MGCPQQ®: Backed by decades of research, this safe and effective ingredient is powering brain health

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The European brain health supplements market is expected to grow at a compound annual growth rate (CAGR) of 12.5% through 2030, driven by rising consumer awareness of cognitive well-being and strong demand for brain health products. As consumers search for the right supplements, it can be challenging to determine which ingredients are most safe and effective. Enter MGCPQQ, a widely studied and powerful ingredient shown to play a key role in helping to support brain health and mitigate cognitive decline across different age groups. Below, we explore the latest scientific findings.

Over the years, numerous studies have examined the benefits of PQQ (pyrroloquinoline quinone), a naturally occurring antioxidant found in various foods, including vegetables, fruits, eggs, dairy products, and fermented foods. It is also present in human and animal tissues, with particularly high concentrations found in human breast milk. However, there is no evidence that humans or animals can synthesize PQQ, making external sources, such as dietary supplements or food, essential for maintaining adequate levels in the body.

A natural source of PQQ was developed through a safe, patented fermentation process by Mitsubishi Gas Chemical Co., Inc. (MGC) in Japan under the brand name MGCPQQ® in Europe, and as BioPQQ® in the United States, Canada, and Japan. Research suggests that its antioxidant and anti-inflammatory properties enable MGCPQQ to support and enhance cognitive function in both animals and humans. Additionally, preliminary findings indicate that MGCPQQ may contribute to heart health and assist in managing stress, improving sleep, boosting energy, and reducing fatigue.

Setting the benchmark for quality

To date, MGCPQQ is the most extensively studied compound ingredient of its kind. The ingredient's safety has been rigorously evaluated in more than 1,000 in vitro, animal, and human clinical studies over the course of more than four decades. MGCPQQ remains the only food-grade supplement of its kind that has undergone comprehensive testing, and human clinical trials have consistently shown no side effects or adverse biochemical or liver function test results.

In fact, it is the only PQQ ingredient to be successfully evaluated for its safety and quality by the European Food Safety Authority (EFSA) and appears on the European Union's approved list of Novel Foods. For that reason, it is the only PQQ legally allowed to be sold in the EU.

Further demonstrating its quality and safety, MGCPQQ is certified by the Informed Ingredient programme. These certifications ensure the ingredient meets high manufacturing standards and that every batch is tested for substances banned by the World Anti-Doping Agency (WADA) reassuring athletes about its safe use.

The role of cognitive function in enhancing quality of life

Maintaining higher brain functions is essential for good health and well-being, particularly in older adults. Cognitive decline can significantly impact an individual's ability to perform daily activities and routine tasks, thereby affecting their self-perceived quality of life.

Aging is associated with increased oxidative stress in the brain, which can impair memory, learning, and other cognitive functions. Elevated levels of reactive oxygen species (ROS), coupled with a decline in the body's antioxidant defenses, contribute to neurodegenerative diseases such as Alzheimer's and other forms of dementia.

MGCPQQ has demonstrated it has significantly higher antioxidant properties than Vitamin C and E, and as an antioxidant ingredient it has been shown to remove active oxygen radicals that are often linked to "oxidative stress" which can contribute to neurodegenerative diseases that include Alzheimer's and other cognitive disorders. As a result, MGCPQQ may help to protect neurons in the brain that are susceptible to cell damage.

Beyond its antioxidant capacity, MGCPQQ has been shown to stimulate Nerve Growth Factor (NGF) synthesis which supports the growth and recovery of nerves in the brain and other organs following damage. Research also indicates that MGCPQQ may contribute to the development and health of mitochondria, responsible for regulating cognitive function, memory, energy and mood.

A healthy body continually creates mitochondria in a process known as mitochondrial biogenesis. However, as we age, our mitochondrial function declines, leading to weakened functioning of the brain and other vital organs. A series of studies suggest that MGCPQQ can activate, increase and enhance mitochondrial biogenesis, essentially infusing the cells with energy and resulting in the growth of mitochondria clusters in cells.

Some of the studies indicating improvements in brain health and mood have revealed enhanced learning, better focus, improved memory, and reduced depression and anxiety amongst subjects.

