

# Science & Solutions



What's Wrong  
With My Birds?

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The *What's Wrong with My Birds?* series offers practical 1-page articles on common issues in modern poultry production. Each differential diagnosis identifies potential cause, description of problem, checklist and corrective actions to help you to maintain production performance.



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# What's Wrong with My Birds?

## Part 1: Oral lesions

Science & Solutions presents a handy checklist for diagnosing poultry mycotoxicosis.

Cut this out and take it along with you to the farm!

Diagnosing common poultry ailments correctly and precisely can be a challenge even for experienced vets, nutritionists or farm managers. Differential diagnosis is especially difficult in the case of mycotoxin-related problems as symptoms vary greatly and may be further complicated by the synergistic effects caused by the co-occurrence of more than one type of mycotoxin in the feed.



	Potential cause	Description of problem	Checklist	Corrective actions
MYCOTOXINS	T-2 toxin (T-2) Diacetoxyscirpenol (DAS)	T-2 and DAS have a dermatotoxic action, thus causing lesions to the epithelium, increasing the speed of epithelial cell renovation.	<input type="checkbox"/> Positive for T-2 and/or DAS in raw materials (ELISA) or feed (HPLC) <input type="checkbox"/> Origin of raw materials from supplier/region with history of T-2/DAS contamination <input type="checkbox"/> Histopathology: Proliferating epithelial cells and hepatic vacuolization <input type="checkbox"/> Overall decrease in flock performance	<input type="checkbox"/> Check average contamination levels <input type="checkbox"/> Use Mycofix® at a correct dosage level <input type="checkbox"/> Avoid feed bins or feed/water lines that have become contaminated by stale, wet or moldy feed
NUTRITION	Feed granulometry	Small particles of feed block saliva ducts, which may result in oral lesions.	<input type="checkbox"/> Pelletized feed: Fine particles >20% <input type="checkbox"/> Mashed feed: Check mean particle diameter <input type="checkbox"/> Histopathology: Presence of inflammatory cells and bacteria <input type="checkbox"/> No overall decline in flock performance	<input type="checkbox"/> Adjust the pelleting process <input type="checkbox"/> Increase the sieve diameter <input type="checkbox"/> Use pellet binders to improve pellet quality
MANAGEMENT	Liquid methionine	Methionine dripping in the application system produces points of high methionine concentration in the feed.	<input type="checkbox"/> Methionine injector dripping inside masher <input type="checkbox"/> Histopathology: Infiltration of inflammatory cells and necrotic lesions <input type="checkbox"/> No overall decline in flock performance	<input type="checkbox"/> Clean/replace methionine injectors
	Organic acids	Excessively high concentrations of organic acids in the feed lead to caustic lesions in the oral mucosa.	<input type="checkbox"/> Acids injector dripping inside masher <input type="checkbox"/> Histopathology: Infiltration of inflammatory cells and necrotic lesions <input type="checkbox"/> No overall decline in flock performance	<input type="checkbox"/> Clean/replace acid injectors <input type="checkbox"/> Adjust dosage of organic acids
	High temperatures	More frequent drinking during hot periods increases feed residues in beaks.	<input type="checkbox"/> Histopathology: Infiltration of inflammatory cells and necrotic lesions <input type="checkbox"/> Possible decline in flock performance <input type="checkbox"/> Increased mortality	<input type="checkbox"/> Apply vitamins in water <input type="checkbox"/> Apply organic acids in water <input type="checkbox"/> Increase chlorine level in water
	Copper sulphate	Concentrations between 0.05 to 0.2% in feed and drinking water can promote oral lesions.	<input type="checkbox"/> Check concentration of CuSO <sub>4</sub> in premix <input type="checkbox"/> Check concentration of CuSO <sub>4</sub> in water <input type="checkbox"/> Check if water dosing system is working correctly (if applicable)	<input type="checkbox"/> Apply group B vitamins and K <sub>3</sub> vitamin in water <input type="checkbox"/> Correct set-up of the water dosing system
PATHOGENS	Candida albicans (Candidiasis)	The yeast <i>C. albicans</i> can lead to lesions in the crop that can extend to other parts, including the mouth. More common in birds with longer lifespans, such as layers and breeders.	<input type="checkbox"/> Histopathology: Fungal hyphae present in affected mucosa	<input type="checkbox"/> Nystatin or diflucan or imidazoles such as ketoconazole, fluconazole, etc. as treatment
	Fowl pox (Avian pox)	Viral disease caused by Poxviridae (Avipoxvirus) often leads to cutaneous lesions on head, neck, legs and feet. • Dry pox: Raised, wart-like lesions on feathered areas (head, legs, vent, etc.) which heal in about 2 weeks. • Wet pox: Canker-like lesions in the mouth, pharynx, larynx, and trachea.	<input type="checkbox"/> Flock history and presence of typical lesions <input type="checkbox"/> Laboratory diagnosis by tissue or transmission studies	<input type="checkbox"/> Use preventive vaccination depending on prevalence and season (typically fall) <input type="checkbox"/> Treat affected birds with antibiotics to reduce secondary infection, although the disease has to run its course
	Protozoans	Protozoans are more prevalent in birds with a longer lifespan, such as layers, breeders and turkeys, game birds and/or free-range birds.	<input type="checkbox"/> Histopathology: Microscopic examination of a smear of mucus or fluid from the throat demonstrates the presence of trichomonads	<input type="checkbox"/> Separate chronically infected birds from breeding birds
	Trichomonas gallinae	First lesions appear as small, yellowish areas on the oral mucosa.	<input type="checkbox"/> Cankers, also known as "yellow buttons" — yellow, rounded areas with central caseous necrotic foci	<input type="checkbox"/> Use nitroimidazoles (not approved in US by FDA and prohibited in the EU)
	Histomonas meleagridis	Also known as histomoniasis or blackhead disease. Common in commercial turkeys and chickens.	<input type="checkbox"/> Cecal inflammation, ulceration, thickening of wall, ceca containing yellowish cheese-like exudate	<input type="checkbox"/> Use nitroimidazoles (not approved in US by FDA and prohibited in the EU)

# What's Wrong with My Birds?

## Part 2: Gizzard lesions

Science & Solutions presents a handy checklist for diagnosing poultry mycotoxicosis. Cut this out and take it along with you to the farm!



