Managing dEB to optimise bird health and performance

The relationship between electrolytes in poultry diets is complex and often misunderstood. Achieving the proper dietary electrolyte balance (dEB) is crucial to achieving better poultry productivity and can solve many issues, including wet litter.

by Dr Ajeet Bishnoi,
Regional Manager, South Asia,
Middle East and Africa, Arm & Hammer
Animal and Food Production.
www.ahfoodchain.com

Many poultry production issues that are considered unavoidable may actually be metabolic disorders that can be prevented with the right dEB. Adjusting poultry diets to the proper dEB may also avoid costly fluctuations in production and health issues that often occur during times of bird stress.

Why is dEB important?

A relatively new concept in poultry nutrition, dEB measures key electrolytes in the diet – sodium (Na), potassium (K) and chloride (Cl). Na and K are cations, which carry a positive charge, while Cl is an anion, with a negative charge. These essential ions maintain osmotic pressure and acid-base balance of body fluids, so birds' metabolic and digestive systems perform at maximum efficiency. Measurement of dEB is expressed in milliequivalents per kilogram (mEq/kg) of feed dry matter and is calculated using this formula:

$$(Na + K) - (Cl)$$

The dEB value can be used to predict if the diet increases or decreases the bird's blood buffering capacity.

Determining optimal dEB levels

Optimal dEB in the diet depends on the type of operation, environment and time of year, with higher demands under heat and stress conditions. High temperatures and humidity induce panting, which creates lower blood carbon dioxide levels, resulting in respiratory alkalosis and a need for higher dietary K.

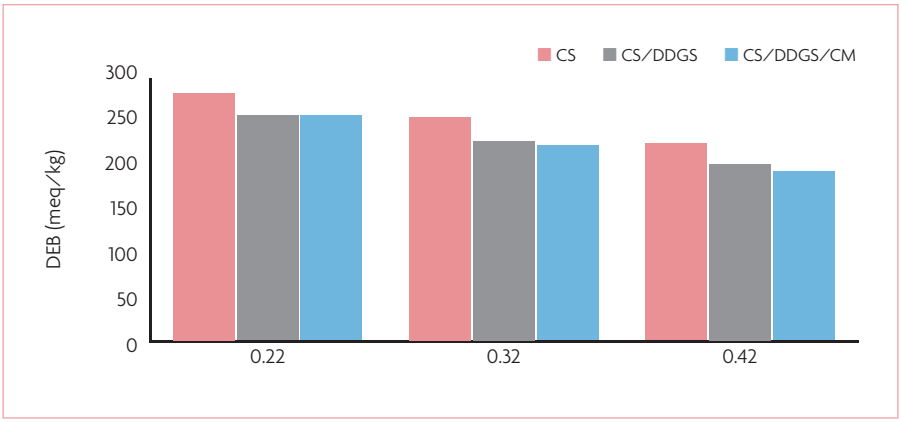

Fig. 1. Dietary electrolyte balance for different diet types (University of Minnesota). CS = corn soy poultry byproduct meal. CS/DDGS = CS + 20% distillers dried grains with solubles. CS/DDGS/CM = CSM + 20% DDGS + 10% canola meal.

Target poultry dEB values are:

- Broilers: 240mEq/kg; higher in summers and times of stress.
- Breeders: 200-230mEq/kg.
- Layers: 250mEq/kg.

It is important to monitor dEB because improper levels result in poor feed conversion and lower bodyweight; muscular and leg weakness; increased faecal moisture; metabolic disorders such as ascites, or 'water belly', and sudden death syndrome.

In addition, metabolic acidosis caused by improper dEB can result in bone or eggshell quality problems.

The longer dEB stays at suboptimal levels, the more serious the impact on productivity.

How feedstuffs affect dEB

Certain types of feedstuffs impact the dEB level in rations, especially when producers replace soya with other protein sources like distillers dried grains (DDGS) and canola meal (CM). These ingredients lead to lowered dEB due to high S and Cl content.

A study at the University of Minnesota, USA, demonstrated dEB variability in three diets for turkey birds at 11-14 weeks of age (Fig. 1).

Producers should be aware of dEB when formulating diets replacing corn and soya, and consider supplementing with the right exogenous salts to correct dEB.

This may help avoid issues of lowered performance.

Other factors impacting dEB

Phytase, a commonly used feed enzyme, also lowers dEB, leading to wet litter problems. That is because phytase binds calcium (Ca) and other cations like Na, which are then excreted in higher volumes.

As a result, birds increase water intake, making droppings wetter. Excess magnesium (Mg) also leads to wet litter. The Ca and Na matrix should be used to avoid wet litter issues when using exogenous phytase.

Cl also has a negative effect on dEB. Often, rations with high Cl levels (0.5% and higher) result in poor growth due to low feed consumption and high faecal moisture.

The value of proper dEB

Research shows the value of proper dEB. In a US broiler trial, researchers compared performance at three dEB levels for broilers fed in houses at 31°C and 75.5% humidity. Those fed a dEB of 250mEq/kg had significantly higher bodyweight gain and more efficient feed conversion compared with birds fed either lower dEB (120mEq/kg) or higher dEB (360mEq/kg).

Continued on page 13

Continued from page 11

In a layer trial in Turkey, dEB affected eggshell quality and overall egg production. Hens fed a diet of 256mEq/kg achieved 76.49% hen-day egg production, compared with 75.25% for those fed a diet of 80mEq/kg and 73.3% for those fed 330mEq/kg.

Limited research has been done in breeders, resulting in uncertainty about the correct electrolyte balance for broiler breeders, especially during egg production. In a recent trial, researchers compared the response of hens to three dEB levels (170, 200 and 230mEq/kg) during the laying phase. The 230mEq/kg treatment resulted in a lower percentage of cracked eggs and higher cumulative chick numbers compared to the lower dEB treatments.

Other dEB impacts

Research also shows how dEB affects bird health, specifically coccidiosis and immune response, as well as nitrogen (N) and amino acid digestibility.

US research with broiler chickens showed that higher dEB produced higher body weight, improved feed conversion and less mortality in the face of cocci challenges. Results indicated that a higher dEB achieved through supplementary Na and K helps control cocci-related diarrhoea.

Heat stress causes abnormal increases in the heterophil:lymphocyte ratio in the blood of broiler chickens, affecting immune response. This can be corrected by increasing dEB to a range of 220-250mEq/kg.

Increasing dEB correlates to a significant linear increase in Newcastle disease antibody titers following vaccinations at seven and 21 days.

Research also shows that higher dEB results in better digestibility, retention and absorption of essential amino acids.

Managing dEB

If the diet does not deliver the correct dEB level, feed supplementation is needed to ensure the proper use of cations and anions for optimal poultry performance. Start with analyses of your feedstuffs and select the proper salts to obtain the correct dEB in the ration.

Strong anions and cation salts (for example: Na2SO4, NaCl, K2SO4, KCl) result in neutral salts but do not produce the benefit of increased dEB. A better choice to increase the dEB is to feed a combination of strong cation and weak anion (for example: NaHCO3, Na2CO3, K2CO3).

Note that water electrolyte therapy in birds helps increase water intake but does not achieve the dEB correction that is only possible through feed supplementation.

Understanding and managing dEB is an important factor to maximise performance and productivity of your flock.

Consult with your nutritionist to learn more on how to achieve optimal dEB. The right selection of salts to obtain the correct dEB in the ration can solve many production issues with marginal added costs. ■

References are available from the author on request