Table S1. Comparison of Bioactive Compounds and Immunomodulatory Properties of Moringa oleifera with Conventional Feed Crops

Bioactive Compound	Moringa oleifera	Soybean	Maize	Alfalfa	Refs
Flavonoids	- Quercetin, kaempferol (high concentrations). Role: Inhibit pro-inflammatory enzymes (COX-2, iNOS), promote IL-10.	- Isoflavones (genistein, daidzein). - Role: Mild anti-inflammatory effects .	- Limited flavonoids (e.g., luteolin). - Role: Minimal immunomodulatory activity .	- Flavonols (quercetin derivatives). - Role: Moderate antioxidant support .	1-8
Polyphenols	- Caffeoylquinic acid, feruloylquinic acid. - **Role**: Scavenge ROS, reduce oxidative stress 6.	- Phenolic acids (ferulic acid). - Role: Moderate antioxidant capacity .	- Ferulic acid (bound to fiber). - Role: Limited bioavailability .	- Coumestrol, phenolic acids. - Role: Antioxidant and phytoestrogenic effects .	
Polysaccharides	- Arabinogalactans (MOP-1, MOP-2). - **Role**: Modulate gut microbiota (↑ *Lactobacillus*) 6.	- Oligosaccharides (raffinose, stachyose). - Role: Prebiotic effects .	- Starch-derived polysaccharides. - Role: Energy source .	- Pectin, fructans. - Role: Mild prebiotic activity .	
Saponins	- High content. - **Role**: Antimicrobial activity, immune stimulation 6.	- Soyasaponins. - Role: Limited immune stimulation .	- Absent or trace amounts. - Role: No significant contribution .	- Medicago-derived saponins. - Role: Anti-parasitic .	
Vitamins	- Vitamin C, E, A. - **Role**: Boost antioxidant enzymes (SOD, CAT) 6.	- Vitamin E (tocopherols). - Role: Antioxidant protection .	- Vitamin B complex. - Role: Metabolic support .	- Vitamin K, folate. - Role: Blood health .	
Minerals	- Calcium (2,016 mg/100g), iron (19.7 mg/100g). - **Role**: Reduce oxidative stress 6.	- Iron (8.2 mg/100g), zinc. - Role: Basic mineral support .	- Phosphorus, magnesium. - Role: Structural roles .	- Calcium, magnesium. - Role: Bone health .	
Unique Components	- Isothiocyanates (e.g., moringin). - **Role**: Anti-cancer via NF-κB inhibition 6.	- Trypsin inhibitors. - Role: Anti-nutritional if unprocessed .	- Zein (storage protein). - Role: No immunomodulatory relevance .	- Phytoestrogens (coumestrol). - Role: Hormonal modulation .	

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