Mastitis and Oxidative Stress Go Hand-in-Hand

Protect your cows by strengthening their antioxidant defenses – starting with Methionine and Selenium!

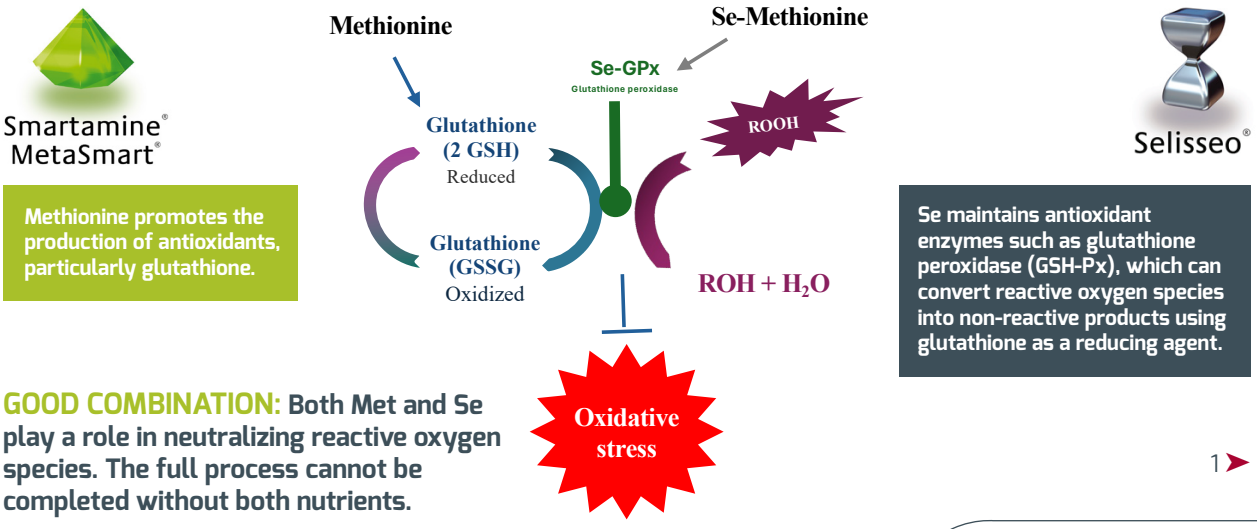
Mastitis is one of the most common and costly health issues in dairy herds, and it's closely tied to oxidative stress, which arises when there is an imbalance between reactive oxygen species (ROS) and antioxidants that neutralize them. This oxidative stress fuels inflammation, tissue damage, and reduces milk performance.

But you can help. Smartamine® M (or MetaSmart®) and Selisseo® deliver two essential nutrients, Methionine (Met) and (organic) Selenium (Se), that work together to limit oxidative stress and support healthier, more productive cows.

MITIGATING OXIDATIVE STRESS: WHY THE REDOX SYSTEMS MATTERS

Oxidative stress plays a central role in mastitis risk and severity - it increases the risk of infection, while immune activation during the infection generates high levels of ROS (Khan et al., 2023). To counter this, cows depend on the **redox system**, a network of enzymes and antioxidants that neutralize ROS and protect tissues. This system relies on multiple nutrients working in synergy - no single element alone can ensure redox balance. Among the most critical are Met and Se, which have complementary roles (Figure 1) in maintaining redox balance and limiting oxidative stress to reduce the risk and severity of mastitis.

Figure 1. Selenium and methionine cross talk: The glutathione system



GOOD COMBINATION: Both Met and Se play a role in neutralizing reactive oxygen species. The full process cannot be completed without both nutrients.