Diagnosing common poultry ailments correctly and precisely can be a challenge even for experienced vets, nutritionists or farm managers. In the case of mycotoxin-related problems, differential diagnosis can be especially difficult as symptoms vary greatly. The following table provides an overview of the potential causes and a checklist of corrective actions; however, please exercise due caution and discretion in use.

	Potential cause	Description of problem	Checklist	Corrective actions
MYCOTOXINS	Cyclopiazonic acid (CPA)	Lesions develop in the proventriculus, gizzard, liver and spleen.	<input type="checkbox"/> Positive for CPA, DON and/or T2 in raw materials (ELISA) or feed (HPLC) <input type="checkbox"/> Raw materials originating from supplier/ region with history of CPA contamination <input type="checkbox"/> Histopathology: Proventriculus hyperplasia of mucosa with heavy infiltration of lymphocytes <input type="checkbox"/> Overall decline in flock performance	<input type="checkbox"/> Check average contamination levels <input type="checkbox"/> Use Mycofix® at a correct dosage level <input type="checkbox"/> Avoid feed bins or feed/ water lines that have become contaminated by stale, wet or moldy feed
	Deoxynivalenol (DON) and/or T-2 toxin (T-2)	The proventriculus is dilated and the mucosa is thickened and sometimes ulcerated.	<input type="checkbox"/> Concentration of CuSO <sub>4</sub> in premix <input type="checkbox"/> Concentration of CuSO <sub>4</sub> in water <input type="checkbox"/> Water dosing system is working properly (if applicable)	<input type="checkbox"/> Apply group B vitamins and K <sub>3</sub> vitamin to the water <input type="checkbox"/> Correctly set-up the water dosing system
MANAGEMENT	Copper sulphate	CuSO <sub>4</sub> can promote gastric lesions especially at the gizzard level.	<input type="checkbox"/> Dosage of salicylates used (check overestimation of feed intake in feed restricted animals) <input type="checkbox"/> Mixability of commercial product in water	<input type="checkbox"/> Avoid low quality products (low mixability, low homogeneity in water) <input type="checkbox"/> Adjust the feed intake of feed-restricted animals
	Acetylsalicylic acid and sodium salicylate	Use of salicylates may induce proventriculus and gizzard ulceration.	<input type="checkbox"/> Level of gizzerosine in raw materials (especially fishmeal)	<input type="checkbox"/> Lower the level of fishmeal in diets <input type="checkbox"/> Avoid using low quality fishmeal <input type="checkbox"/> Replace standard fishmeal with low temperature (LT) fishmeal
NUTRITION	Biogenic amines (Gizzerosine)	Low quality/ over-processed fishmeal can result in high levels of gizzerosine. Hyper-production of HCl in the proventriculus causes erosions in the gizzard.	<input type="checkbox"/> Quality of fats in term of peroxide value, rancidity and free fatty acids	<input type="checkbox"/> Avoid low quality fats <input type="checkbox"/> Use low quality fats in the grower/ finisher phases <input type="checkbox"/> Replace animal fats with vegetable fats
	Rancid fats	Low quality fats (long storage, overheating) can contain high levels of superoxide radicals and hydroxyl radicals.	<input type="checkbox"/> Level of tannins in some raw materials (sorghum) and in tannin-based products	<input type="checkbox"/> Use high quality tannin-based product (chestnut is preferred to quebracho) <input type="checkbox"/> Reduce % of sorghum in high-tannin diets
	Tannins	Toxic levels of tannins in the feed cause oesophageal and gastric edema, hemorrhagic ulceration, necrosis and sloughing of the mucosal lining.	<input type="checkbox"/> Isolation of serotype I, II or III from the lesions by serological assays	<input type="checkbox"/> Use inactivated vaccines (only available for group 1) <input type="checkbox"/> Check the breeding stock and eliminate affected birds
PATHOGENS	Adenovirus serotype 1	Vertically transmitted, usually sub-clinical but provides more exposure to secondary bacterial infection. <ul style="list-style-type: none"> <li>• Group I is exhibited through inclusion body hepatitis (sudden onset of mortality, typically 10% and rarely up to 30%) or hydro pericardium (same symptoms as IBH, but severe mortality at 20-80%).</li> <li>• Group II is exhibited through hemorrhagic enteritis and marble spleen disease in turkeys, and avian adenovirus group II splenomegaly in chickens.</li> <li>• Group III affects most poultry due to the egg drop syndrome.</li> </ul>	<input type="checkbox"/> Maternal antibody titers are very low in day-old chicks	<input type="checkbox"/> Implement/ correct vaccination program in breeders <input type="checkbox"/> Change from mild- to strong-reaction vaccine <input type="checkbox"/> Correct vaccination age (Deventer formula) <input type="checkbox"/> Increase biosecurity level
	Infectious bursal disease (IBDV/ Gumboro)	IBDV is very immunosuppressive and causes lesions at the junction of the proventriculus-gizzard.		

# What's Wrong with My Birds?

## Part 3: Fatty Liver

A handy checklist for diagnosing poultry mycotoxins that you can cut out and keep with you for reference.

Diagnosing common poultry ailments correctly and precisely can be a challenge even for experienced vets, nutritionists or farm managers. In the case of mycotoxin-related problems, differential diagnosis can be especially difficult as symptoms vary greatly. The following table provides an overview of the potential causes and a checklist of corrective actions; however, please exercise due caution and discretion in use.