In summary, MGCPQQ has proven to help support cognitive health through its antioxidant activity, nerve growth promotion, and mitochondrial function enhancement, thereby contributing to an improved quality of life for people of all ages.

In vitro and animal data in cognitive function and disease

In animal models, MGCPQQ has been associated with improved cognitive functions. One study[1] compared cognitive performance in aged rats administered either vitamin E or MGCPQQ over two weeks, using the Morris water maze test. The results revealed higher learning rates and improved memory retention in rats treated with either vitamin E or MGCPQQ, compared to untreated controls.

Another study[2] evaluated cognitive responses to experimentally induced oxidative stress in young rats treated with MGCPQQ, a combination of MGCPQQ and CoQ10, or a placebo over nine weeks, followed by exposure to hyperoxia conditions. Compared to controls, memory retention increased significantly in the rats given MGCPQQ either alone or in combination, five days after hyperoxia. Memory retention was even higher in the combination-treated group after seven days of hyperoxia. These findings suggest that MGCPQQ may have protective effects in the brain against oxidative stress-induced neurodegenerative damage.

Collectively, these animal studies suggest that MGCPQQ may help to enhance cognitive function through its antioxidant properties, promotion of mitochondrial biogenesis, and neuroprotective effects. However, further research, including human clinical trials, is necessary to fully understand its potential benefits for cognitive health.

Highlights from human studies

Recent human studies have shown similar enhancements in cognitive functions across different age groups when taking MGCPQQ by itself or combined with CoQ10.

Study 1: MGCPQQ Improves Higher Brain Function (Koikeda T et al.)[3]

A 6-month, placebo-controlled, double-blind study with 65 healthy Japanese participants aged 45–65 assessed MGCPQQ's effects on cognitive function. Participants scoring 29–52 on RBANS (indicating mild cognitive impairment) were randomized to receive MGCPQQ (20 mg/day), MGCPQQ + CoQ10 (300 mg/day), or a placebo.

- **Findings:** All groups showed improvement in RBANS scores, but the MGCPQQ + CoQ10 group experienced significantly greater short-term memory gains ($p<0.003$). MGCPQQ alone showed a trend toward improvement.
- Stratification revealed that subjects with lower baseline scores (n=32) had significantly greater improvements at 8 and 16 weeks with MGCPQQ + CoQ10 compared to placebo (see Figure 1).
- MGCPQQ improved higher brain functions like visual-spatial awareness, with significant differences at week 16 versus with the placebo.
- **Safety:** No side effects were reported in any group.

Summary: MGCPQQ, alone or with CoQ10, is safe and effective in improving higher brain functions, with pronounced effects in those with lower baseline memory scores.

Study 2: Effect of MGCPQQ on Mental Status (Nakano M et al.)[4]

A 12-week, placebo-controlled, double-blind trial involving 71 participants aged 45–65 evaluated MGCPQQ's impact on mental status using the Verbal Memory Test and Stroop Test. Subjects were randomized into three groups: MGCPQQ (20 mg/day), MGCPQQ + CoQ10 (300 mg/day), or placebo.

- **Findings:** MGCPQQ-treated groups showed

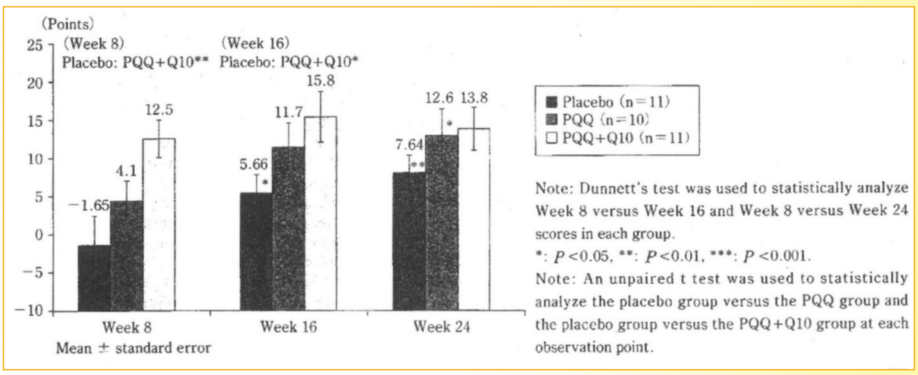

Figure 1: RBANS Short-Term Memory Scores among Subjects with Lower Baseline Scores

trends toward improvement in Verbal Memory Test scores, though not significant.

