Maltobionic Acid, A Plant-Derived Bionic Acid for Topical Anti-Aging

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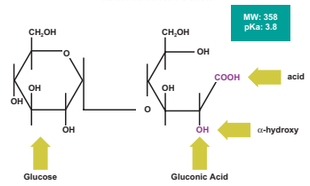
Introduction

Maltobionic acid (4-O-α-D-glucopyranosyl-D-gluconic acid, MW: 358, pKa: 3.8) is a **new polyhydroxy bionic acid** formed by oxidation of **maltose**. Maltobionic acid is comprised of one molecule of D-glucose attached via an ether-type linkage to D-gluconic acid (a polyhydroxy acid or PHA).

Maltobionic Acid



A chemically similar compound to the well-known lactobionic acid, this novel ingredient has the advantage of being **plant derived**, as well as, **gentle and non-irritating**. Maltobionic acid is a strong humectant and is also an antioxidant/chelator.

Previous work has documented prominent anti-aging effects for lactobionic acid including skin plumping and smoothing of surface topography with diminished appearance of fine lines and wrinkles.[1]

A study was conducted to evaluate the anti-aging effects of the new polyhydroxy bionic acid, maltobionic acid.

Objective

This poster will present safety data of maltobionic acid as well as clinical study results of a topical cream formulation containing **8% maltobionic acid** to evaluate its anti-aging effects on human skin.

Safety Profile of Maltobionic Acid[2]

Test	Test Material	Result
1. Ames II Assay	10% maltobionic acid (aq.)	Non-mutagenic: no base pair or frame shift mutations in the presence of S9 fraction
2. Cell Viability: Epiderm (EPI-100)	8% maltobionic acid cream in contact with living skin equivalent for 1, 4, and 24 hours. Negative control: water; Positive control: Triton-X 100 (1%), a mild irritant	Test material was classified as innocuous and nonirritating
2a. PGE2 assay (EPI-100)	(above)	No inflammatory prostaglandin release; test material was equivalent to the water control
2b. Lactate Dehydrogenase (LDH) (EPI-100)	(above)	No increase in cellular lysis; test material was equivalent to the water control
2c. Interleukin-1α (EPI-100)	(above)	No effect on cytokines; test material was equivalent to the water control

Anti-Aging Study Results

Study Conduct

- **Design:** prospective, direct-comparison to baseline scores (for visual grading & firmness) and to untreated control skin (for skin thickness & biopsies); protocol received IRB approval and informed consent was executed
- **Subjects:** 28 women, 35-58 years of age, Fitzpatrick types I, II and III (Caucasian), presence of mild-moderate periocular fine lines, periocular coarse wrinkles and mottled hyperpigmentation on the face
- **Product Application:** maltobionic acid, 8% cream, pH 3.8 was applied twice daily to the face and 3 times daily to one forearm; one forearm remained untreated as a control for forearm measurements
- **Clinical Evaluations:**
  - **Clinical Grading** (weeks 0, 6, 12): scores were collected visually by a trained evaluator using a 0 to 10 scale with 0.25 point increments for the following parameters:

Parameter	Site for Grading	Low Extreme of Scale	High Extreme of Scale
Fine Lines	Eye area	0 = None	10 = Severe
Coarse Wrinkles	Eye area	0 = None	10 = Severe
Pore Size	Cheek	0 = Invisible	10 = Very Large
Laxity	Cheek	0 = Firm, unpliable	10 = Loose, pliable
Roughness	Cheek	0 = Soft, smooth	10 = Rough, coarse
Sallowness	Face	0 = Light, non-yellow	10 = Dark, matte
Clarity	Face	0 = Dull, matte	10 = Clear, radiant
Mottled Pigmentation	Face	0 = Even tone	10 = Mottled, uneven tone

