imports) are now more like whatever the rest of the world are facing at the same time. Developments in vaccinology have also affected the spectrum of diseases seen. Vaccination of breeders with coccidial vaccines has meant there are now farmers that have no experience with coccidiosis: un-thought of twenty years ago that a chicken man could not recognise a sick chook at complain that it was coccidiosis (but this is worldwide). The removal of many of the antibiotic growth promoters has also had a profound effect on broiler health with necrotic enteritis being greatly feared. Free range broilers have not had enormous problems although one organic free range operation has had trouble with *Pasturella multicauda*. The health of turkeys has been improved by shedding and the instillation of impervious floors. The control of ALV infections by eradication at the primary breeder level has brought considerable benefits that may have only been possible with being able to source from big breeding programmes able to run and finance effective control programmes. Perhaps the most profound effect has been the weaning of the Australian industry off antibiotics which has been facilitated by live MG and MS vaccination (and a decreasing suite of registered antibiotic products). Australia leads the world here in my opinion. In fact I think that until a country diagnoses *Brachyspira* as a problem in chicken flocks it has not decreased its antibiotic dependence.

ILT and IBV, (and maybe Fowl pox) have remained constant problems with ILT actually being a more persistent and chronic problem in broiler flocks. Others are talking about this problem at this conference.

In reality an industry veterinarian's day now days is less about doing post mortems and spreading medication but more about quality assurance, training and trouble shooting and zoonosis mitigation. All the time the industry vet must be ready to investigate food safety problems or defend welfare especially at 4.30 on a Friday afternoon. ILT can bring biosecurity to the fore while producers struggle with making permanent fundamental changes in production organisation that would implement better biosecurity (crate washing between pick-ups for example). The continual cyclic intrusion of EDS-76 in breeder and layer sites shows that AIV from wild ducks on water sources is not a big risk and again shows the need for constant consistently improving biosecurity implementation and maintenance.

The poultry industry in Australia has an enviable health status, probably, in part, explaining the reluctance to implement higher levels of biosecurity², nearly on par with New Zealand³ but without the scourges of many other countries.

¹ Poultry – birds raised for meat production

² Cost benefit of intrusions depends on the great unknown – Risk. While you don't have an infection producers often think this is evidence that the risk is zero in their operation. One manifestation of bad management virus infection.

³ New Zealand has allowed importation of vaccines but paradoxically they have a better health status than Australia with their commercial flocks recognized as being free of IBD infection.

Importantly this includes the absence of vvIBD viruses which means Australian broilers can be grown without IBD vaccination. In Australia hyperimmunization of breeders with live/killed IBD programmes provides adequate immunity against the endemic IBD strains at the broiler level. Quarantine is needed to maintain this advantage. Any incursion would be rapidly recognized and presumably a cost benefit analysis of eradication would be made at the time (but with the trouble the industry is having with ILT biosecurity may make successful eradication of vvIBD a challenge).

The absence of SE also has meant that the pressure on the industry for Salmonella control has not been as great as in other parts of the world. Post harvest treatments are more popular in New Zealand (US technology) but both countries try to implement preharvest controls as long as they cost very little. The industry is coming to terms with the idea that control of carriage of zoonotic pathogens (Salmonella and Campylobacter) that cause no losses in the chicken will have a cost benefit. Also most assessments of salmonella vaccines are still done on reduction of colonization and shedding whereas the industry really wants decreased contamination of products. Evidence is emerging that these are independent properties and environmental contamination may remain but product quality protected in breeders and layers. Refocusing on this may improve control with our current tools. ST as a cause of parathyroid is rare unless broiler flocks are stressed at placement or initial brooding.

Newcastle Disease occurrences in the 1990s and early 2000s have been limited to situations where the virulent viruses have evolved for local progenitor viruses (Not V4) rather than a quarantine failure. This is understood from the molecular characterization of these viruses. Australia is free APMV although Balker did rate swollen head syndrome as a problem.

