wellmune®

Research Summary

wellmune®

A natural food, beverage and supplement ingredient clinically proven to help strengthen the immune system.

Introduction.

The powerful and consistent clinical research supporting Wellmune® makes it an ideal immune health ingredient for delivering real health benefits to consumers.

Wellmune has been shown to help:

- Improve general immune health.
- Maintain overall physical health.
- Protect against the harmful effects of stress.
- Promote healthy energy levels and mental clarity.

Wellmune is:

- Supported by over a dozen clinical studies.
- A patented and award-winning global brand.
- Kosher, Halal, gluten-free, non-allergenic, non-GMO.
- Informed-Sport certified.
- Safe for everyday consumption with broad regulatory approvals.

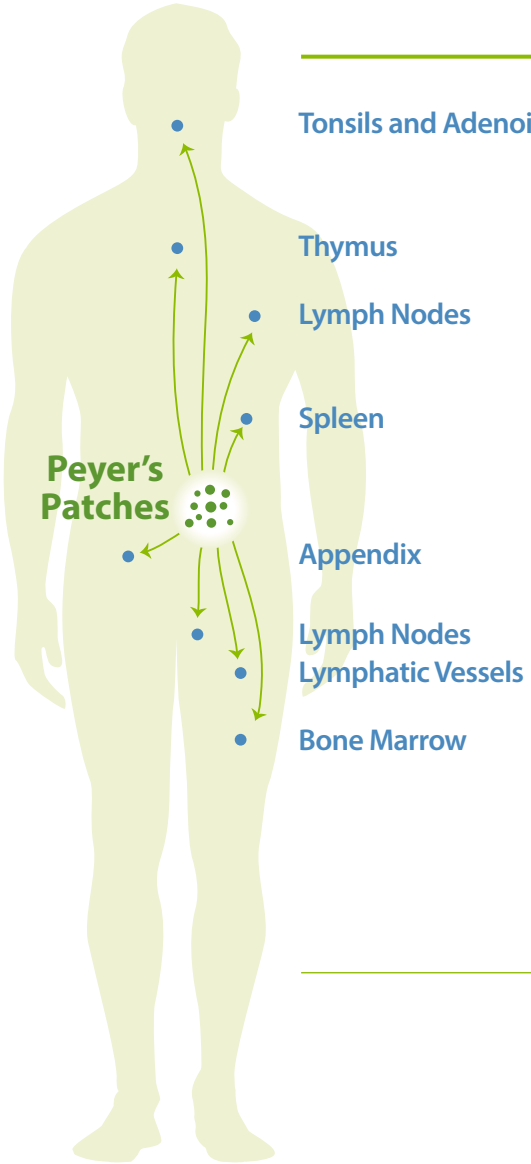
Wellmune has regulatory approval in major markets around the world, including GRAS status in the U.S. and novel food approval in Europe and China. Focused on immune health benefits, products containing Wellmune are available in more than 60 countries.

*Immune health is a **top functional benefit** that consumers want in foods and beverages, second only to general health and wellness.*

2015 Global Data survey of nearly 28,000 consumers in 31 markets.

The Wellmune® mechanism of action.

Wellmune interacts with human immune defenses that have evolved over thousands of years to protect the body. And importantly, **Wellmune supports immune function without overstimulating the immune system**.



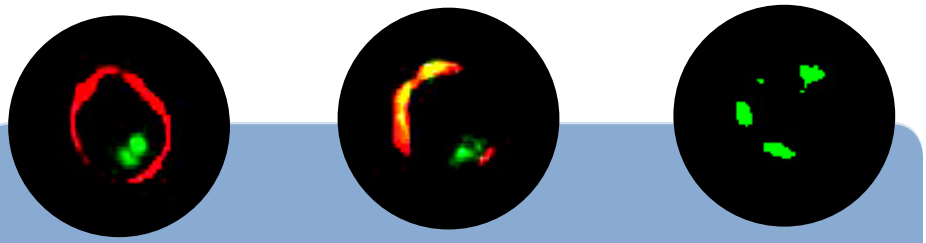
- Wellmune is a natural beta 1,3/1,6 glucan highly purified from the cell wall of a proprietary baker's yeast (Saccharomyces cerevisiae).
- Consumed orally, Wellmune is taken up in the body by the Peyer's Patches in the intestines.
- Immune cells called macrophages (located in the Peyer's Patches) ingest Wellmune and travel to the immune organs throughout the body.
- Macrophages break down Wellmune into smaller fragments that bind to neutrophils, the most abundant immune cells in the body.
- Primed by Wellmune, neutrophils move more quickly to recognize and kill foreign challenges.

Research related to the mechanism of action.

Scientific understanding of Wellmune's mechanism of action in the body is well documented in published, peer-reviewed research. Researchers discovered Wellmune's mechanism of action through a series of experiments:

- Studies tracked fluorescently dyed Wellmune as immune cells transported it throughout the body (Figure 1). **Within days, Wellmune is carried** to the spleen, bone marrow and other immune organs.
- A study observed **significant improvement in the killing activity of immune cells**. Phagocytic cells, which literally engulf and destroy foreign challenges, showed greater microbial killing in subjects who had taken Wellmune.
- Expanded research focused on immune biomarkers linked health benefits to changes in immune function. While more research is needed, the studies **confirm immunological activity consistent with the presence of Wellmune**.

