

## Chelated Minerals in Poultry Nutrition

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### Introduction

Mineral nutrition plays a vital role in maintaining growth, production performance, immune competence, skeletal integrity, and reproductive efficiency in poultry. Traditionally, poultry diets have relied on inorganic mineral salts such as sulfates, oxides, and carbonates. However, these forms often exhibit low bioavailability due to antagonistic interactions in the gastrointestinal tract, leading to poor absorption and higher mineral excretion. To overcome these limitations, chelated (organic) minerals have been increasingly incorporated into poultry diets.

### What is chelated minerals?

Chelated minerals are trace elements chemically bound to organic ligands such as amino acids, peptides, or organic acids, forming stable complexes that enhance mineral utilization.

Common categories of organic/chelated minerals used in poultry include:

- **Metal amino acid chelates** (e.g., Zn-methionine, Cu-lysine)
- **Metal amino acid complexes**
- **Metal proteinates**
- **Metal polysaccharide complexes**
- **Metal organic acid complexes**

### Comparison between Inorganic and Chelated Minerals Used in Poultry Nutrition

Parameter	Inorganic Minerals	Chelated (Organic) Minerals
Chemical form	Simple mineral salts (sulphates, oxides, carbonates)	Metal ions bound to organic ligands (amino acids, peptides, organic acids)
Stability in gastrointestinal tract	Low	High; remain stable during digestion

Interaction with dietary antagonists	High interaction with phytates, calcium, and phosphorus	Minimal interaction with antagonists
Absorption pathway	Passive diffusion or mineral transporters	Amino acid or peptide transport systems
Bioavailability	Generally low to moderate	High
Required dietary inclusion level	Higher	Lower
Mineral excretion	High	Reduced
Cost	Lower	Higher

### Mechanism of action

Chelated minerals are electrically neutral and chemically stable, which protects them from undesirable interactions in the gastrointestinal tract. Unlike inorganic minerals that compete for absorption sites, chelated minerals are absorbed through amino acid or peptide transport systems. This unique absorption pathway allows chelated minerals to bypass mineral antagonism and reach target tissues more efficiently. Once absorbed, the mineral dissociates from the ligand at the site of metabolic activity, ensuring improved utilization and retention.

### Common Chelated Minerals Used in Poultry

#### 1. Zinc (Zn) :

Zinc is essential for enzyme activity, immune response, feather development, and skin integrity. Chelated zinc (e.g., zinc methionine, zinc proteinate) shows higher absorption and retention compared to zinc sulphate or oxide.

#### Benefits in poultry:

- Improved growth rate and feed efficiency
- Enhanced immune response and antioxidant status
- Better feathering and skin quality
- Improved eggshell quality and hatchability

#### 2. Copper (Cu)

Copper plays a role in iron metabolism, connective tissue formation, pigmentation, and antimicrobial activity in the gut. Chelated copper is effective at lower inclusion levels than inorganic copper sulphate.

#### Benefits:

- Improved growth performance
- Reduced oxidative stress
- Enhanced gut health and microbial balance
- Lower environmental copper excretion

### 3. Manganese (Mn)

Manganese is required for bone formation, eggshell quality, and enzyme activation. Chelated Mn is particularly beneficial in breeder and layer diets.

#### Benefits:

- Improved skeletal development and reduced leg disorders
- Enhanced eggshell thickness and strength
- Improved hatchability and embryo development

### 4. Iron (Fe)

Iron is essential for haemoglobin synthesis and oxygen transport. Chelated iron avoids antagonism with calcium and phosphorus.

#### Benefits:

- Improved haematological parameters
- Reduced risk of iron deficiency anaemia
- Better immune function

### 5. Selenium (Se)

Selenium is commonly used in organic form (e.g., selenium yeast, selenomethionine). Organic selenium is more efficiently incorporated into tissues and eggs than sodium selenite.

#### Benefits:

- Enhanced antioxidant defense (glutathione peroxidase activity)
- Improved immune response
- Better meat quality and shelf life
- Improved fertility and hatchability in breeders

### 6. Chromium (Cr)

Organic chromium (e.g., chromium picolinate, chromium yeast) is used to alleviate stress and improve carbohydrate metabolism.

#### Benefits:

- Improved growth under heat stress
- Enhanced immune response
- Better feed efficiency

#### Advantages of Chelated Minerals in Poultry

- Higher absorption and retention
- Reduced mineral antagonism (Ca, P, phytates)
- Improved growth, immunity, and reproduction

- Lower dietary inclusion levels required
- Reduced mineral excretion and environmental pollution
- Improved egg quality and meat quality
- Improved feed conversion ratio
- Reduced oxidative stress
- Improved eggshell thickness and strength
- Higher egg production and egg mass
- Improved mineral deposition in eggs
- Improved fertility and hatchability
- Better embryo development
- Reduced leg abnormalities in chicks

### Conclusion

Chelated minerals represent an advanced approach to poultry mineral nutrition. Their superior bioavailability, reduced antagonism, and positive effects on growth, immunity, reproduction, and environmental sustainability make them valuable alternatives to inorganic mineral sources. Strategic partial or complete replacement of inorganic minerals with chelated forms is recommended for optimal poultry performance.