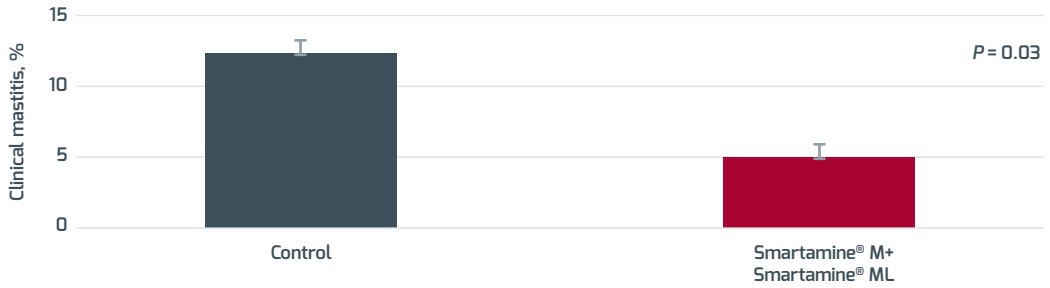
HOW METHIONINE HELPS: AN ESSENTIAL AMINO ACID FOR ANTIOXIDANT SYNTHESIS

Methionine is a key precursor for **glutathione**, a powerful antioxidant. In a recent study (Paz et al., 2024), cows (145 ± 51 DIM) fed Smartamine® M (0.09% DM; +13.4 g metabolizable Met; 2.53 Lys:Met) for 21 d prior to a subclinical mastitis challenge with *Streptococcus uberis* demonstrated:

- **Improved milk production:** Despite no difference in DMI, Smartamine M-fed cows produced more milk fat (+140 g/d), protein (+120 g/d), and ECM (+3 kg/d) during the first 72 h post-challenge vs. cows not fed supplemental Met, highlighting the importance of Met for sustaining production during a period of stress.
- **Reduced oxidative stress and inflammation:** Smartamine M-fed cows showed favorable changes in liver and plasma biomarkers (glutathione and the genes that synthesize it, ROS, and inflammatory markers) during the subclinical mastitis challenge, indicating **lower local and systemic oxidative stress and inflammation**, likely supporting improved performance.

Moreover, Abreu et al., 2023 reported a **decrease in clinical mastitis risk** (Figure 2; 61% reduction) when they balanced the diets of mid-lactation cows for Met and lysine using Smartamine M and ML (+ 13.9 g metabolizable Met and 36.9 g metabolizable Lys; 2.41 Lys:Met).

Figure 2. Effect of balancing for Met and Lys on clinical mastitis



HOW SELENIUM HELPS: AN ESSENTIAL TRACE MINERAL FOR THE REDOX SYSTEM

Selenium is crucial for the activity of several antioxidant enzymes, such as **glutathione peroxidase (GSH-Px)**. Deficiency in Se is consistently linked to **increased mastitis risk and elevated SCC**, a key marker of mammary gland inflammation (Xiao et al., 2021). However, source of Se matters (check out this recent Smartmail), and Selisseo®, hydroxy-selenomethionine (OH-SeMet), offers clear advantages over inorganic Se and Selenoyeast:

- **Superior bioavailability:** OH-SeMet avoids rumen losses common to inorganic forms.
- **Tissue storage:** OH-SeMet is converted in the body to SeMet which can be stored in muscle, creating antioxidant reserves for periods of stress when more antioxidants are needed.

Research shows OH-SeMet improves **Se status, GSH-Px activity, antioxidant capacity, and reduces SCC** (Figure 3; Hachemi et al., 2023a,b) compared to Selenoyeast. These improvements prepare the cow to handle oxidative stress and perform better in the face of a stressor, such as mastitis.

Figure 3. Effect of Se source on milk SCC

Means with different letters differ at $P < 0.05$.

CONCLUSION: SYNERGISTIC NUTRITIONAL DEFENSE

How do Met and Se work together? To neutralize ROS, Se-dependent antioxidant enzymes like GSH-Px rely on glutathione, which requires Met to be synthesized. Without both nutrients, the antioxidant system is incomplete.

That's why Met and Se (as SeMet) have distinct yet complementary roles in defending against oxidative stress. Adequately supplying both nutrients builds antioxidant reserves, which enhances resiliency to oxidative stress and sets the cow up to perform better during health challenges like mastitis.

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