Maltobionic Acid, a Powerful yet Gentle Skincare Ingredient with Multiple Benefits to Protect Skin and Reverse the Visible Signs of Aging

Irina Brouda, MA, Brenda L. Edison, BA, Ronni L. Weinkauf, PhD, Barbara A. Green, RPh, MS
NeoStrata Company, Inc., Princeton, NJ, USA

INTRODUCTION

Maltobionic acid is a naturally-derived polyhydroxy bionic acid that was recently discovered to provide topical anti-aging benefits. Maltobionic acid is a maltose-derived stereoisomer of lactobionic acid, a well characterized anti-aging ingredient.

Previously, maltobionic acid was shown to be non-mutagenic in the Ames II Assay and did not elicit irritation or sensitization in the MatTek EpiDerm skin model *in vitro*. Histological studies with maltobionic acid demonstrated increased epidermal thickness and enhanced GAG staining, in conjunction with a more compact stratum corneum. In a clinical study with 28 Caucasian women, 35-58 years of age, maltobionic acid (8%, pH 3.8) cream improved fine lines and wrinkles, elasticity, firmness, texture, dryness, and clarity of facial skin, and increased forearm skin thickness over 12 weeks of use.[1]

Before (Week 0)

After 16 weeks of use (Week 16)

This volunteer used an anti-aging regimen consisting of a face wash (maltobionic acid 0.5%), a daytime cream with sunscreen, a nighttime cream (maltobionic acid 4%), and an eye cream (maltobionic acid 3%).

Note the reductions in crow's feet around the eye as well as improvements in skin's texture and radiance.

OBJECTIVE

To demonstrate additional *in vitro* and *in vivo* **anti-aging and skin protective effects of maltobionic acid** through a series of new studies.

STUDY METHODS AND RESULTS

Protective Effects of Maltobionic Acid *in Vitro*

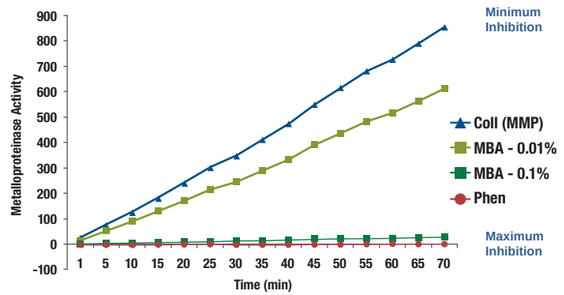
Maltobionic acid was tested for matrix metalloproteinase (MMP) inhibition, UV-induced lipid peroxidation inhibition, and melanogenesis inhibition in B16 melanocytes. These *in vitro* assays simulate the processes of collagen degradation,[2] oxidative stress,[3] and photodamage[4] that occur in living skin and are used to assess potential benefit ingredients in skincare products.

➤ Matrix Metalloproteinase Inhibition

Rationale	Test Materials	Results and Implications
MMPs break down and recycle collagen in skin's extracellular matrix. Blocking MMP action can preserve the skin matrix and help restore and maintain firm, tight, plump, and supple skin.	Maltobionic Acid (0.0001% - 0.1% solutions) Negative Control: Clostridium Collagenase IV (MMP) Positive Control: Phenantroline (MMP inhibitor)	-Maltobionic acid strongly inhibited matrix metalloproteinase activity **(Figure 1).** **-Maltobionic acid can be used to help prevent collagen degradation in human skin.**

Maltobionic acid shows strong dose-dependent inhibition of MMP activity *in vitro* and can be used to prevent collagen degradation in human skin.