	Potential cause	Description of problem	Checklist	Corrective actions
NUTRITION	Energy-protein ratio	Excessive energy in diets can cause lipodosis and fatty liver problems.	<input type="checkbox"/> Carbohydrate level in diet <input type="checkbox"/> Energy-protein ratio in diet	<input type="checkbox"/> Avoid high carbohydrate diets, especially in summer <input type="checkbox"/> Adopt proper energy-protein ratio <input type="checkbox"/> Apply amino acids in drinking water
	Rancid fats	Peroxides can impair liver activity, creating fatty liver.	<input type="checkbox"/> Quality of fats in term of: peroxide value, rancidity and free fatty acids	<input type="checkbox"/> Avoid low quality fats <input type="checkbox"/> Use low quality fats in the grower/finisher phases <input type="checkbox"/> Replace animal fats with vegetable fats <input type="checkbox"/> Apply choline chloride and Vitamin B in feed or water
MYCOTOXINS	Aflatoxins (Afla)	Young animals: fibrosis of liver leads to hardening of the organ. Older animals: hepatic lipodosis, with softening of the organ.	<input type="checkbox"/> Positive for Afla in raw materials (ELISA) or feed (HPLC) <input type="checkbox"/> Raw materials originating from supplier/region with history of aflatoxin contamination <input type="checkbox"/> Histopathology: Check other target organs of Afla (ex. Liver) <input type="checkbox"/> Overall decline in flock performance	<input type="checkbox"/> Check average contamination levels <input type="checkbox"/> Use Mycofix® at a correct dosage level <input type="checkbox"/> Avoid feed bins or feed/water lines that have become contaminated by stale, wet or moldy feed
MANAGEMENT	Hormone status	An over-stimulation of egg production may lead to excessive levels of estrogen in the blood that facilitate fat storage in the liver and the occurrence of fatty liver, especially in layers and breeders.	<input type="checkbox"/> Management of laying birds	<input type="checkbox"/> Improve management of laying birds <input type="checkbox"/> Correct lighting program
PATHOGENS	Viral hepatitis (IBH – viral inclusion body hepatitis)	Adenovirus causes yellow/hemorrhagic liver and focal necrosis. Symptoms include immunosuppression, diarrhea, anorexia, depression, ruffled feathers, especially in the region of head and neck. Group I is exhibited through inclusion body hepatitis (sudden onset of mortality, typically 10% and rarely up to 30%) or hydro pericardium (same symptoms as IBH, but severe mortality from 20-80%). Usually occurs in chickens older than 3 weeks.	<input type="checkbox"/> Clinical signs only several hours prior to death: pale comb and wattles, depression and apathy <input type="checkbox"/> Up to 30% mortality <input type="checkbox"/> Necropsy: Macroscopic lesion is the enlarged, dystrophic liver with yellowish color and crumbly texture and enlarged kidneys <input type="checkbox"/> Histopathology: Detection of intranuclear inclusion bodies <input type="checkbox"/> Isolation of serotype I or II or III from the lesions by serological assays	<input type="checkbox"/> Use inactivated vaccines (exist only for group I) <input type="checkbox"/> Check the breeding stock and eliminate the affected birds

For more information, visit [www.mycotoxins.info](http://www.mycotoxins.info)

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# What's Wrong with My Birds?

## Part 4: Impaired feathering/feather loss

In poultry, feathers serve important roles in terms of protection and insulation of the body. While moulting, or renovation of older feathers by new ones, is a natural process occurring in mature layers upon completion of a laying cycle (which itself can be influenced by many factors), feather loss or impaired feathering may be indicative of other problems in the farm.

Feather-related problems in poultry can be roughly divided into two groups, either:

- They are not properly developed (linked to feather formation) which is often related to nutrition or the presence of mycotoxins.
- They are pulled off by birds (feather pecking), which is a management-related issue.

In each case it is critical to understand the foundation of the problem so that it can be properly solved (see table right).

Stressful conditions in the barn, especially during brooding, such as heat, cold and existence of air currents, amongst others, can result in feather loss and poor feather quality in the birds. In this case, it is crucial that the behavior and interaction of animals is observed. Often, feather pecking and pulling can also be triggered by inadequate intake of nutrients. Due to the high protein content in feathers, higher protein levels in feed may encourage faster feather development and shedding.

Imbalance of amino acids in the feed, particularly sulphur amino acids cysteine and methionine, may cause feather abnormalities and/or rough feather appearance.

The dermatotoxic effect of trichothecene mycotoxins, such as T-2 toxin and others, may also contribute to low feather quality along with other negative effects, such as oral lesions and decreased performance.

Overall, excessive feather loss or impaired feathering adversely affects feed conversion as birds have to allocate extra energy from the diet to compensate for heat loss.

As such, management, housing and nutrition should be optimized to reduce this occurrence. In terms of mycotoxins, prevention can be undertaken through the use of a proper mycotoxin risk management tool which adsorbs and/or biotransforms mycotoxins, thus eliminating their toxic effects for the animals, while guaranteeing liver and immune protection.

Checklist	Corrective action
<b>Potential cause: MANAGEMENT: Temperature of barn</b>	
<ul style="list-style-type: none"> <li>• Temperature of barn</li> <li>• Humidity of barn</li> <li>• Ventilation system</li> </ul>	<ul style="list-style-type: none"> <li>• Improve management of barn</li> <li>• Correct temperature, ventilation rate and humidity according to management manuals</li> </ul>
<b>Potential cause: MYCOTOXINS: T-2 toxin (T-2)/Deoxynivalenol (DON)/ Other trichothecenes</b>	
<ul style="list-style-type: none"> <li>• Positive for trichothecenes in raw materials (ELISA) or feed (HPLC)</li> <li>• Raw materials originating from supplier/ region with a history of trichothecenes contamination</li> <li>• Histopathology: Check other target organs for trichothecenes (ex. liver, for hepatic vacuolisation)</li> <li>• Decline in overall flock performance</li> </ul>	<ul style="list-style-type: none"> <li>• Check the average contamination levels</li> <li>• Use Mycofix® at the correct dosage level</li> <li>• Avoid contamination of feed bins or feed/water lines by stale, wet or mouldy feed</li> </ul>
<b>Potential cause: NUTRITION: Amino acid (AA) deficiency/unbalance</b>	
<ul style="list-style-type: none"> <li>• Level of Total Sulphur Amino Acids (TSAA) in diet</li> <li>• Ratio TSAA/Lys/Arg/Thr</li> <li>• AA scale at feed mill</li> </ul>	<ul style="list-style-type: none"> <li>• Increase level of synthetic Amino Acids (AA) in low digestible diets (high levels of by-products)</li> </ul>
<b>Potential cause: MANAGEMENT: Red mites</b>	
<ul style="list-style-type: none"> <li>• Presence of red mites in the barn during the night.</li> </ul>	<ul style="list-style-type: none"> <li>• Flame cages during withdrawal period</li> <li>• Clean egg belts during withdrawal period.</li> <li>• Increase biosecurity level</li> <li>• Use plastic egg belts whenever possible</li> </ul>
<p>Note: Pathogens were excluded from the table due to space constraints but may be important to consider.</p>	

References are available on request

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# What's Wrong with My Birds?