Figure 1:
Wellmune® in Action



Day 1	Day 2	Day 3
Wellmune (shown in green) ingested by macrophages.	Macrophages degrade Wellmune and release tiny fragments.	Wellmune fragments bind to neutrophils, priming them for activity.

"Mechanism by which Orally Administered Beta-1,3-Glucans Enhance the Tumoricidal Activity of Antitumor Monoclonal Antibodies in Murine Tumor Models." (2004) *Journal of Immunology* 173:797-806.

Wellmune® product applications.

Wellmune is designed for food, beverage and supplement applications, and is stable under the vast majority of manufacturing processes. It is available in two powder forms:

- **Dispersible** for food and select beverage applications.
- **Water soluble** for certain beverage applications with clarity or other manufacturing requirements. In water at 1mg per milliliter, soluble Wellmune is odorless, clear and has a mild if any taste.

Wellmune® research: proof of efficacy.

Clinical studies have consistently demonstrated:

- The ability of Wellmune to **support healthy human immune responses** to stress in a variety of populations.
- That Wellmune **reduces the incidence of upper respiratory tract infection symptoms** and **improves an overall sense of well-being** in people of all ages experiencing physical or lifestyle stress.

The complete body of research supporting Wellmune includes additional clinical research, numerous preclinical studies and human biomarker research. Beginning on page 27 is a bibliography of clinical and preclinical research related to Wellmune.

Ongoing research continues to advance the science behind Wellmune. For more information on Wellmune, immune health and additional resources, please visit **www.wellmune.com.**

Clinical Studies Table of Contents

Children · Older Adults · Athletes · Stress · General/Environmental

*Pending publication

Older Adults

Wellmune® supports the immune health of older adults.

Study: Older Adults

In a cold-and-flu season pilot study with older adults, Wellmune demonstrated a strong trend towards reducing the number of upper respiratory tract infections (URTIs), reducing symptom days of a cold, and statistically significant changes in the body's response to viral encounters and inflammation.

Study Protocol

Study Site	University of Southampton School of Medicine, UK
Population	100 healthy adults (54 men, 46 women)
Age	50-68 (average 59 years)
Design	Randomized, double-blinded, placebo-controlled, parallel arm study
Duration	90 days
Serving	Participants were split into two groups, and consumed one of the following once daily: • 250mg Wellmune • placebo
Details	Incidence of URTIs was medically confirmed. Blood biomarker evaluation included plasma cytokines and LPS-induced cytokine response.

"Respiratory infections are a major source of health burden and a leading cause for antibiotic use. The concept of using Wellmune as a nutritional supplement to support immune defenses was very popular with study participants. The results of this pilot are encouraging and further studies certainly seem justified."

—Richard Fuller, M.D., study leader and University of Southampton Hospital Department of Primary Care and Population Science

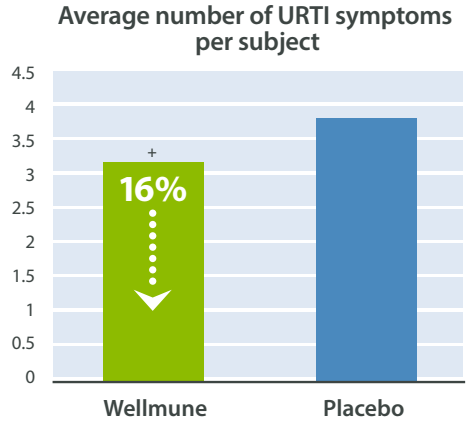
Results

Wellmune modulated the cytokine response to LPS by:

- Increasing levels of a key cell-activating cytokine (interferon-gamma).
- Maintaining levels of key cell-attracting cytokines MCP-1 and MIG.

There was a strong statistical trend that showed Wellmune decreased the number of URTI symptom days.

Participants taking Wellmune had **16% decrease in total URTI symptom days.**



+ p=0.067

"Yeast-Derived Beta 1,3/1,6 Glucan, Upper Respiratory Tract Infection and Innate Immunity in Older Adults." (2017) *Nutrition* 39-40:30-35.

Children

Children taking Wellmune® are significantly healthier.

Study: Children

Wellmune helped keep children healthier by decreasing episodes of common childhood illnesses and symptoms of illness, such as upper respiratory tract infections (URTIs).

Study Protocol

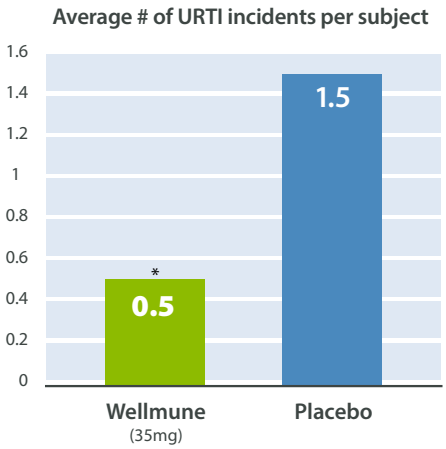
Study Site	Department of Pediatrics, Chang Ping Women and Children Health Care Hospital, PR China
Population	156 healthy children (73 boys, 83 girls)
Age	12-48 months (average 36 months)
Design	Randomized, double-blinded, placebo-controlled, parallel arm study
Duration	12 weeks
Serving	Participants were split into three groups, and consumed one of the following once daily (beverage based): • 75mg Wellmune • 35mg Wellmune • placebo
Details	All records were medically verified; significant differences between placebo and Wellmune groups were found; no significant differences between the Wellmune groups (35 & 75mg) were found. Investigators observed the health of children after administration of Wellmune or the placebo, recorded total days and times of URTIs, and total days and times of all kinds of infection symptoms.