Necrotic Enteritis in broilers has been increasingly feared as pressure to remove AGPs has had successes. Zinc Bacitracin and ionophores probably are the greatest factors still standing between NE and broilers but better coccidiosis control, genetic resistance, improved feed milling practises and raw material awareness are all contributing better control. These effects are being claimed by the feed additives industries as demonstration that their products work. With the Australian discovery that NE is caused by a toxin elaborated by *netB* genes in *Clostridium perfringens* strains has the industry punting on a vaccine as the ultimate protection. I would predict that necrotic enteritis will become a non issue without vaccination but wet litter and intestinal integrity will remain as problems.

Pullorum is no longer a problem in industrial chickens due to eradication programmes and indeed is no longer monitored in the Australian flock. It is not being masked by antibiotic usage and even if it got a toe hold in free range birds it would not become a problem as breeding stock will not be free range. It is only really of interest for exporters who need the backing of an OIE compliant country wide monitoring programme to export to some markets. On the downside SP is non motile and may be easily missed by modern salmonella enrichment/isolation techniques. Similar comments exist for it's close cousin, SG.

Tenosynovitis as a problem due to reovirus is undescribed in Australia. Studies in the 1980s showed Australian strains had little potential for this. The introduction of spin feeders has helped decrease this problem in some Australian operations made possible by the high pellet durability of our wheat based diets. New Zealand has had greater problems with deep pectoral myopathy in broilers and shown that flapping certainly contributes to this occurrence.

Mycoplasmosis changed from being one of the greatest problems of the industry with MG that were Tylosin resistant emerging isolates in the 1980s to being a controlled problem with MG ts-11 and MSH vaccine (breeders and layers). Most producers prefer to use Mycoplasma free replacement stock and continuous vaccination as the method of choice for control. Infectious synovitis was not thought to be in Australia until it was demonstrated in the 1980s by the author and co-workers (Morrow et al 1990). MSH vaccination appears to have driven this problem off the continent. Recently MS infection has been shown to cause egg shell downgrades in the Australian layer flock.

Mareks disease was an enormous problem in layer and broiler breeder operations in the 1990s with imported stock not being adequately protected from local challenge by the then currently available vaccines and vaccination application methods. The introduction of high titred CVI988 (Rispens) vaccine by Bioproperties (then The Mareks company) using Merial campaign manufacturing in Australian laboratories with Australian SPF substrates was the single most important improvement. The field trial was the largest ever undertaken in Australia and its success led rapidly to oversupply. It highlighted that the electric vaccinators originally designed for administration of Cell Free HVT were too rough on the cells in the Rispens vaccine and caused a massive decrease in titre during administration.

Leucosis control in the Australian flock was greatly improved by the introduction of overseas genetic stock from large breeding programmes that had developed effective ALV control programmes. Although the technology was developed and available in Australia the cost of such programmes were better amortized over larger breeding programmes. Despite the strict health status for importation of genetic stock ALV-J was probably introduced several times with importations in a variety of broiler breeder lines but it has been flushed out now. Some overseas companies considered the Steggles male to be the origin of ALV-J but this is erroneous. REV contamination of vaccines (Pox and Mareks) is a thing of the past with the development of SPF flocks and regulatory standards.

IBH has been a continual problem for the industry waxing and waning over the years. The initial work in Australia characterized a FAV8 as the major cause of problems but more recently FAV11 has been causing problems. Uniquely FAV8 virus had two fibres on each corner capsid protein. Gordon Firth developed a live FAV8 vaccine which is very effective at preventing early IBH. Like the rest of the world we have seen the evolution since the 1990s of FAV strains that now appear to be primary pathogens and not needing CAV or IBD to trigger IBD. What is needed now are FAV protectotype specific ELISAs to be developed.