## Part 5: Egg production/quality problems



Good, stable egg production and good quality are of utmost importance. Bad management practices, feed and environment-related issues and diseases are some of the factors which may negatively impact egg production and egg quality.

Also animal-related factors, such as age and strain of layer birds, must not be disregarded. Older birds and birds after molting are known to produce bigger eggs with thinner shells and indigenous strains cannot quite compete with commercial layers in terms of number of eggs produced.

Several management issues (see table) may lead to nervous birds and/or traumatic lesions in the ovary which cause poor egg quality (fragile shell/bloodspots/meat spots). Nutrition-wise, improper balance of calcium, phosphorus and vitamin D may lead to thin egg shells. Also large amounts of Lucerne/alfalfa meal in diet can lead to blood spots caused by vitamin K antagonists in this feed ingredient. Interestingly, the use of the drug sulphaquinoxaline may have the same effect as mineral imbalance. In terms of pathogens, Infectious Bronchitis (IB) causes respiratory disease and kidney damage in growers and oviduct infection in adult hens which can cause wrinkled egg shells as well as a reduction in eggs laid.

Due to the liver and kidney toxicity mycotoxins may negatively impact egg and shell formation, leading to poor egg and shell quality (pale eggs/small, fragile shell/bloodspots/meat spots). For mycotoxin-related problems, prevention can be undertaken through the use of a proper mycotoxin risk management tool which adsorbs and/or biotransforms mycotoxins, thus eliminating their toxic effects for the animals, while guaranteeing liver and immune protection. The Mycofix® product line from BIOMIN combines the three strategies – adsorption, biotransformation and bioprotection – which work together to prevent the hazardous effects of mycotoxins in poultry flocks.

Checklist	Corrective action
<b>Potential cause: MANAGEMENT: Nervous birds/traumatic lesions in the ovary</b>	
<ul style="list-style-type: none"> <li>• Lighting program</li> <li>• Temperature of the barn</li> <li>• Presence of frights and disturbances in the barn that may get birds nervous</li> </ul>	<ul style="list-style-type: none"> <li>• Correct lighting program</li> <li>• Correct temperature of the barn</li> <li>• Improve management of laying birds</li> </ul>
<b>Potential cause: MYCOTOXINS: Aflatoxins (Afla), Cyclopiazonic acid (CPA), T-2 toxin (T-2), Ochratoxin A (OTA)</b>	
<ul style="list-style-type: none"> <li>• Positive for Afla, CPA, T-2 and/or OTA in raw materials (ELISA) or feed (HPLC)</li> <li>• Raw materials originating from supplier/region with history of mycotoxin contamination</li> <li>• Histopathology: Check other target organs</li> <li>• Decline in overall flock performance</li> </ul>	<ul style="list-style-type: none"> <li>• Check average contamination levels</li> <li>• Use Mycofix® at the correct dosage level</li> <li>• Avoid feed bins or feed/water lines to become contaminated by stale, wet or mouldy feed of these mycotoxins (for example kidneys, liver)</li> </ul>
<b>Potential cause: NUTRITION: Mineral/vitamin imbalance</b>	
<ul style="list-style-type: none"> <li>• Calcium/phosphorus balance in diets</li> <li>• Calcium carbonate particle size</li> </ul>	<ul style="list-style-type: none"> <li>• Correct mineral and vitamin balance</li> <li>• Correct calcium carbonate particle size</li> </ul>
<b>Potential cause: NUTRITION: Vitamin K antagonists</b>	
<ul style="list-style-type: none"> <li>• Content of lucerne/alfalfa meal in diets</li> <li>• Presence of sulphaquinoxaline in diets</li> </ul>	<ul style="list-style-type: none"> <li>• Correct amount of lucerne/alfalfa meal in diets</li> <li>• Correct medication program</li> </ul>
<b>Potential cause: PATHOGENS: Infectious bronchitis (IB)</b>	
<ul style="list-style-type: none"> <li>• Laboratory tests to confirm the presence of the coronavirus in a swab or tissue sample</li> </ul>	<ul style="list-style-type: none"> <li>• Vaccination program must be adapted to the demands of the field situation in each particular area/epidemiology</li> </ul>
<b>Potential cause: GENETICS: Bird strain</b>	
<ul style="list-style-type: none"> <li>• Check with genetic supplies (some strains more susceptible to blood spots)</li> </ul>	<ul style="list-style-type: none"> <li>• Replace genetics if necessary</li> </ul>

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# What's Wrong with My Birds?

## Part 6: Carcass bruising

The consumer's decision making process when purchasing poultry products mainly takes into account appearance, hygiene and flavor. To help guarantee that the best quality product reaches consumers, several procedures should be in place.

Veterinary inspection at the time of slaughter aims to guarantee that poultry carcasses are free from disease or fecal contamination. In the presence of one (or both) contaminations, carcasses are condemned and withdrawn from the food chain.

Carcass bruising/hemorrhaging is one of several reasons leading to carcass downgrading (reduced quality) or condemnation in the slaughterhouse. It is caused by the breakage of blood vessels and subsequent leakage of blood into tissues without skin rupture.

It is difficult to determine whether they occur at the farm, during transport or at the plant; therefore, any major financial losses that result are usually absorbed by the slaughterhouse.

According to scientific literature, the colour of the bruise may be indicative of the age of the injury with red to dark red being recent bruises ( $\leq 12$  hours) and light green, yellow-orange and yellow ones being older ( $\geq 24$  hours).