  - **Pinch Recoil** (weeks 0, 6, 12) measurements were taken of the under eye area to assess skin elasticity by pinching the skin and recording time with a stopwatch (in hundredths of a second) to full recovery of the skin. The measurements were performed in triplicate, and the average score was reported. Pinch recoil is a recognized indicator of skin resiliency and firmness.[3]
  - **Total Skin Thickness (plumping) Measurements** (weeks 0, 12) were collected on the outer forearms using a hinged pinching device and digital calipers as previously described.[4] Duplicate measurements representing a two-fold thickness of skin were taken and averaged at baseline and endpoint for both the treated and untreated control arms
  - **Irritation/Safety Grading** (weeks 0, 6, 12): global evaluation of objective irritation and safety was conducted for dryness, erythema and edema and subjective irritation scores were collected for burning, stinging, itching, tightness and tingling. Scale: 0 – 3 (none, mild, moderate, severe)
  - **Digital Photography** (weeks 0, 12) was collected using standardized lighting and positioning
  - **Self-Assessment** (weeks 0, 6, 12) was collected via questionnaires
  - **3-millimeter Punch Biopsies** were collected at endpoint on the forearms of several study participants. Biopsies were stored in 10% formalin and subsequently processed for histological assessments

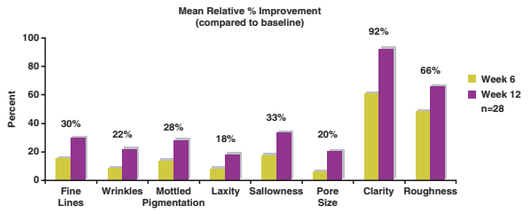
Statistics

- Clinical grading and pinch recoil: mean values were compared to baseline scores using a paired *t*-test, p≤0.05
- Total skin thickness: mean values were compared to baseline scores using a paired *t*-test, p≤0.05. Comparisons between treated and untreated test sites were made using ANOVA with Fishers LSD for pair-wise comparisons
- Self-assessment questionnaires were tabulated and a top box analysis was performed

Results

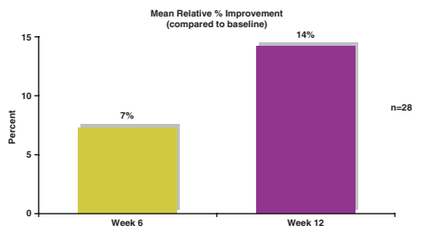
- 28 of 33 subjects completed the study. 4 subjects discontinued for reasons unrelated to the test product and 1 subject discontinued due to a reported allergic response.

Anti-Aging Effects



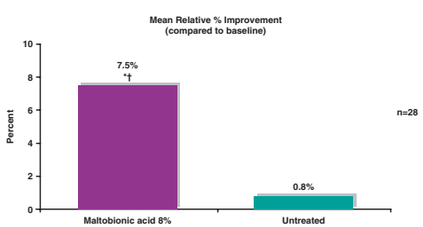
Clinical grading revealed significant improvements in all of the visually graded parameters at 6 and 12 weeks compared to baseline, p<0.05

Pinch Recoil/Firmness



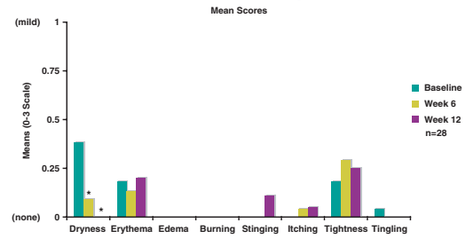
Firmness/elasticity was significantly improved at 6 and 12 weeks compared to baseline, p<0.05

Skin Thickness Measurements on Forearms



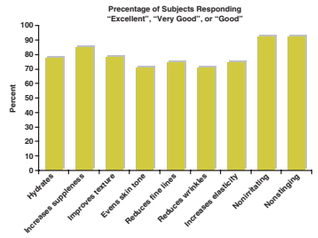
*Significant increase in skin thickness (plumpness) compared to baseline, p<0.05.
†Significantly thicker than untreated (p=0.0001).