- On the Stroop Test (step 4), MGCPQQ + CoQ10 significantly reduced response times by 7.3 seconds ($p<0.009$) versus 2.0 seconds in the placebo group. MGCPQQ alone reduced response times by 5 seconds ($p<0.182$).
- **Safety:** No side effects were reported, and both regimens were well tolerated.

Summary: MGCPQQ, particularly when combined with CoQ10, improves higher-level executive functions, including processing speed and attention, with no reported adverse effects.

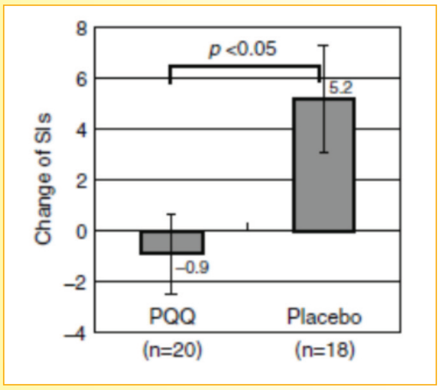

Figure 2. Mean Changes of the Stroop Interference Ratios (SIs) from 0 to 12 weeks*
*Bars indicate standard error range.

Study 3: MGCPQQ and Cognitive Function (Itoh et al.)5

A 12-week, placebo-controlled, double-blind study assessed MGCPQQ's effects on cognitive function in 41 elderly adults (mean age ~58.5). Participants received either MGCPQQ (20 mg/day) or placebo, with cognitive status evaluated via Stroop/Reverse Stroop tests and Touch M scores.

- **Findings:**
  - Stroop Interference Ratios (SIs) improved significantly in the MGCPQQ group (-0.9 points) versus placebo (+5.2 points, $p<0.05$) after excluding three outliers (see Figure 2).
  - Touch M scores improved significantly in participants with lower baseline scores (<70 points), increasing from 58.1 to 71.5 ($p<0.01$), while higher baseline scores remained unchanged.
- **Safety:** No adverse effects or abnormal findings were reported.

Summary: MGCPQQ improved attention and working memory, particularly in participants with lower baseline cognitive scores, with no safety concerns.

Study 4: Improvements in Cognitive Flexibility, Reaction Speed, and Executive Function in Young People (Tamakoshi et al., 2023)6

This recent double-blind, placebo-controlled study assessed MGCPQQ's effects on cognitive function in 100 adults aged 20–65 years. Participants received MGCPQQ (20 mg/day) for 12 weeks.

Findings:

- In younger adults (20–40 years), MGCPQQ improved cognitive flexibility, processing speed, and execution speed by 8 weeks (Figure 3).
- Older adults (41–65 years) experienced significant improvements in composite and verbal memory after 12 weeks.
- Logistic regression analysis confirmed significant improvements in cognitive function in younger adults by week 8 and in older adults by week 12 (Figure 4).
- **Safety:** No adverse effects were reported in any group.

Summary: This study highlights MGCPQQ's versatility in improving cognitive functions across different age groups, with faster improvements in younger adults and memory-specific benefits in older adults.

References:

1 Takatsu H, Owada K, Abe K, et al. (2009). Effect of vitamin E on learning and memory deficit in aged rats. J Nutr Sci Vitaminol (Tokyo) 55:389-93.

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3 Koikeda Y, Nakano M, Masuda K (2011). Pyrroloquinoline quinone disodium salt improves higher brain function. Medical Consultation & New Remedies 48: 59-67).

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5 Itoh H, Hine K, Miura H et al. Effect of the antioxidant supplement Pyrroloquinoline Quinone disodium salt (BioPQQ™) on Cognitive Functions. Adv Exp Med Biol 2016; 876:319-325.