Figure 1. Inhibition of Matrix Metalloproteinase (MMP) Activity by Maltobionic Acid *In Vitro*



Abbreviations: Coll (MMP) = Clostridium Collagenase IV (a collagen degrading enzyme - a type of matrix metalloproteinase); MBA = Maltobionic Acid; Phen = Phenantroline (a potent matrix metalloproteinase inhibitor)

➤ UV-Induced Lipid Peroxidation

Rationale	Test Materials	Results and Implications
UV light exposure generates O_2 free radicals that break down polyunsaturated fatty acids in cell membranes and mitochondria and damage cells. Inhibitors of lipid peroxidation scavenge free radicals and retard cell aging.	Maltobionic Acid (0.0001% - 0.1% solutions) Negative Control: Water Positive Controls: Vitamin C, Vitamin E	-Maltobionic acid reduced the production of malondialdehyde, an oxidative degradation product, thus acting as an antioxidant. Vitamins C and E demonstrated expected antioxidant activity. -Maltobionic acid is a moderate inhibitor of UV-induced lipid peroxidation. **-Maltobionic acid can act as a protective antioxidant in human skin.**

➤ Melanogenesis Inhibition in Cultured B16 Melanocytes

Rationale	Test Materials	Results and Implications
Exposure to sunlight stimulates melanin synthesis in melanocytes, which can lead to pigmentation irregularities such as age spots. Inhibitors of melanogenesis interfere with unwanted pigmentation.	Maltobionic Acid (0.0001% – 0.32% solutions) Negative Control: Water Positive Control: Kojic Acid + / - α-MSH*	-Maltobionic acid + α-MSH and kojic acid + α-MSH inhibited melanin synthesis in cultured B16 melanocytes in a dose-dependent manner. -Maltobionic acid is a moderate inhibitor of MSH-stimulated melanogenesis. **-Maltobionic acid can help prevent hyperpigmentation after sun exposure.**

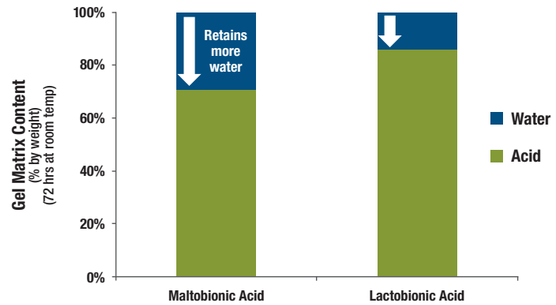
*All materials were tested in the presence (+) and in the absence (-) of α-melanocyte stimulating hormone (α-MSH) analog

Water-Binding Properties of Maltobionic Acid

Study Design: Aqueous solutions (1 g of material dissolved in 1 ml of water) of maltobionic acid and its lactose-derived stereoisomer, lactobionic acid, were allowed to evaporate at room temperature for up to 96 hours. Lactobionic acid is a well known moisturizer with better water-binding properties than glycerol, a commonly used humectant.[1]

Study Results: Both materials formed a continuous gel matrix after 72 hours; however, maltobionic acid was found to retain more water (29%) than lactobionic acid (14%)[5] **(Figure 2)**.

Figure 2. Gel Matrix Formation by Evaporated Oligosaccharide Aldonic Acid Solutions



Maltobionic acid binds more water than lactobionic acid during free evaporation of their respective aqueous solutions

Conclusion: Maltobionic acid is a superior humectant to lactobionic acid and traditional moisturizing agents.

Dermal and Ocular Safety of Maltobionic Acid

Clinical Test	Participants	Test Product	Results
Repeated Insult Patch Test (RIPT) (Semi-occlusive patch)	100 men and women, 16-75 years old	Maltobionic Acid (20% in cream, pH 3.8)	-No skin irritation reported -No allergic contact sensitization reported
Ophthalmological Evaluation of Ocular Irritation (4 weeks of twice daily at home applications to periocular areas)	32 women, 40-60 years old half were contact lens wearers	Maltobionic Acid (3% in cream, pH 3.8)	-No eye irritation reported -Safe to use by contact lens wearers