Mead Johnson Nutrition has conducted two clinical studies with children in daycare settings. One study demonstrated children consuming a beverage-based formula with Wellmune had significantly fewer acute respiratory infections and the duration of their illnesses were significantly shorter than children drinking unfortified cow's milk. A second study demonstrated fewer episodes of allergy symptoms and other ailments with children drinking the formula with Wellmune.

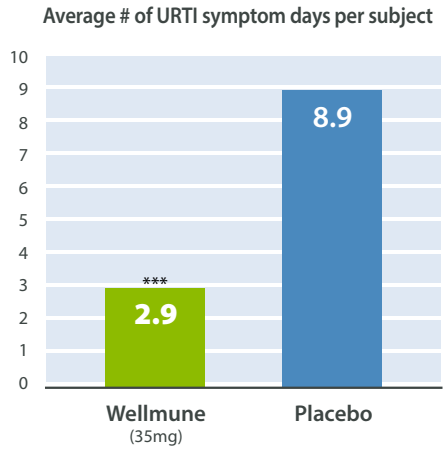
Results

- Children taking Wellmune for 12 weeks reported fewer URTI symptoms and fewer sick days.
- Children taking Wellmune were significantly healthier.

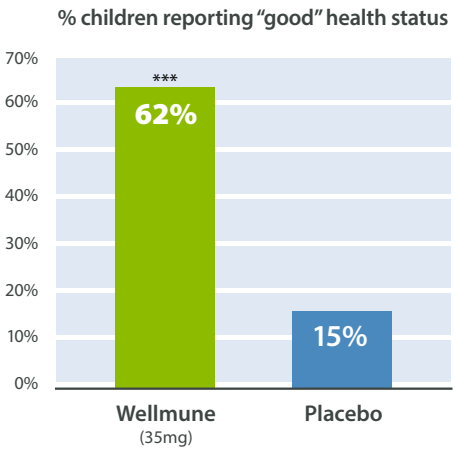
Children taking Wellmune had
2/3 fewer URTI symptoms.



Children taking Wellmune had
6 fewer sick days in 12 weeks.



Children taking Wellmune were
significantly healthier, with 62% reporting "good" health status.



*p≤0.05, **p≤0.01, ***p≤0.001

"Baker's Yeast Beta-Glucan Decreases Episodes of Common Childhood Illness in 1 to 4 Year Old Children during Cold Season in China." (2016) Journal of Nutrition & Food Sciences 6:518.

Athletes

Wellmune® reduces upper respiratory tract infection (URTI) symptoms among marathoners.

Study: Texas Marathon

This study confirmed previous clinical research showing that Wellmune supports the immune system of athletes. In this case, Wellmune showed health benefits for runners who had completed a marathon, for whom post-race URTIs are common.

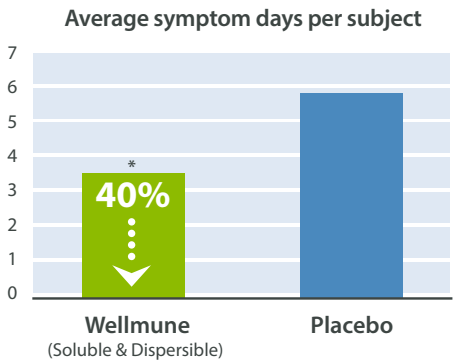
Study Protocol

Study Site	Department of Health and Human Performance, University of Houston, USA
Population	182 runners (96 men, 86 women) who completed the 2011 LiveStrong Marathon in Austin, Texas with an average finish time of 4 hours
Age	29-46 (average 34 years)
Design	Randomized, double-blinded, placebo-controlled, parallel arm study
Duration	Four weeks
Serving	Participants were split into three groups, and consumed one of the following once daily: • 250mg Wellmune soluble • 250mg Wellmune dispersible • placebo
Details	Incidence of URTI symptoms was assessed using the clinically-validated WURSS-44 survey.

Results

- Wellmune supplementation significantly reduced the number of days that subjects reported both general health problems as well as cold/flu symptoms.

Participants taking Wellmune had **40% reduction in URTI symptoms.**



Additional Information

Based on previous studies by the University of Houston, it is reasonable to speculate that the improvements associated with Wellmune were due to alterations in monocytes, plasma cytokines and improved mucosal immunity.

*p≤0.05, **p≤0.01, ***p≤0.001

"Baker's Yeast Beta Glucan Supplementation Increases Salivary IgA and Decreases Cold/Flu Symptomatic Days After Intense Exercise." (2013) *Journal of Dietary Supplements* 10:171-183.

