A full spectrum gut health nutraceutical
absorption, healing, microbiota, and immune

16 in-vitro and 8 in-vivo studies

Published in
Journal of Agricultural and Food Chemistry
Molecular Nutrition & Food Research
Scientific Reports

Patents US8197860 B2, US 13/444765,

GRAS/NDI self-affirmed
NPN 80079287

Pennies per serving

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The human gut has a huge impact on the entire health of the body. A healthy gut contributes to better absorption, a healthy gut ecosystem, stronger immune functions, heart health, brain health, improved mood, healthy sleep, and more.

Nutrients in the foods, once digested, may enter the human body from the gut lumen by passive diffusion and osmosis. But many nutrients such as amino acids, do require active transporters located on the intestinal epithelial cell membrane to transport them from the gut lumen to circulation, such as SGLT1 for glucose absorption. These active transporters are activated by mRNA.

Disruption of normal barrier function is a fundamental factor in inflammatory bowel disease, which includes increased epithelial cell death, modified mucus configuration, altered tight junctions, along with decreased expression of antimicrobial peptides.

Gut microbiota is a dynamic “organ” of critical importance for human health. In healthy conditions the symbiotic microorganisms in the intestinal tract participate in the normal nutrient metabolism and immunity regulation of the host. Gut mucosal integrity is absolutely important for the adhesion and growth of gut microbiota.

The lymphoid elements of the gut comprise organized lymphoid tissues such as the Peyer’s patches (PP), and the mesentric lymph nodes (MLN). The effector sites of the intestine are the mucosal epithelium and underlying lamina propria (LP). Here there are many different immune cells including activated T cells, plasma cells, mast cells, dendritic cells and macrophages. Inflamed intestinal epithelial cell and lamina propria reduce these immune cells and weaken the immune functions.

For more details, please view the scientific papers
ASTRAGIN® PROMOTES ABSORPTION, INTESTINAL WALL REGENERATION, MICROBIOTA POPULATION AND IMMUNE FUNCTIONS

AstraGin® is NuLiv Science’s proprietary gut nutraceutical composed of highly purified and fractionated Panax notoginseng and Astragalus membranaceus produced by a proprietary pharmaceutical extraction and processing technology.

AstraGin® has shown in 16 in-vitro and 8 in-vivo studies that are published in the Journal of Agricultural and Food Chemistry, Molecular Nutrition & Food Research and Scientific Reports to:

• increase the absorption of peptides, amino acids, fatty acids, vitamins and phytonutrients by up-regulating the absorption specific mRNA and transporters, such as SGLT1, CAT1, and GLUT4.

• repair ulcerated and damaged intestinal walls and reduce intestinal submucosa inflammation. AstraGin® was shown in a hematoxylin-eosin stain and a MPO assay to reduce ulceration and unclear surfaces of intestinal epithelial cells and sub-mucosal edema in TNBS-induced colitis rats.

• may help maintain a healthy microbiota population by mending ulcerated and damaged intestinal epithelial cell surfaces for the microbiota to populate.

• may help support stronger immune functions by mending ulcerated epithelial cells and reducing the inflammation in intestinal mucosal lamina propria that hosts the gut-associated lymphoid tissue (GALT), T cells, plasma cells, mast cells, dendritic cells, and macrophages.

For details, please view the scientific papers
ASTRAGIN® INCREASES ABSORPTION & BIOAVAILABILITY OF AMINO ACIDS, PEPTIDES, FATTY ACIDS, VITAMIN, AND PHYTONUTRIENTS

Many nutrients, such as glucose and amino acids, are absorbed through special absorption sites on intestinal lumen by special transport proteins.

AstraGin® has shown in 16 in-vitro in Caco-2 cell and 8 in-vivo in normal and TNBS-induced colitis rat to increase the absorption of amino acids, peptides, fatty acids, folate, and phytogenic nutrients by up-regulating the expression level of special mRNA and transport proteins, such as SGLT1 and CAT1.

Types of Transport Proteins

- Non-specific transporter
- Specific transporter

(Miner-Williams WM, et al, 2014)
**ASTRAGIN® INCREASES AMINO ACIDS AND PEPTIDES ABSORPTION IN CACO-2 CELL**
**ASTRAGIN® INCREASES FATTY ACIDS ABSORPTION**

- Fish Oil: 100**
- Flax Seed Oil: 58%***
- Omega-7 Fatty Acids: 39%**
**ASTRAGIN® INCREASES PROTEIN TRANSPORTER CAT1 IN RATS**

Jejunum CAT1 Protein

Ileum CAT1 Protein

Jejunum CAT1 Transcript

Ileum CAT1 Transcript
**ASTRAGIN® INCREASES LYSINE, HISTIDINE AND ARGinine ABsorption IN NORMAL AND TNBS-INDUCED RATS**

- **Lysine**
  - *25%* 1 week after AstraGin® in normal rats
  - **38%** 1 week after AstraGin® in TNBS-induced colitis rats

- **Arginine**
  - *16%* 1 week after AstraGin® in normal rats
  - **30%** 1 week after AstraGin® in TNBS-induced colitis rats

- **Histidine**
  - *-2%* 1 week after AstraGin® in normal rats
  - **22%** 1 week after AstraGin® in TNBS-induced colitis rats

* 1 week after AstraGin® in normal rats
** 1 week after AstraGin® in TNBS-induced colitis rats
**MUSCLE SYNTHESIS**

**ASTRAGIN® INCREASES PROTEIN SYNTHESIS THROUGH MITOCHONDRIAL FUNCTION DERIVED SIGNALING PATHWAYS**

Mitochondrial dysfunction inhibits muscle mass growth. AstraGin® has shown to increase liver ATP production by 18% and elevated mitochondrial function.