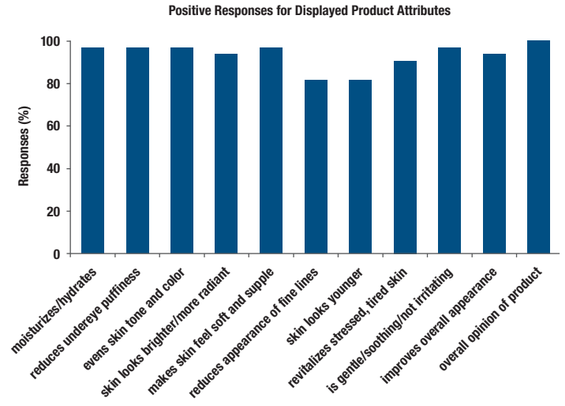
Periocular Anti-Aging Effects of Maltobionic Acid

Study Design: Healthy women, 40-60 years of age, applied an eye cream that contained maltobionic acid 3% (total PHA 6%) to bilateral outer and under eye areas twice a day for 4 weeks and graded cosmetic skin changes and test product aesthetics at the end of use.

Study Results: 32 participants completed 4 weeks of periocular use. Participants rated the cream as gentle and non-irritating (97%), reported reductions in fine periocular lines (81%), improvements in skin hydration (97%), texture (97%), tone and color (97%), and a more youthful (81%) and radiant (94%) appearance **(Figure 3)**. Also, 75% of participants noted their eye areas looked younger as early as within 2 weeks of use.

Figure 3. Positive Product Ratings for Eye Cream with Maltobionic Acid 3% after 4 Weeks of Use

Each column represents the percentage of Excellent + Very Good + Good responses from 32 women (40-60 years old) who applied a cream containing maltobionic acid 3% (total PHA 6%) twice daily to periocular areas and graded its cosmetic benefits and aesthetics on a scale of Excellent, Very Good, Good, Fair, Poor. (Fair and Poor responses are not shown.)



Summary: Women using a cream with maltobionic acid (3%) around their eyes for 4 weeks noted a positive change in their appearance and were pleased with the product's anti-aging benefits and mildness.

SUMMARY

New *in vitro* and clinical studies with **maltobionic acid** indicate that it **has multiple anti-aging and skin-protective benefits**:

- **Maltobionic acid** can be used to help preserve collagen and protect skin cells from oxidative stress and photodamage
- **Maltobionic acid** is a superior humectant, able to retain moisture better than lactobionic acid and other traditional moisturizing agents
- **Maltobionic acid** is non-allergenic and non-irritating to human skin and is clinically safe for topical use around the eyes, including in individuals who wear contact lenses
- Formulations that contain **maltobionic acid** can improve skin texture, firmness, clarity, and tone, reduce periocular lines and wrinkles, and contribute to a more youthful and radiant appearance

Maltobionic acid is a powerful yet gentle plant-derived anti-aging ingredient that offers simultaneous benefits as a moisturizer, antioxidant, pigment evening agent, and collagen preserver for today's skincare formulations.