Athletes

Wellmune® reduces immune suppression associated with strenuous exercise.

Study: Exercise Stress

Wellmune helps enable both recreational and elite athletes to exercise longer and harder, with less risk of immune system suppression than normally follows high-intensity exercise.

Study Protocol

Study Site	Department of Health and Human Performance, University of Houston, USA
Population	60 recreational athletes (29 men, 31 women)
Age	22-38 (average 23 years)
Design	Randomized, double-blinded, placebo-controlled, crossover study
Duration	10 days supplementation with Wellmune or placebo; seven-day wash out period; 10 days supplementation with Wellmune or placebo.
Serving	Participants were split into two groups, and consumed the following once daily for 10 days, in two separate instances: • 250mg Wellmune • placebo
Details	After the 10 day supplementation period, participants rode an exercise bicycle for one hour in a heat-stress chamber. Blood and saliva samples were collected on day zero, and immediately before and after the exercise session on day 10.

The effectiveness of the immune system drops sharply below its normal state two to six hours after strenuous exercise, gradually recovering within 24 hours."During this 'open window,' the athlete is more susceptible to infection, which may result in lost training time as well as missed work or school."

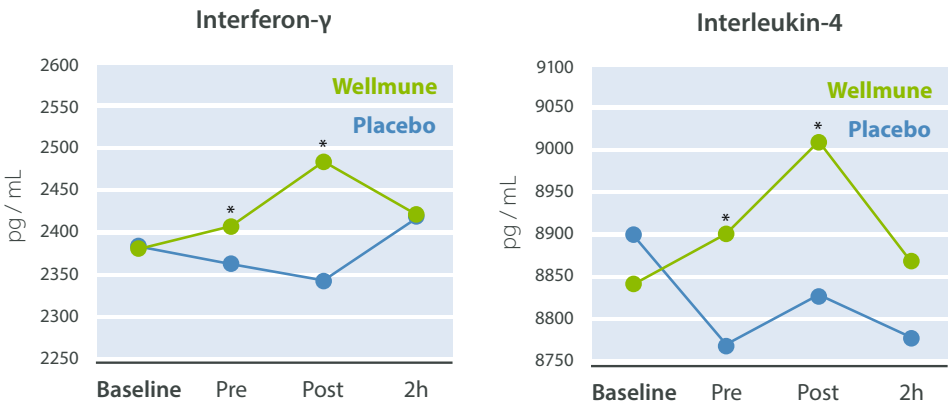
— Brian McFarlin, Ph.D., FACSM, Associate Professor of Kinesiology, Health Promotion and Recreation.

Results

In this study, Wellmune prevented alterations in monocytes and key cytokines following high-intensity exercise—suggesting that **participants' immune systems avoided common post-exercise suppression**.

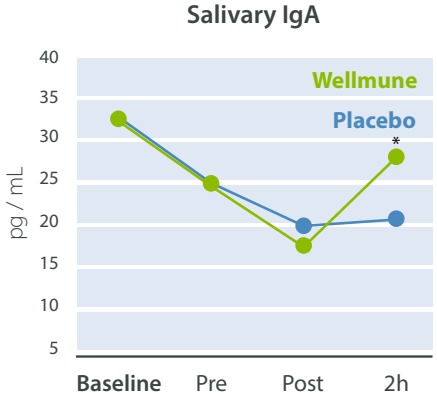
- **Maintained white blood cell levels:** Wellmune prevented the drop in white blood cells that occurs following intense exercise.
- **Improved mucosal immunity:** Two hours post-exercise, Wellmune improved salivary IgA recovery by 32% compared to the placebo. IgA, a protective protein, is associated with improved immune protection of the mucosa.
- **Enhanced immune responses to a simulated bacterial challenge:** The Wellmune group had higher levels of key cytokines following lipopolysaccharide (LPS) stimulation suggesting the priming of leukocytes that mediate immune responses.

Wellmune supports immune health in elite athletes by maintaining higher levels of LPS-stimulated cytokines.



No effect on IL-1β, IL-6, IL-7, IL-8, IL-10, IL-12p70, IL-13, GM-CSF or TNF-α

Wellmune helped salivary IgA levels rebound more quickly after exercise.



*p≤0.05, **p≤0.01, ***p≤0.001

"Baker's Yeast Beta Glucan Supplementation Increases Salivary IgA and Decreases Cold/Flu Symptomatic Days After Intense Exercise." (2013) *Journal of Dietary Supplements* 10:171-183.

"Baker's Yeast ß-glucan Supplementation Increases Monocytes and Cytokines Post-Exercise: Implications for Infection Risk?" (2013) *British Journal of Nutrition* 109:478-486.

General/
Environmental

Wellmune® provides significant relief to ragweed allergy sufferers.

Study: Allergy

Ragweed is a leading cause of seasonal allergy symptoms and affects 36 million Americans, with typical symptoms including nasal congestion, sneezing, itchy eyes and difficulty breathing. This study found that Wellmune reduced allergy symptoms and improved quality of life for ragweed allergy sufferers.