Some 90% of bruising occurs within 12-24 hours before processing, with breast, wings and legs the most frequently affected parts. The potential causes are inadequate flock density in the grow-out house and/or the failure to properly adjust pickers at catching.

Inadequate stunning (voltage and time) can lead to petechial hemorrhages usually occurring in the breast and legs. The presence of pathogens in the farm, such as IBDV (Gumboro disease), may increase capillary weakness which leads to carcass bruising.

Mycotoxins such as aflatoxins work in a similar way by reducing the force required to produce bruises due to increased capillary fragility. Usually these occur in the thighs. For mycotoxin-related problems, prevention can be undertaken through the use of a proper mycotoxin risk management tool which relies on complementary detoxification strategies (biotransformation, adsorption, bioprotection) can eliminate the toxic effects in the animals, while guaranteeing liver and immune protection.



Photo: sansubba

Checklist	Corrective action
<b>Potential cause: MANAGEMENT: Stunning system</b>	
<ul style="list-style-type: none"> <li>• Voltage of stunning system</li> <li>• Duration of electric shock</li> </ul>	<ul style="list-style-type: none"> <li>• Correct voltage and timing of electric shocks</li> </ul>
<b>Potential cause: PATHOGENS: Infectious bursal disease (IBDV/Gumboro)</b>	
<ul style="list-style-type: none"> <li>• Blood spots mainly located in the legs and the breast</li> <li>• Necropsy: Bursa of Fabricius is swollen, enlarged and bloody</li> <li>• Maternal antibody titres are very low in day-old chicks</li> <li>• Implement/correct vaccination program in breeders</li> </ul>	<ul style="list-style-type: none"> <li>• Change from mild to strong-reaction vaccine</li> <li>• Correct vaccination age (Deventer formula)</li> <li>• Increase biosecurity level</li> </ul>
<b>Potential cause: MYCOTOXINS: Aflatoxins</b>	
<ul style="list-style-type: none"> <li>• Detection in raw materials (ELISA) or feed (HPLC)</li> <li>• Animals present jaundice-like symptoms, are dehydrated and emaciated. They present purple-reddish areas in the carcass</li> <li>• Raw materials originating from supplier/region with history of aflatoxin contamination</li> <li>• Histopathology: Check other target organs (for example liver)</li> <li>• Decrease in overall performance of the flock</li> </ul>	<ul style="list-style-type: none"> <li>• Check average contamination levels.</li> <li>• Use Mycofix® at a correct dosage level.</li> <li>• Avoid feed bins or feed/water lines becoming contaminated by stale, wet or moldy feed</li> </ul>
<b>Potential cause: MANAGEMENT: Animal density</b>	
<ul style="list-style-type: none"> <li>• High flock density at grow-out house</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust flock density</li> </ul>
<b>Potential cause: MANAGEMENT: Catching</b>	
<ul style="list-style-type: none"> <li>• Poor catching procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust picking machines and/or catching procedure</li> </ul>

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# What's Wrong with My Birds?

## Part 7: Avian Gout/Kidney Failure

Avian gout is a consequence of kidney damage which can occur from a number of potential causes leading to the accumulation of uric acid/urates in the renal tubules and serous coats of the heart, the liver, the mesentery, the air sacs or the peritoneum.

**D**ue to its complex aetiology, it is difficult to diagnose; however, the most common signs are dehydration, pale combs, depression and swelling and reddening of the feet which impair bird movement. In layers, where it is mainly observed, avian gout can lead to mortalities up to 50%, with 19-35 week-old hens mostly affected.

The causes for this condition are varied (see table right), ranging from management and/or nutrition-related, to pathogens and/or the presence of mycotoxins in feed. In terms of nutrition, special attention must be paid to the calcium/phosphorus balance, sodium and vitamin D<sub>3</sub>.

In general, any condition favouring an increase of uric acid in blood favours precipitation in tissue and, as a consequence, development of gout. Excess dietary calcium with low available phosphorus results in the precipitation of sodium-urate crystals and calcium pyrophosphate (pseudogout). In younger birds, gout due to sodium intoxication may be observed at sodium levels exceeding 0.4% in water and 0.8% in feed.

Likewise, high levels of vitamin D<sub>3</sub> can increase calcium absorption from the intestine favouring the formation and deposition of urate crystals. Also nutrition-related is the protein level in feed which in excess of 30% causes uric acid production leading to excretory loads in kidneys. Concurrently, sulphates decrease calcium resorption causing excess calcium secretion through the urine. This favors gout, as well as any other factor contributing to urine alkalinity. Water deprivation falls in this category as it leads to increased concentrations of uric acid and other minerals in the blood and later on in the kidneys and urine.

Viruses such as infectious bursal disease (IBDV) and/or infectious bronchitis can enhance mortalities in the presence of preexisting kidney damage.

In terms of mycotoxin contamination of feeds, the nephrotoxic aflatoxins (Afla), ochratoxin A (OTA) and citrinin are of major concern. The impairment of the kidney function which results from the action of these mycotoxins reduces uric acid excretion and results in the accumulation of uric acid in the body.