REFERENCES

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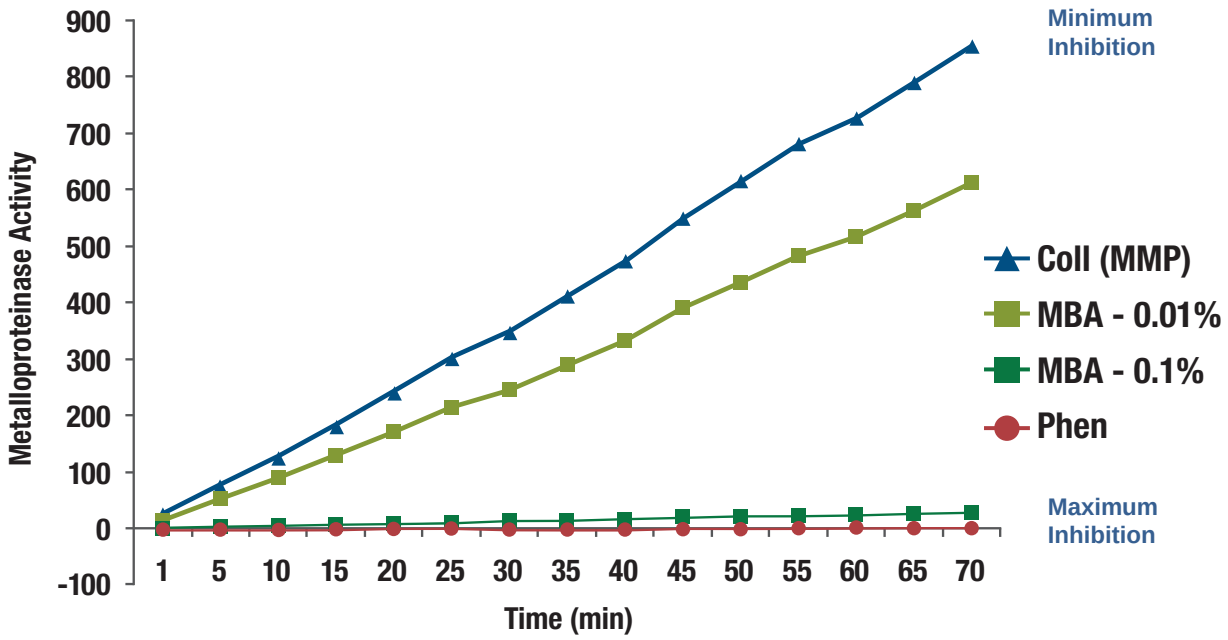

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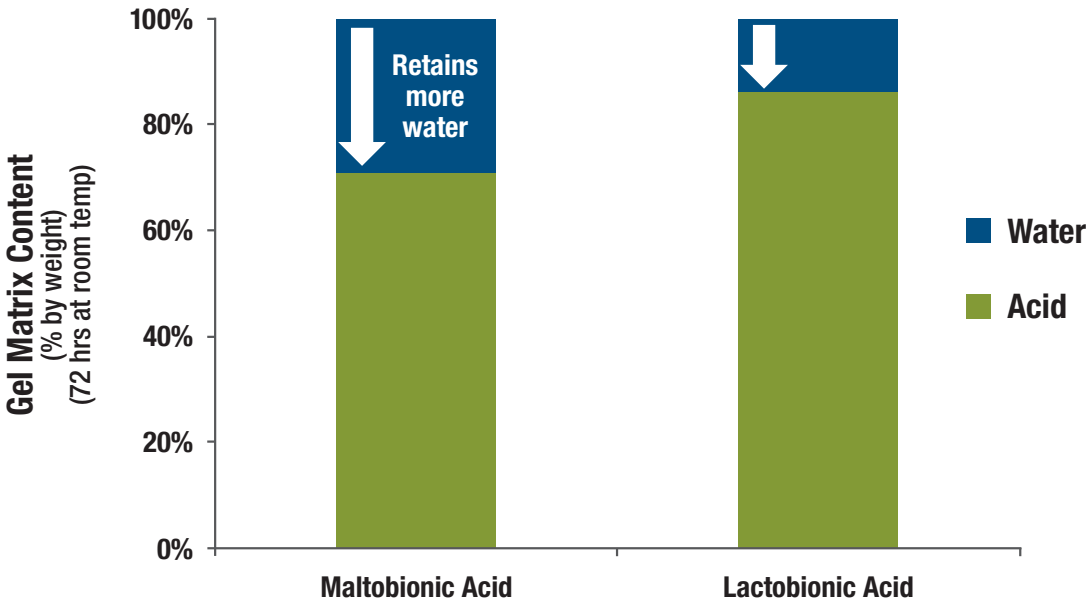