Study Protocol

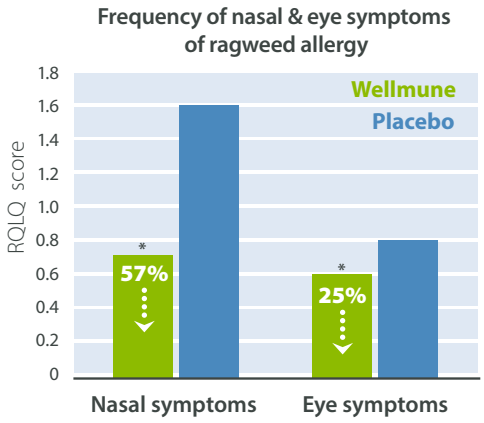
Study Site	GLH Nutrition, Draper UT USA
Population	48 healthy volunteers (31 female, 17 male)
Age	18-53 (average 39 years)
Design	Randomized, double-blinded, placebo-controlled, parallel arm study
Duration	Four weeks
Serving	Participants were split into two groups, and consumed one of the following once daily: • 250mg Wellmune • placebo
Details	Allergy surveys, including the validated Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ), were used to assess allergy symptoms and overall quality of life.

Results

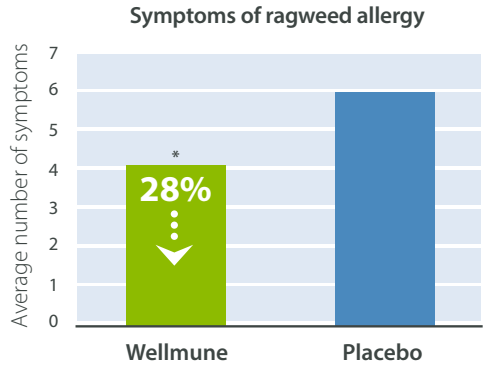
Participants taking Wellmune for four weeks reported:

- 56% improvement on the Quality of Life Index.
- Significant reduction in average allergy symptoms and key nasal- and eye-related symptoms.

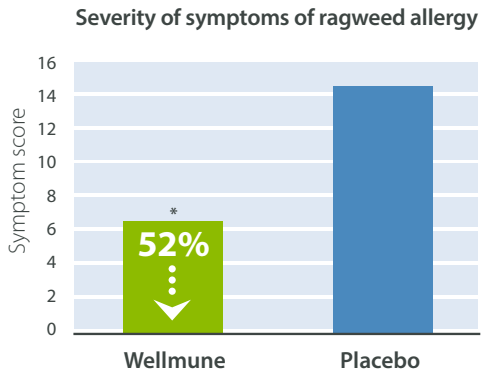
Participants taking Wellmune had
57% reduction in nasal symptoms
and
25% reduction in eye symptoms.



Participants taking Wellmune had
28% reduction in average number of allergy symptoms.



Participants taking Wellmune had
52% reduction in severity of allergy symptoms.



*p≤0.05, **p≤0.01, ***p≤0.001

"ß-Glucan Supplementation, Allergy Symptoms and Quality of Life in Self-Described Ragweed Allergy Sufferers." (2013) *Food Science & Nutrition* 1:90-101.

Stress

Wellmune® reduces duration of cold/flu symptoms for highly stressed adults.

Study: Medical Students

Lifestyle stress has been shown to suppress the immune system, putting otherwise healthy individuals at risk—especially during cold-and-flu season. In this study, Wellmune demonstrated a strong trend towards reducing the duration of upper respiratory tract infection (URTI) symptoms for medical students.

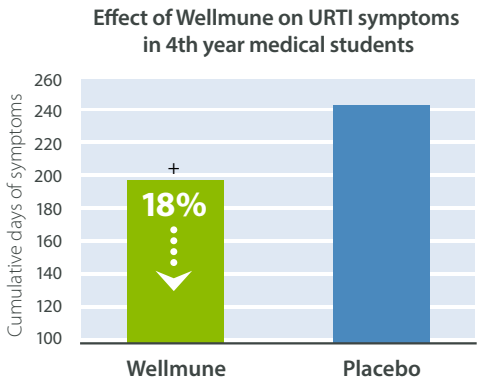
Study Protocol

Study Site	University of Southampton School of Medicine, UK
Population	97 fourth-year medical school students
Age	18-65 (average 21 years)
Design	Randomized, double-blinded, placebo-controlled, parallel arm study
Duration	90 days
Serving	Participants were split into two groups, and consumed one of the following once daily: • 250mg Wellmune • placebo
Details	Participants completed a daily health diary recording presence or absence of URTI symptoms. Two or more reported symptoms for two consecutive days triggered a medical assessment and cytokine analysis within 24 hours. 24 episodes of URTIs were medically confirmed; 12 in each group.

Results

- Participants taking Wellmune experienced a signification reduction in URTI symptoms.
- Wellmune did not stimulate the immune system with inflammatory cytokines when subjects were not experiencing a URTI.

Participants taking Wellmune had
18% reduction in the total days with URTI symptoms.