Australia's IB strains are unique and the absence of Mass vaccination makes IBV control uniquely Australian. Broilers are vaccinated against IB and until the introduction of NDV vaccination this was the only vaccine given to broilers. The currently registered vaccines are all very similar. Vic S, VaxSafe IB-I and Steggles are of the same lineage and vary in immunogenicity and residual pathogenicity in subtle ways only expressed in the broiler generation (in layers and breeders you would be hard pressed to tell them apart). These effects are further modulated by stress and season with seasonal dose cutting being practised by some operations in an attempt to get what they want from these vaccines. Armidale strain was originally developed to protect against nephrotrophic problems but is the same protectotype as the VicS strains. Another protectotype has been identified but seemed to disappear but then a hybrid new protectotype recently appeared. Some live autogenous IB vaccines have been permitted but what is really needed is a new IB vaccine of a different protectotype from VicS so that vaccination programmes can be designed to provide broad protection. This is not likely to happen as the market for such a vaccine would be extremely small being limited to Australia.

Histomoniasis especially in turkeys is problematic at the moment as it has no registered treatment. Some feed additives have been suggested. In the long term a live vaccine will probably control this disease. It occurs sporadically in breeders and may be under diagnosed especially in broilers. Certainly Heterakis is not considered necessary now days for problems to occur.

AEV as a problem was solved by the introduction of vaccination. The transition period was tricky as the vaccine is not attenuated but just given at a time in the bird's life where infection causes no consequences (between 6 and 14 weeks). How to introduce vaccination on a naive multiage site was a problem in the 1980s. Titres are usually checked before lay and the presence of any amount of antibody is considered protective. This antibody could even come from natural infection. Whether these vaccines will survive scrutiny in registration review is not known.

Skeletal abnormalities have been controlled by some breeding programmes by genetic selection (Ross being the most successful) while others are still struggling and must use management interventions to control leg problems. Better understanding of nutrition has aided here including the concept of available phosphorus and phytase enzymes. In my experience when a region goes to 100% vegetarian diets they will have problems for 1 to 2 years as their nutritionists learn how to use new raw materials in greater inclusion rates.

Nutritional deficiencies appear to be rarer with our greater understanding of nutrition⁴. Overseas some episodes of suspect nutritional deficiency have not been able to be confirmed suggesting a phenocopy may be occurring with a different aetiology. For example curled toe paralysis in broilers not being associated with riboflavin deficiency occurs about every five years in the UK. FLKS was a unique syndrome in Australia because of our wheat based diets. Sudden death in broilers with pink discoloration of the tissues developing after death due to relative biotin deficiency. Sudden death syndrome of Broiler breeders was first characterized in Australia and appears to be associated with the increased phosphorus requirements of the Cobb bird.

Mycotoxins were not reported by Balkler to be very important but over the years a lot of veterinary brain power has been used on looking at this as a cause of poor performance. Generally mycotoxins will cause the most problem in the broiler generation (unless the effect is on reproduction) because the birds eat the greatest amounts per kg at this stage. The rule of thumb used to be that in grain grown in winter rainfall areas had less problems with mycotoxins while going further north summer rainfall could wet grain at harvest time. This cross over is around Armidale.

Other toxicities from cross contamination in feedmills seem to be less now days with better mill practises and more dedicated poultry mills. Wet litter can have a multitude of causes but dysbacteriosis had to be developed by the diagnostically destitute. Factors like broilers playing with water, electrolyte load in the feed, genotype of bird need to be understood when investigating but this problem seems independent of Necrotic enteritis. It will be interesting to see what comes out of the recent studies on gut microflora populations.

Fowl cholera is a perpetual problem that has been ameliorated to some extent with better shedding and impervious floors (especially in the Australian turkey flock). Autogenous vaccines have been the main stay of control along with antibiotics. The registration of a killed vaccine is recent and it claims to protect against three serotypes. Vaxsafe PM is a new unique advance in Fowl cholera control. Injected like a killed PM vaccine but stimulating the chicken's immune system as a natural infection delivering broad protection. Unlike older generation live vaccines Vaxsafe PM is safe like killed vaccines with no persistence nor problems with reversion to virulence. The Australian industry should try this vaccine with an open mind – it is not like previous live vaccines.

Coryza in Breeders appears to have disappeared from the Australian poultry industry. More recently *Avibacterium paragallinarum* has been isolated from the abdomen of broilers without clinical signs.