(Vanina Romanello, et al, 2016)
Muscle protein synthesis is influenced by the availability of leucine.

(Vanina Romanello, et al, 2016)
ARGININE CONCENTRATION AND \textit{mTOR} PATHWAYS

\textbf{mTOR}

\textit{mTOR} (Mammalian target of rapamycin) is an enzyme that is stimulated by nutrients and growth factors and inhibited by stress to ensure that cells grow only during favorable conditions.

\textbf{p70S6K}

\textit{p70S6K} (S6K1) is a kinase that acts downstream of \textit{mTOR} signaling in response to growth factors and plays a role in protein synthesis and in cell growth control.
EFFECTS OF ASTRAGIN® ON mTOR PATHWAY

Based on the difference in extracellular concentration of leucine from 130nM to 210nM.
Healthy epithelial cells of the villi transport nutrients (amino acids and carbohydrates) and lacteals (lipids) from the lumen of the intestine to the blood stream. When epithelial barrier integrity is compromised due to inflammation, medications or other factors, harmful substances get into our body.

Precise mechanisms of this condition is still unknown. Most studies concur that it is associated with hereditary, infectious, environmental, and auto-immune factors. The integrity of the intestinal epithelial barrier plays a critical role in human health.

Restoration of the epithelial barrier integrity is an important healing response in intestinal disorders. Medications such as non-steroidal anti-inflammatory drugs, steroids, and immunomodulators, are limited in their application because of poor efficacy and adverse effects.
**ASTRAGIN® INCREASES L-ARGININE UPTAKE AND CAT TRANSPORTER LEVELS IN CACO-2 CELLS**

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**LUMEN RENEWAL**

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*p < 0.05, **p < 0.01, and ***p < 0.001 versus the untreated control.*
ASTRAGIN® ACTIVATES THE mTOR PATHWAY AND ENHANCES PROTEIN SYNTHESIS IN CACO-2 CELLS

![Graphs showing p-mTOR/mTOR, p-4E-BP1/4E-BP1, p-S6K/S6K, and Protein Synthesis](image)

*p < 0.05, **p < 0.01, and ***p < 0.001 versus the untreated control.
LYSINE AND RAPAMYCIN SUPPRESS THE EFFECTS OF ASTRAGIN® ON mTOR SIGNALING PATHWAY

*\( p < 0.05 \), **\( p < 0.01 \), and ***\( p < 0.001 \) versus the untreated control.

## \( p < 0.01 \), and ### \( p < 0.001 \) versus the AstraGin®-treated.
ASTRAGIN® REDUCES INFLAMMATION
IN TNBS-INDUCED COLITIS MICE

**Graphs:**
- Plot of % Body Weight over time (day) for Control, TNBS, and TNBS + AstraGin®.
- Bar graph showing Small Intestinal Length in cm for Control, TNBS, and TNBS + AstraGin®.
- Bar graph showing MPO Activity (Units/mg tissue) for Control, TNBS, and TNBS + AstraGin®.
- Bar graph showing Mucosal Permeability (ng/ml) for Control, TNBS, and TNBS + AstraGin®.
- Bar graph showing Tissue L-Arg Uptake (pmol/mg protein -1 * min -1 ) for Control, TNBS, and TNBS + AstraGin®.
ASTRAGIN® PROMOTES CELL PROLIFERATION AND SCRATCH WOUND CLOSURE IN CACO-2 CELLS

The mTOR pathway, a central regulator of human metabolism and physiology, regulates cell growth, cell proliferation, cell motility, cell survival, protein synthesis, autophagy, and transcription.

**p < 0.01, and ***p < 0.001 versus the untreated control.
AstraGin® was shown in a hematoxylin-eosin stain and a MPO assay to reduce ulceration and unclear surface of intestinal epithelial cells and sub-mucosal edema in TNBS-induced colitis rats. It is suggested from the many in-vitro studies that this effect may be due to AstraGin®’s ability to up-regulate the mTOR pathway to increase the protein synthesis and cell proliferation.
Gut microbiota is a dynamic “organ” of critical importance for human health. In healthy conditions, the symbiotic microorganisms in the intestinal tract participate in the normal nutrient metabolism and immunity regulation of the host. Gut mucosal integrity is absolutely important for the adhesion and growth of gut microbiota.

AstraGin® may help populate good gut microbiota by mending ulcerated and damaged intestinal epithelial cells for the microbiota to live.
Intestinal epithelial cells and sub-mucosa (lamina propria (LP)) host gut-associated lymphoid tissue (GALT), T cells, plasma cells, mast cells, dendritic cells, and macrophages. Inflamed intestinal epithelial cells and lamina propria reduce these immune cells and weaken the immune functions.

AstraGin® has shown to repair ulcerated epithelial cells and reduce inflammation in lamina propria that host many immune cells, such as gut-associated lymphoid tissue (GALT), T cells, plasma cells, mast cells, dendritic cells, and macrophages.


3. T.C. Chang, etc. Astragaloside II promotes intestinal epithelial repair by enhancing L-arginine uptake and activating the mTOR pathway. *Scientific Reports.* (2017)
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For questions and additional information please contact

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