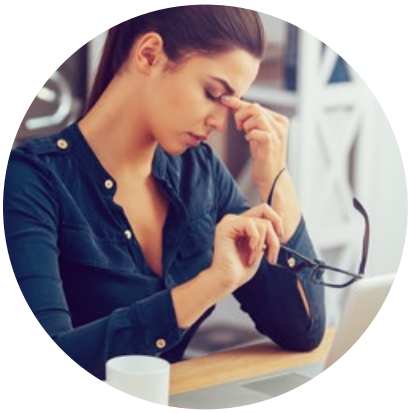


+p=0.06

"Influence of Yeast-Derived 1,3/1,6 Glucopolysaccharide on Circulating Cytokines and Chemokines with Respect to Upper Respiratory Tract Infections." (2012) *Nutrition* 28:665-669.

Stress

Wellmune® reduces upper respiratory tract infection (URTI) symptoms and improves mood state for moderately stressed women.



Study: Lifestyle Stress, 12 Weeks

This study's results were consistent with data from other studies demonstrating that Wellmune can support immune responses during periods of both physical and psychological stress.

Study Protocol

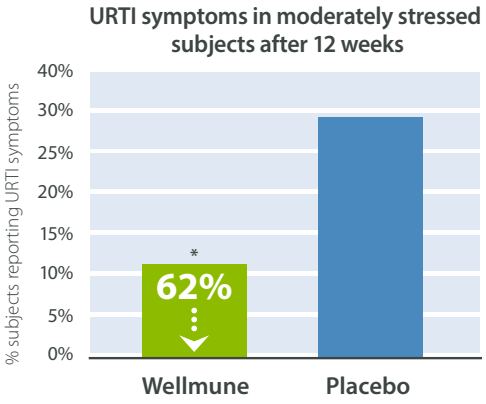
Study Site	SupplementWatch, Draper, UT USA
Population	77 healthy female volunteers
Age	18-65 (average 41 years)
Design	Randomized, double-blinded, placebo-controlled, parallel arm study
Duration	12 weeks
Serving	Participants were split into two groups, and consumed one of the following once daily: • 250mg Wellmune • placebo
Details	Changes in mental and physical energy levels and overall well-being were measured using the clinically-validated Profile of Mood States (POMS) psychological survey.

Results

Participants taking Wellmune for 12 weeks reported:

- A significant decrease in URTI symptoms.
- An 8.3% improvement in overall well-being and 26% increase in vigor.

Participants taking Wellmune had **62% reduction in URTI symptoms.**



Additional Information

The Profile of Mood States (POMS) Survey Instrument is clinically validated and employs 65 adjective-based indicators of mood scaled for intensity (0-4); specific combinations of the adjectives define the 6 mood state factors:

*p≤0.05, **p≤0.01, ***p≤0.001

"Baker's Yeast Beta-Glucan Supplement Reduces Upper Respiratory Symptoms and Improves Mood State in Stressed Women." (2012) *Journal of the American College of Nutrition* 31:295-300.

Stress

Wellmune® significantly improves mood state and reduces upper respiratory tract infection (URTI) symptoms for stressed adults.

Study: Lifestyle Stress, 4 Weeks

Stress can negatively affect immune function—and thus health—in a variety of ways. This study found a marked improvement in general health of stressed individuals in reduction of amount and duration of URTIs and improvement in general well-being.

Study Protocol

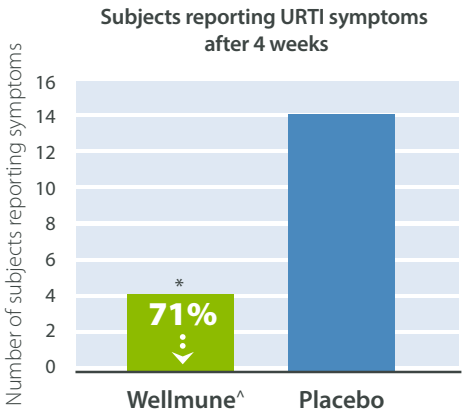
Study Site	GLH Nutrition, Draper UT USA
Population	150 healthy volunteers (45 men, 105 women)
Age	18-65 (average 37 years)
Design	Randomized, double-blinded, placebo-controlled, parallel arm study
Duration	Four weeks
Serving	Participants were split into three groups, and consumed one of the following once daily: • 250mg Wellmune • 500mg Wellmune • placebo
Details	Subjects maintained a daily health log to track the occurrence and duration of URTI symptoms (cough, sore throat, sneezing, etc.) Subjects also periodically completed a questionaire on overall health. Changes in mental and physical energy levels and overall well-being were measured using the clinically-validated Profile of Mood States (POMS) psychological survey.