Checklist	Corrective action
<b>Potential cause: MYCOTOXINS: Ochratoxin A (OTA), citrinin, aflatoxins (Afla)</b>	
<ul style="list-style-type: none"> <li>• Positive for Afla, citrinin and/or OTA in raw materials (ELISA) or feed (HPLC)</li> <li>• Raw materials originating from supplier/region with history of mycotoxin contamination</li> <li>• Histopathology: Check other target organs of these mycotoxins (e.g. kidneys, liver)</li> <li>• Decline in overall flock performance</li> </ul>	<ul style="list-style-type: none"> <li>• Check average contamination levels</li> <li>• Use Mycofix® at the correct dosage level</li> <li>• Avoid feed bins or feed/water lines becoming contaminated by stale, wet or mouldy feed</li> </ul>
<b>Potential cause: NUTRITION: Calcium, sodium, vitamin D<sub>3</sub></b>	
<ul style="list-style-type: none"> <li>• Level of minerals and vitamins in diets</li> </ul>	<ul style="list-style-type: none"> <li>• Correct level of minerals and vitamin D<sub>3</sub></li> <li>• Control fish meal usage (rich in salt)</li> <li>• Control total sodium chloride content in feed (&lt;0.3% )</li> </ul>
<b>Potential cause: NUTRITION: Protein</b>	
<ul style="list-style-type: none"> <li>• Protein level in feeds</li> </ul>	<ul style="list-style-type: none"> <li>• Correct protein level in feeds</li> </ul>
<b>Potential cause: MANAGEMENT: Water deprivation</b>	
<ul style="list-style-type: none"> <li>• Observe animal behavior to understand the cause of water deprivation</li> <li>• Transportation and vaccination procedures</li> <li>• Drinkers in terms of number, position and blockages that may impede access.</li> <li>• Chemicals added to water (disinfectants, copper sulphate, etc) may result in water refusal, dehydration and gout</li> </ul>	<ul style="list-style-type: none"> <li>• Improve transportation condition of birds (access to water)</li> <li>• Adjust number, position and access to drinkers</li> <li>• Avoid overcrowding</li> <li>• Correct blockages in nipples</li> </ul>
<b>Potential cause: PATHOGENS: Infectious bursal disease (IBDV/Gumboro)</b>	
<ul style="list-style-type: none"> <li>• Maternal antibody titres are very low in day-old chicks</li> </ul>	<ul style="list-style-type: none"> <li>• Adapt vaccination program to the demands of the field situation in each particular area/epidemiology</li> <li>• Increase biosecurity level</li> </ul>
<b>Potential cause: PATHOGENS: Infectious bronchitis (IB)</b>	
<ul style="list-style-type: none"> <li>• Laboratory tests to confirm the presence of the coronavirus in a swab or tissue sample</li> </ul>	<ul style="list-style-type: none"> <li>• Adapt vaccination program to the demands of the field situation in each particular area/epidemiology</li> </ul>

References are available on request

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# What's Wrong with My Birds?

## Part 8: Lameness conditions (nutrition)

Chickens raised for commercial meat production are selectively bred to reach marketweight quickly. This rapid growth, however, can place increasing demands on the bird's skeletal system resulting in impaired loco-motion. Lameness and gait abnormalities in poultry are conditions of high significance not only because of their implications in terms of animal welfare, but also due to the financial losses caused by increased mortality, reduced feed utilisation and growth rate, and downgrading in the processing plant. Nutrition plays

a significant role in skeletal health and development, thus a multitude of nutritional factors can lead to musculo-skeletal diseases, which are commonly characterised by lameness. It is important to identify and understand these risk factors in order to develop a prevention or mitigation strategy to reduce incidence of lameness in poultry flocks. The purpose of this table is to outline several nutritional factors that can contribute to increased incidence of lameness in poultry and offer approaches to help mitigate the damage caused by these conditions.

Condition	Corrective action
<b>RICKETS Potential cause: Vitamin D3 deficiency, Ca/P imbalance</b>	
<ul style="list-style-type: none"> <li>• Symptoms: Enlargement of the ends of tibia and femur, with widened epiphyseal plate</li> <li>• Lesions: Disorganised cartilage matrix, irregular vascular penetration</li> </ul>	<ul style="list-style-type: none"> <li>• Feed vitamin D3 with balanced calcium and phosphorus</li> </ul>
<b>PEROSIS/CHONDRODYSSTROPHY Potential cause: Manganese deficiency</b>	
<ul style="list-style-type: none"> <li>• Symptoms: Thickened and shortened legs, shortened wings</li> <li>• Lesions: Enlargement and malformation of the tibio-metatarsal joint, twisting and bending of tibial distal end and the proximal end of tarso-metatarsus, slippage of the gastrocnemius tendon from its chondyles</li> </ul>	<ul style="list-style-type: none"> <li>• Feed appropriate manganese as per the production stage</li> <li>• Maintain Mn/Ca/P balance</li> </ul>
<b>OSTEOPOROSIS/CAGE LAYER FATIGUE Potential cause: Impaired calcium flux in laying hens</b>	
<ul style="list-style-type: none"> <li>• Symptoms: Soft and rubbery bones, birds on their sides in the back of the cage</li> <li>• Lesions: Vertebral fracture affecting spinal cord</li> </ul>	<ul style="list-style-type: none"> <li>• Feed appropriate calcium as per the production stage</li> <li>• Care must be taken to feed ~50% of the dietary calcium in the form of coarse limestone, with the remaining half as fine particle limestone</li> </ul>
<b>IONOPHORE TOXICITY Potential cause: Monensin</b>	
<ul style="list-style-type: none"> <li>• Symptoms: Legs extended backward</li> <li>• Lesions: No specific lesions</li> </ul>	<ul style="list-style-type: none"> <li>• Mix feed properly</li> <li>• Withdraw the ionophore</li> </ul>
<b>PODODERMATITIS/FOOTPAD DERMATITIS/FOOT BURN/AMMONIA BURN Potential cause: Biotin deficiency, poor quality litter</b>	
<ul style="list-style-type: none"> <li>• Symptoms: Ulceration of the metatarsal and digital footpads</li> <li>• Lesions: Necrotic lesions on the plantar surface of the footpads</li> </ul>	<ul style="list-style-type: none"> <li>• Improve gut integrity by feeding multi-species, poultry-specific, live probiotics</li> <li>• Supplement biotin in the feed</li> <li>• Lower litter moisture with proper ventilation and avoid water spillage</li> </ul>
<b>TIBIAL DYSCHONDROPLASIA/OSTEOCHONDROSIS Potential cause: Ca/P ratio, excess chloride in feed metabolic acidosis, acid/base balance, mycotoxins</b>	
<ul style="list-style-type: none"> <li>• Symptoms: Swelling and bowing in the region of the knee joints, angulations of legs, typically in birds &gt;35 days</li> <li>• Lesions: Plug of cartilage in proximal end of tibia, distal tibia, and proximal metatarsus, in decreasing order of frequency</li> </ul>	<ul style="list-style-type: none"> <li>• Correct the nutritional imbalances</li> <li>• Add an effective mycotoxin deactivator in the feed</li> </ul>

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# What's Wrong with My Birds?