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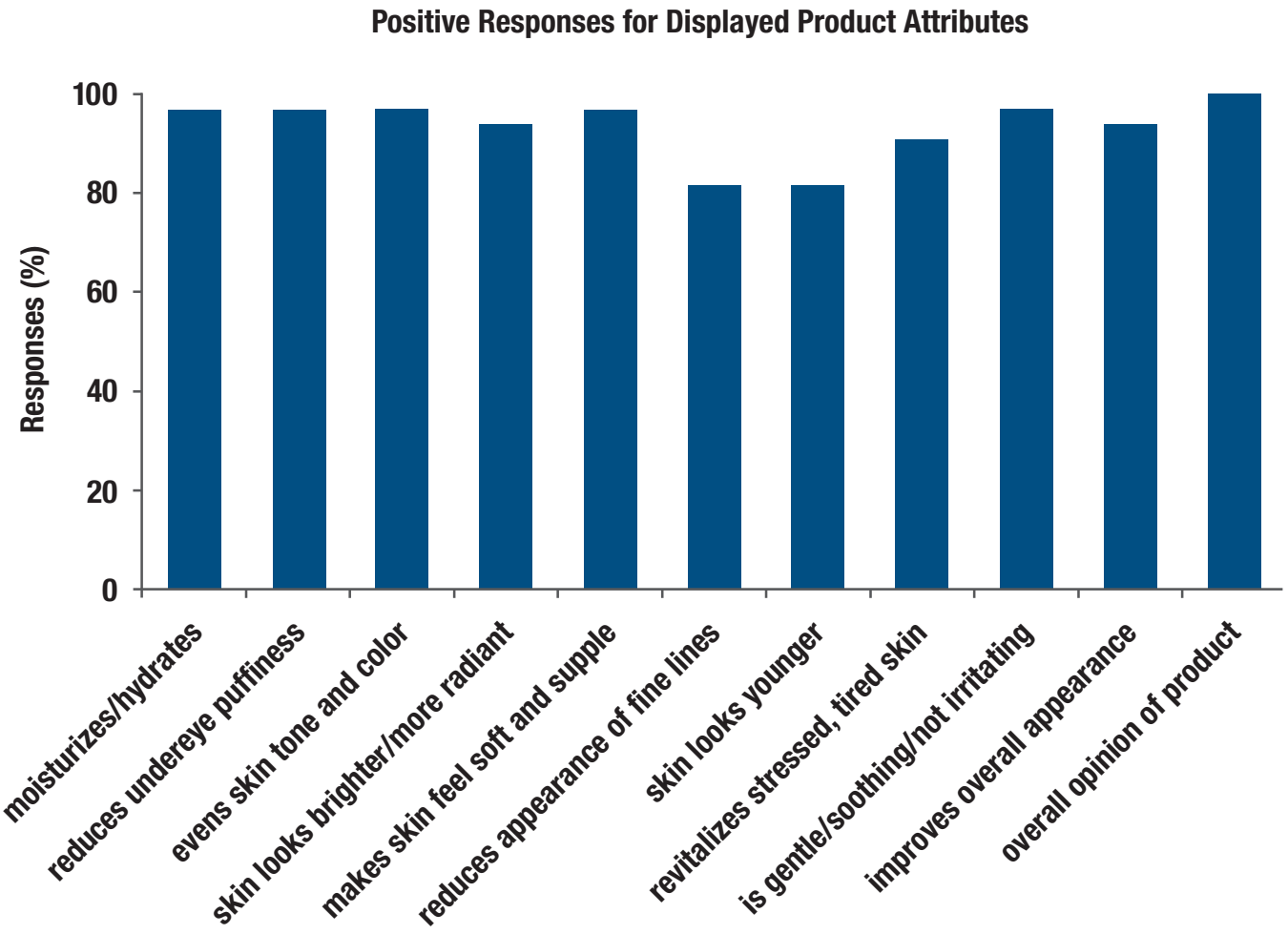

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