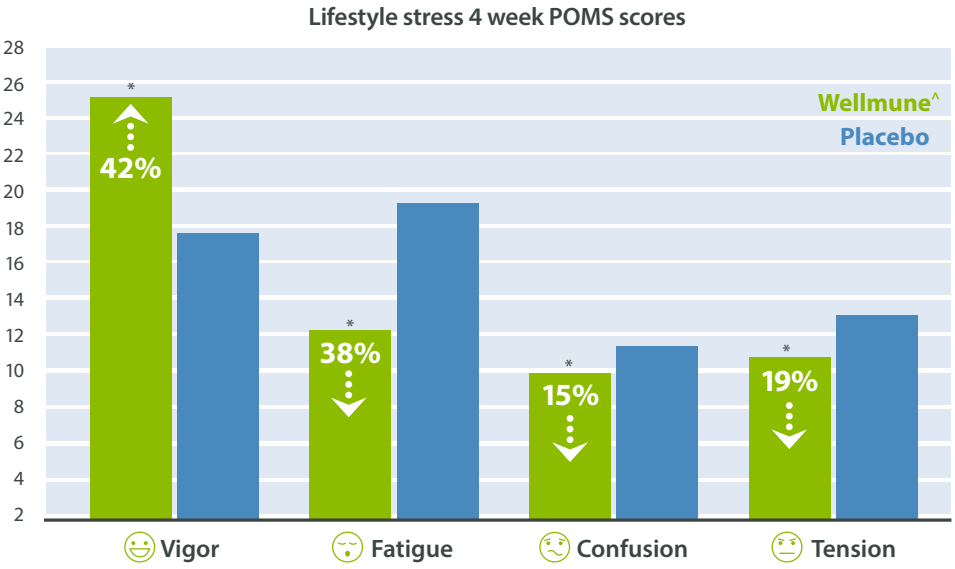
Results

Participants taking Wellmune for four weeks reported:

- A significant decrease in reported URTIs.
- Decreases in fatigue, confusion and stress, and an increase in vigor.

In the Wellmune group there was a **71% reduction in number of individuals reporting URTI symptoms.**





About the POMS

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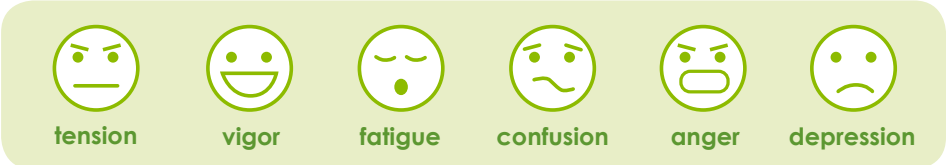


*p≤0.05, **p≤0.01, ***p≤0.001

^250mg Wellmune group only (500mg Wellmune group not included in data set)

"Beta 1,3/1,6 Glucan Decreases Upper Respiratory Tract Infection Symptoms and Improves Psychological Well-being in Moderate to Highly-Stressed Subjects." (2010) *Agro FOOD Industry Hi-Tech* 21:21-24.

Athletes

Wellmune® improves health in marathoners.

Study: California Marathon

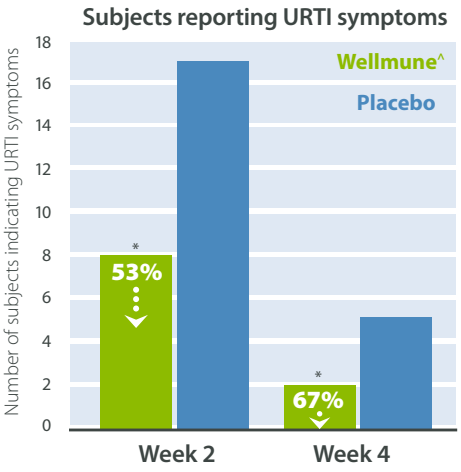
Wellmune increased vigor and mental clarity, while reducing fatigue, tension, confusion and upper respiratory tract infection (URTI) symptoms in marathon runners.

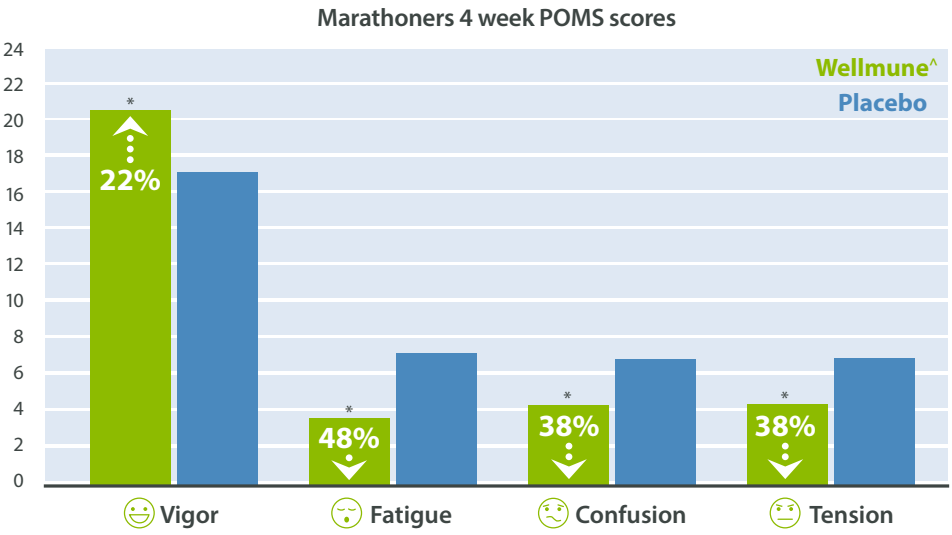
Study Protocol

Study Site	GLH Nutrition, Draper UT USA
Population	75 marathon runners (35 men, 40 women) recruited at the 2007 Carlsbad Marathon in California
Age	18-53 (average 36 years)
Design	Randomized, double-blinded, placebo-controlled, parallel arm study
Duration	Four weeks
Serving	Participants were split into three groups, and consumed one of the following once daily: • 250mg Wellmune • 500mg Wellmune • placebo
Details	Subjects maintained a daily health log to track the occurrence and duration of URTI symptoms (cough, sore throat, sneezing, etc.) Subjects also periodically completed a questionaire on overall health. Changes in mental and physical energy levels and overall well-being were measured using the clinically-validated Profile of Mood States (POMS) psychological survey.