## Part 9: Lameness conditions (bacterial pathogens)

In 50 years, broiler growth rates have increased dramatically due to intense genetic selection and enhanced nutritional programs. Fast growth places great demands on birds' musculoskeletal systems, which can result in impaired locomotion and lameness.

Lameness reduces animal well-being and has severe economic consequences from poor growth, increased culling and mortality, and increased carcass condemnation and downgrading at slaughter.

Lameness is often a multifactorial condition. Understanding the various causes can help producers identify areas for improvement and develop effective strategies to reduce the incidence of lameness in their flocks. Conditions responsible for lameness can be of infectious or non-infectious origin. This table focuses on lameness conditions caused by bacterial pathogens and suggests solutions that can help prevent or alleviate lameness caused by these conditions.

Condition	Corrective action
<b>Bacterial Chondronecrosis with Osteomyelitis (BCO)</b>	
<ul style="list-style-type: none"> <li>• Etiology: Enterococcus cecorum, Streptococcus spp., Staphylococcus spp, E. coli</li> <li>• Symptoms: Bird will be sitting on its breast/keel, with the legs directed forward, use of wings for walking support and hip flexion</li> <li>• Lesions: Necrotic degeneration and microbial infection, primarily within the proximal heads of the femur and tibia</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Improve gut integrity by feeding multi-strain poultry-specific live probiotic</li> <li>• Treatment: Antibiotics depending on severity, but mostly birds are euthanised</li> </ul>
<b>Vertebral Osteomyelitis/Spondylitis/Spondylopathy/Spondylolisthesis/Kinkyback</b>	
<ul style="list-style-type: none"> <li>• Etiology: Enterococcus cecorum, Staphylococcus spp., E. coli</li> <li>• Symptoms: Typically starts from day 22, bird will be sitting on its breast/keel, with the legs directed forward, posterior paralysis due to spinal cord compression</li> <li>• Lesions: Abscess and/or necrosis in T4-T7 vertebrae, dorsal buckling of spinal cord (kyphosis), interstitial oedema, atrophy, degeneration of muscle fibres</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Improve gut integrity by feeding multi-strain poultry-specific live probiotic</li> <li>• Treatment: Antibiotics depending on severity, but mostly birds are euthanised</li> </ul>
<b>Bumble Foot</b>	
<ul style="list-style-type: none"> <li>• Etiology: Staphylococcus spp.</li> <li>• Symptoms: Swelling above the hock and around the hocks and feet.</li> <li>• Lesions: Abscess on hock joint, infected joints may have clear exudate with fibrin clots</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Improve gut integrity by feeding multi-strain poultry-specific live probiotic</li> <li>• Treatment: Antibiotics</li> </ul>
<b>Fowl Cholera</b>	
<ul style="list-style-type: none"> <li>• Etiology: Pasteurella multocida</li> <li>• Symptoms: Swollen hock joints, swollen wattles and comb, greenish diarrhoea</li> <li>• Lesions: Necrotic foci on liver, petechiae in the epicardial fatty tissues</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Vaccines only if endemic</li> <li>• Treatment: Antibiotics</li> </ul>
<b>Osteomyelitis Complex</b>	
<ul style="list-style-type: none"> <li>• Etiology: Bacterial, but no specific pathogen has been identified</li> <li>• Symptoms: None</li> <li>• Lesions: Green discolouration of liver, inflammatory lesions in bones and joints</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Improve gut integrity by feeding multi-strain poultry-specific live probiotic</li> <li>• Only identified at slaughter</li> </ul>
<b>Bacterial arthritis/Airsacculitis (MS)</b>	
<ul style="list-style-type: none"> <li>• Etiology: Enterococcus faecalis, Mycoplasma synoviae</li> <li>• Symptoms: Ruffled feathers, swollen hock joints and feet, bilaterally asymmetrical legs</li> <li>• Lesions: Joints and tendon sheaths have viscous grey to yellow exudate, caseous exudate from the lesions</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Improve gut integrity by feeding multi-strain poultry-specific live probiotic</li> <li>• Treatment: Antibiotics and eradication of infected breeding stock</li> </ul>

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# What's Wrong with My Birds?

## Part 10: Lameness conditions (viral pathogens)

In 50 years, broiler growth rates have increased dramatically due to intense genetic selection and enhanced nutritional programs. Fast growth places great demands on birds' musculoskeletal systems, which can result in impaired locomotion and lameness. Lameness reduces animal wellbeing and has severe economic consequences from poor growth, increased culling and mortality, increased carcase condemnation and downgrading at slaughter. Lameness is often a multifactorial condition.

Understanding various causes can help producers identify improvements and develop effective strategies to reduce the incidence of lameness in their flocks. Conditions responsible for lameness can be of infectious or non-infectious origin.

This table focuses on lameness conditions caused by pathogenic factors, namely viruses, and suggests solutions that can help prevent or alleviate lameness caused by these conditions.