6 Tamakoshi, M., Suzuki, T., Nishihara, E., Nakamura, S., & Ikemoto, K. (2023). Pyrroloquinoline quinone disodium salt improves brain function in both younger and older adults. Food & Function, 14(5), 2496–2501. https://doi.org/10.1039/d2fo01515c

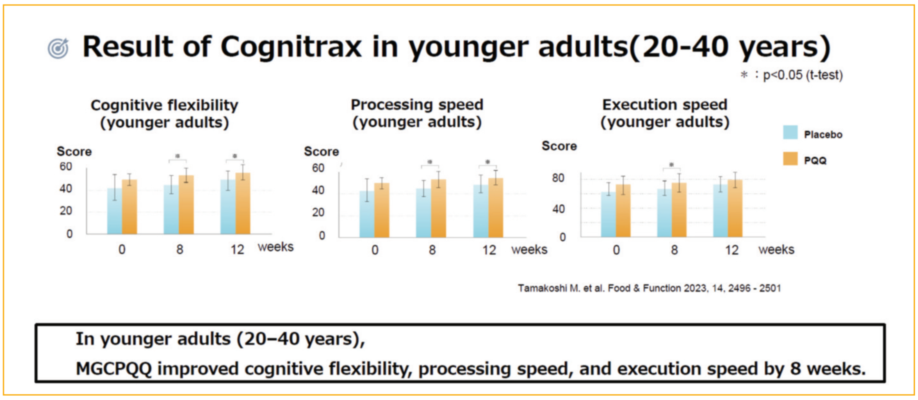

Figure 3: Cognitive Results Among Test Subjects 20-40 years

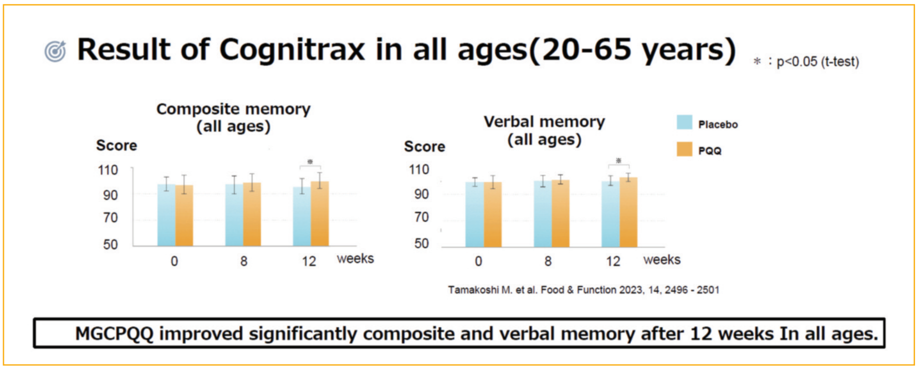

Figure 4: Cognitive Functions Among Test Subjects of all Ages, 20-65 Years

Conclusion: A well-documented path in brain health and wellness

As the brain health supplement market in Europe continues to thrive, driven by increasing consumer interest and demand in cognitive well-being, MGCPQQ—long recognized as one of the most extensively studied ingredients—remains prominent among its competitors. Backed by years of research, including laboratory, animal, and human clinical trials, the evidence highlights MGCPQQ's exceptional safety and its significant antioxidative and neurogenerative benefits for brain health. This robust research suggests that MGCPQQ has the potential to play an important role in helping to prevent, manage, and slow down neurodegenerative factors contributing to cognitive decline, meeting the increasing demand for effective brain health solutions in Europe.

For more information about MGCPQQ, visit www.mgcpqq.eu. This product is not intended to diagnose, treat, cure or prevent any disease.

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As a subsidiary of Mitsubishi Gas Chemical Company, Inc. in Tokyo, a pioneer in its research of pyrroloquinoline quinone (PQQ), Mitsubishi has manufactured a safe, all-natural supplement ingredient that supports cognitive function and mitochondrial biogenesis and is branded as MGCPQQ in Europe, and BioPQQ in North America and Japan. The powerful ingredient is a natural source of PQQ and made through a proprietary fermentation process. MGCPQQ/BioPQQ have multiple certifications and registrations attesting to its safety, efficacy and high-quality standards.