Runting stunting is an interesting syndrome. Like BLS this often has the smell of a management problem and is a very difficult diagnosis. In my opinion is cannot be diagnosed without ruling out management, nutrition and genetic factors (further confused by the fact that these may be contributing factors). It comes and goes in a ten year cycle in Australia. Around the world researchers have struggled with this disease. My conclusion that it is a syndrome rather than a disease created by Lumpers⁵ with the various variations in pathology (pancreatic lesions, intestinal lesions etc) and

⁴ I am not referring to the greater understanding of nutrition by veterinarians compared to other professionals but.... (What is the difference between God and a Vet- God knows that he is not a nutritionist!)

⁵ Lumpers – people who lump things together, Splitters – people who split things up. Both can be useful or an obstruction at various stages in a disease definition and investigation (Kevin Whithear)

nominated aetiological agents. I loved the insight of McNulty reviewing possible aetiological agents –“if you can see it, you cannot culture it and if you can culture it, you cannot see it.” Methodological advances may help here- cloning by infectious clone development and deep sequencing to remove biases with culture and EM. More recently off label use of some V4 vaccines in Australia has been suspected of causing runting/stunting in broilers and maybe associated with persistent infection of the intestine (independent of maternal antibody status). Other V4 vaccines which should be the same do not have this problem. No contaminants could be detected in the suspect vaccine by 454 pyrosequencing. Similar observations have been made overseas with other enterotrophic NDV vaccines.

Coccidiosis in broilers is has been well controlled by chemicals especially ionophores (introduced in 1973). Short withholding times have meant that use has been very flexible fitting in easily with thinning programmes. Resistance has sometimes been suspected but not proven. New coccidiosis vaccines for broilers offers an alternative to chemicals and have been adopted extensively in Australia for organic broiler production. Restoration of anti-coccidial sensitivity with these products is also a possibility. This has been practised extensively in the USA in recent years.

Other parasites have not been problems recently except mites can be an OH&S problem if egg collection is manual. Vaccination against red mite is being actively investigated overseas but not much interest is in Australia.

E. coli was not mentioned in Balcer's review but is emerging as a big problem with vertical transmission being suspected. Clinically it is high first week mortalities, polyserositis, peritonitis coming into lay. The carriage of superplasmids encoding multiple drug resistance and resistance to desiccation and disinfectants means that traditional control strategies (C & S) may actually continued selection pressure for carriage of these determinants. I think this is one of the greatest challenges looming for the Broiler industry. More autogenous *E. coli* vaccines would be my first response.

ANV (avian nephritis virus) has recently been identified as a problem in Australian flocks that had been suspected of having nephropathogenic IB perhaps with lateral transmission of the virus from broilers to layers (presumably with no maternal antibody). For a long time we have been waiting to clinical disease associated with ANV infection suspecting that if we did rear breeder flocks free of infection till lay that seronegative progeny would be at risk. A disease of partial hygiene with an epidemiology like CAV and AE. A vaccine that was non infectious is probably the best solution for this problem and perhaps it could be combined with a new generation AE vaccine.

Management problems as a cause of disease have become more prominent as time goes by with better control of pathogens with biosecurity and vaccines. Veterinarians have to become bird management experts. The understanding that the greatest impact of coccidiosis in breeders is not mortality but the effect on uniformity is imperative. Indeed the impact of uncontrolled Brunetti infections may be just an effect on uniformity. One Australian producer gets improved uniformity from Brunetti vaccination even though no other signs of coccidiosis have been seen in these flocks. The last decade has seen peritonitis at the beginning of lay rise in prominence and then be controlled by better management recommendations (delaying lighting up, better body weight control and uniformity) although sometimes these problems can appear to be caused by clonal *E. coli* infections.

Any how this conference is sure to discuss these continuing modern problems in greater depth and remember sometimes health problems will be solved by non" healthy" means. Fresh air and concrete have been some of the best vaccines I have ever seen.

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