Condition	Corrective action
<b>Tenosynovitis/Viral arthritis</b>	
<ul style="list-style-type: none"> <li>• Aetiology: Avian reovirus</li> <li>• Symptoms: Soft swelling of the joints with turbid fluid in the capsule, swollen shanks</li> <li>• Lesions: Swelling and petechiae in the synovial membranes, small erosions on the articular cartilage, adhesions between the tendons and fibrosis of tissues</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Live vaccine followed by inactivated vaccine</li> <li>• Treatment: Euthanise the infected flock</li> </ul>
<b>Amyloidosis</b>	
<ul style="list-style-type: none"> <li>• Symptoms: Swollen hock joint containing orange-yellowish material, muscular shivering</li> <li>• Lesions: Extracellular build up of amyloid protein in joints and internal organs</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Live vaccine</li> <li>• Treatment: Sodium salicylate 1g/litre (acute phase). Antibiotics to control secondary colibacillosis</li> </ul>
<b>Infectious bronchitis (IB)/Infectious laryngo tracheitis (ILT)</b>	
<ul style="list-style-type: none"> <li>• Aetiology: Corona virus, Herpes virus</li> <li>• Symptoms: Sudden death, muscular shivering</li> <li>• Lesions: Oedema of skeletal and pectoral muscles</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Live vaccine</li> <li>• Treatment: Sodium salicylate 1g/litre (acute phase). Antibiotics to control secondary colibacillosis</li> </ul>
<b>Marek's disease</b>	
<ul style="list-style-type: none"> <li>• Aetiology: Avian Herpes virus 2</li> <li>• Symptoms: One leg stretched forward and the other backward</li> <li>• Lesions: Tumors in internal organs, unilateral enlargement of peripheral nerves</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Live vaccine</li> <li>• Treatment: Eradication of infected flock</li> </ul>
<b>Avian encephalomyelitis (AE)</b>	
<ul style="list-style-type: none"> <li>• Aetiology: Picornavirus</li> <li>• Symptoms: Trembling of the head, neck, and wings, paralysis of both legs extended out to one side</li> <li>• Lesions: Gross lesions are mild or absent, focal white areas in gizzard muscle</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Vaccination of breeders</li> <li>• Treatment: None</li> </ul>
<b>Newcastle disease</b>	
<ul style="list-style-type: none"> <li>• Aetiology: Avian paramyxovirus serotype 1</li> <li>• Symptoms: Twisting of neck and paralysis of wings and legs, cyanosis of comb, facial oedema, green diarrhoea, drop in egg production, sudden death</li> <li>• Lesions: Haemorrhage in intestine, petechial haemorrhage in proventriculus, congestion and mucoid exudates seen in the respiratory tract, especially in trachea</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Live vaccine</li> <li>• Treatment: None. Antibiotics to control secondary bacterial infections</li> </ul>
<b>Eastern equine encephalitis</b>	
<ul style="list-style-type: none"> <li>• Aetiology: Arbovirus</li> <li>• Symptoms: Flaccid neck, staggering, paralysis</li> <li>• Lesions: No gross lesions</li> </ul>	<ul style="list-style-type: none"> <li>• Prevention: Vaccination. Control mosquito population</li> <li>• Treatment: None</li> </ul>

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# What's Wrong with My Birds?

## Part 11: Lameness conditions (management)

**D**ue to intense genetic selection for increased growth and feed efficiency, lameness has become a growing issue in today's broiler industry on a global scale. Lameness is not only a concern in terms of

animal welfare: it also poses a serious financial threat to poultry producers as it is a significant cause of culling, mortality, and condemnations. Overall, the economic cost associated with lameness problems in poultry can add up to several hundred million dollars each year.

Many risk factors, including both nonpathogenic and pathogenic

causes, could be associated with the occurrence of lameness in broilers and the condition is usually multifactorial.

It is important to differentiate the multiple causes of lameness in order to develop proper prevention and treatment strategies as these strategies will change based on the causative agent identified.

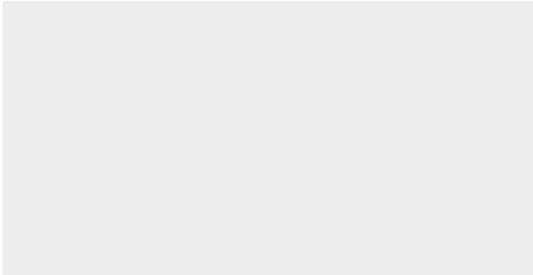
Management factors, such as litter quality and stocking density, can play a major role in the development of leg issues and lameness.

This table highlights several management factors that are commonly associated with increased occurrence of lameness and offers solutions to help mitigate the consequences of these conditions.

Condition	Corrective action
<b>Pododermatitis/Footpad dermatitis/Foot burn/Ammonia burn</b>	
<ul style="list-style-type: none"> <li>• Causation: Poor litter quality, biotin deficiency</li> <li>• Symptoms: Ulceration of the metatarsal and digital footpads</li> <li>• Lesions: Necrotic lesions on the plantar surface of the footpads</li> </ul>	<ul style="list-style-type: none"> <li>• Lower litter moisture with proper ventilation and avoid water spillage</li> <li>• Improve gut integrity by feeding poultry-specific, live probiotics</li> <li>• Supplement biotin in the feed</li> </ul>
<b>Tibial dyschondroplasia/Osteochondrosis</b>	
<ul style="list-style-type: none"> <li>• Causation: Genetic selection, late rapid growth rate, calcium-phosphorus ratio, excess chloride in feed metabolic acidosis, acid/base balance, mycotoxins</li> <li>• Symptoms: Swelling and bowing in the region of the knee joints, angulations of legs typically in birds &gt;35 days</li> <li>• Lesions: Plug of cartilage in proximal end of tibia, distal tibia, and proximal metatarsus, in decreasing order of frequency</li> </ul>	<ul style="list-style-type: none"> <li>• Lower the energy and protein density of feed to slow down the growth</li> <li>• Correct the nutritional imbalances</li> <li>• Add an effective mycotoxin deactivator in the feed</li> </ul>
<b>Twisted leg</b>	
<ul style="list-style-type: none"> <li>• Causation: Genetic selection, stocking density</li> <li>• Symptoms: Distortion at hock, valgus/varus, various angulations of legs</li> <li>• Lesions: Linear twisting of tibia and femur, Changed angulation of tibial condyles</li> </ul>	<ul style="list-style-type: none"> <li>• Euthanise affected bird</li> </ul>
<b>Degenerative joint disease</b>	
<ul style="list-style-type: none"> <li>• Causation: Developmental defects, physical damage</li> <li>• Symptoms: Imbalanced walking, huddling</li> <li>• Lesions: Damaged epiphyseal articular cartilage, especially of femoral anti-trochanter, but also other leg joints, resulting in erosions and cartilage flaps</li> </ul>	<ul style="list-style-type: none"> <li>• Euthanise affected bird</li> </ul>
<b>Ionophore toxicity</b>	
<ul style="list-style-type: none"> <li>• Causation: Monensin</li> <li>• Symptoms: Legs extended backward</li> <li>• Lesions: No specific lesions</li> </ul>	<ul style="list-style-type: none"> <li>• Mix feed properly</li> <li>• Withdraw the ionophore</li> </ul>

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