Facial Irritation Grading



The test material was well tolerated with no increases in irritation parameters. *Denotes significant improvements in preexisting symptoms compared to baseline, p<0.05

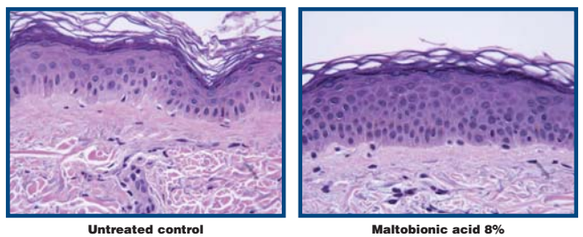
Self-Assessment



Significant self-assessed skin improvements were noted. These findings support the clinical grading and efficacy measurements

Histology Results

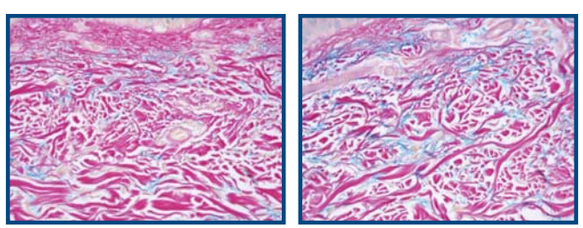
Epidermal Structure: 400x



Untreated control | Maltobionic acid 8%

Increased viable epidermal thickness and a more compact stratum corneum

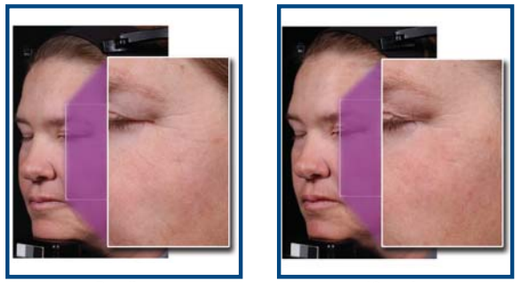
GAGs: 400x



Untreated control | Maltobionic acid 8%

Increased density of dermal colloidal iron staining (blue color) representing glycosaminoglycans/acid mucopolysaccharides (GAGs)

Clinical Photographs



Baseline | 12 weeks

Diminished periocular fine lines and smoother texture at 12 weeks

Baseline | 12 weeks

Improved texture, reduced pore size and erythema at 12 weeks

Baseline | 12 weeks

Diminished periocular fine lines and smoother texture at 12 weeks

Summary

Maltobionic acid is a **new, plant-derived polyhydroxy bionic acid** for anti-aging and skin smoothing. Due to its polyhydroxy structure, it is a potent **humectant** and **antioxidant**. Safety studies indicate that this compound is **safe and nonirritating** to skin. The clinical study presented in this poster reveals **significant cutaneous anti-aging effects** of an 8% formulation. Benefits presented in this poster include:

- Increased skin thickness and plumping to provide skin smoothing effects
- Visual improvements in skin texture, clarity and roughness
- Increased skin firmness and elasticity
- Self-assessed improvements in skin texture, suppleness, degree of hydration and elasticity
- No irritation
- Histological effects

References

1. Green BA, Edison BL, Wildnauer RH, Sigler ML. Lactobionic acid and Gluconolactone: PHAs for Photoaged Skin. *Cosmet Dermatol.* 2001;9:24-28.
2. Date on file, NeoStrata Company, Inc.
3. Appa Y, Asuncion BS, Stephens TJ, Rizer RL, Miller DL, Herndon JH. A six month clinical study to evaluate the long term efficacy and safety of an alpha hydroxy acid lotion. *Amer Acad Dermatol Poster Exhibit*: Washington DC, February 1996.
4. Ditre CM, Griffin TD, Murphy GF, Sueki H, Telegan B, Johnson WC, Yu RJ, Van Scott EJ. Effects of α-hydroxy acids on photoaged skin: A pilot clinical, histologic, and ultrastructural study. *J Am Acad Dermatol.* 1996:34:187-195.

Poster exhibit at the *64th Annual American Academy of Dermatology Meeting*; San Francisco, California; March 4-6, 2006.