Results

Participants taking Wellmune had **53% reduction in number of individuals reporting URTI symptoms** after 2 weeks.
and
67% reduction in number of individuals reporting URTI symptoms after 4 weeks.





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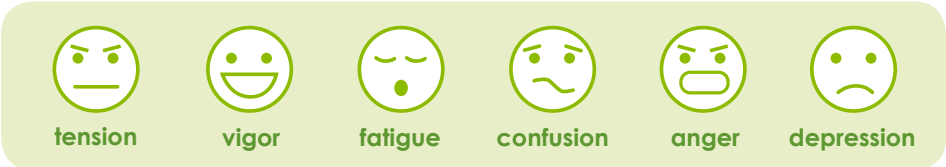

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^250mg Wellmune group only (500mg Wellmune group not included in data set)

"Effect of Beta 1,3/1,6 Glucan on Upper Respiratory Tract Infection Symptoms and Mood State in Marathon Athletes."(2009) *Journal of Sports Science and Medicine* 8:509-515.

General/
Environmental

Wellmune® maintains and enhances general health, reducing downtime.

Study: Cold/Flu

In a cold and flu season study, Wellmune eliminated the need to miss work or school due to cold/flu-like symptoms. Participants also reported an increase in general health markers, including physical energy and emotional well-being.

Study Protocol

Study Site	Miami Research Associates, South Miami, FL USA
Population	40 healthy subjects (12 men, 28 women)
Age	18-60 (average 33 years)
Design	Randomized, double-blinded, placebo-controlled, parallel arm study
Duration	12 weeks
Serving	Participants were split into two groups, and consumed one of the following once daily: • 500mg Wellmune • placebo
Details	Cold/flu symptoms were evaluated by medical staff within 24 hours of onset.

Results

Participants taking Wellmune for 12 weeks reported:

- **No missed work or school due to colds**, compared with 1.38 days of work/school missed for the placebo group.*
- **An increase in quality of life**, including physical energy and emotional well-being, as measured by a clinically validated health survey questionnaire (SF-36v-2).*
- **No adverse events** were detected and no safety concerns were present.

While there were no significant differences in the incidence of symptomatic respiratory infections among the study groups, the duration and severity of the symptoms were alleviated in subjects receiving Wellmune.

*p≤0.05, **p≤0.01, ***p≤0.001

"Randomized Phase II Clinical Trials of Wellmune® for Immune Support During Cold and Flu Season." (2009) *Journal of Applied Research* 9:30-42.

Stress

Firefighters report improved health with Wellmune®.

Study: Firefighters

Wellmune reduced upper respiratory tract infection (URTI) symptoms and improved overall physical health during this two-week trial with Montana's Wildland Firefighters, who serve their communities by fighting seasonal wilderness fires, typically May through October.

Study Protocol

Study Site	University of Montana, USA
Population	54 Firefighters
Age	18-65 (average 26 years)
Design	Single-blind, randomized cross-over study design.
Duration	14 days supplementation with Wellmune or placebo; three-day washout period; 14 days supplementation with Wellmune or placebo.
Serving	Participants were split into two groups, and consumed one of the following once daily: • 250mg Wellmune • placebo
Details	Subjects completed a daily health questionnaire as used by Nieman et al. (2002), with additional questions added that pertained specifically to the supplement. An individual was classified as having a URTI when he or she recorded a cold or flu symptom for a minimum of two consecutive days. At the conclusion of each trial arm, subjects completed an overall health performance questionnaire, which contained questions regarding the subject's overall health during the 14-day trial.

Results

Participants taking 250mg of Wellmune for four weeks reported:

- 23% reduction in URTI symptoms.[+]

+p=0.06

"Effects of an Immunomodulating Supplement on Upper Respiratory Tract Infection Symptoms in Wildland Firefighters." (2008) *Medicine & Science in Sports & Exercise* 40:S353.

Research Bibliography

Research supporting the safety and efficacy around Wellmune is the subject of numerous peer-reviewed journal articles and presentations at scientific forums as outlined below.

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Children | Older Adults | Athletes | Stress | General/Environmental

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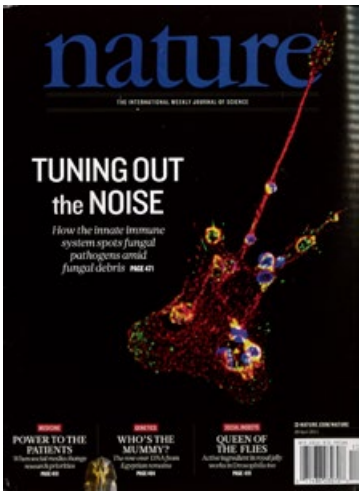
Preclinical Research



*Wellmune has been the focus of high-profile pre-clinical studies. The April 2011 issue of the journal **Nature** depicts Wellmune that has been engulfed by a macrophage.*

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