




Energize your mind

Health benefit solutions

HEALTH • NUTRITION • MATERIALS





Energize your mind

There are two distinct concepts that define how we think of mental energy: our brain cells need fuel to support our thought processes and we also identify with a feeling of being awake and energetic.

Both concepts have a good scientific rationale and are supported by a host of nutritional ingredients that contribute to mental energy. Some of the most notable ingredients are:

- Glucose, the favorite energy source for the nerve cells
- B-vitamins, to contribute to energy production
- PUFAs, for their benefits to mood and the maintenance of normal cognitive function in aging
- Coenzyme Q10, to support energy generation at the cellular level
- Caffeine, to boost reaction speed and enhance alertness
- Taurine, to improve memory, alertness and focus
- Ginseng, for improvements in mood and cognitive tasks
- Ginkgo biloba, for alertness and cognitive speed

Mental energy to power your busy life

People are busy but they want to pack ever more into their active lives. Energizing products have been positioned to give people a quick means to help them regroup, refocus and continue functioning at a high level.

The concept of “mental energy” is seen as a combination of high cognitive functioning, high levels of alertness, a motivation to do more, and a positive, optimistic mood. Safe and natural ways of boosting mental energy have the potential to improve quality of life, and give people’s work performance a boost.

Fast facts:

- *Although the brain is only 2% of the body’s weight, it consumes around 20% of the body’s total energy¹*
- *The average power consumption of an adult brain is 20 Watts²*
- *80% of the energy used in the brain is related to the brain’s signaling processes¹*

^{1 - 35} The above information is based on scientific studies, and a list of the latest references is available on request.

Activate the mental energy market with innovative ingredients

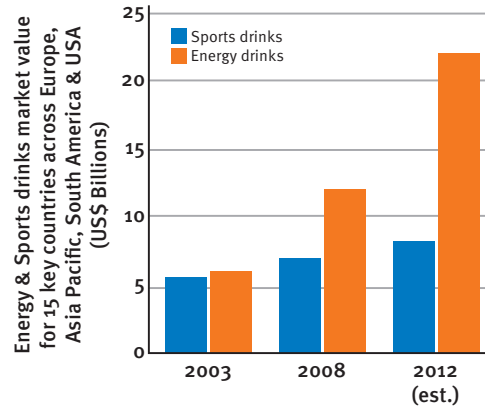
There is a strong consumer interest in products that contribute to mental energy and improve motivation. Non-alcoholic energy drinks for young adults really created the market and are leaders in the category. Newer products are geared towards office workers and older adults looking to beat the afternoon lull and power through to the end of the day.³ Other categories have seen growth more recently, such as snacks, breakfast cereals, and bakery items, which have proven to be appropriate products to deliver energy-related health benefits. There is considerable innovation in applying energy claims to diverse marketing segments.⁴

North America leads the energy category in terms of new product launches, with Europe and Asia-Pacific not far behind. Latin America and the Middle East may have the highest growth potential.⁴

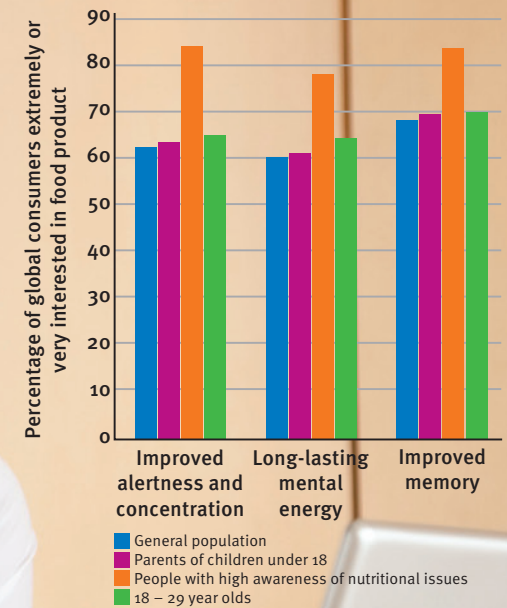
Mental energy products live up the cognition market

Young adults are normally the target demographic, and a few drinks dominate the market providing room for innovation with products providing a unique twist.⁵ Globally, energy drinks account for almost half of the functional beverage market and strong growth is expected in the coming years.⁵

Energy drinks power past sports drinks
(Adapted from Datamonitor Market Data Analytics, 2009)



Interests of consumer groups in mental energy products
(Health Focus study of consumers in 11 countries in 2008)



The Science of Mental Energy

Mental energy can be defined in two ways:

- A perception of mental alertness, high mood levels and motivation
- The metabolic processes that support the brain

A model consisting of cognition, mood and motivation has been proposed to describe mental energy.⁶ Cognition is a combination of attention, vigilance and a high ability to perform mental tasks. Mood is related to separate feelings of energy and fatigue. Motivation is the determination and enthusiasm to perform mental tasks.⁶ These areas of mental energy can be measured with questionnaires, specific mental tests and via brain activity measurements.⁷

Nutritional ingredients support mental energy by providing fuel for thought, and by affecting mood and motivation

Various components of our diet can modify the internal processes in the brain and thereby exert a perceivable and measurable impact on energy levels, cognitive performance and mood.

The brain demands a large amount of energy, around 20% of what we use every day.⁸ A large portion of this energy is consumed by the neurons, because a fuel source is required to send the electrical signals required for the process of thought.

Glucose is the preferred source of energy for proper functioning of the brain, but dietary factors, such as adequate B vitamin or coQ10 intakes, are also vitally important co-factors for the brain's energy-yielding metabolism.⁹ Other dietary components affect mental energy through their effects on neurotransmitters, brain blood flow, and the metabolic basis of thought.

Brain waves mark our state of consciousness from active thought through quiet relaxation to deep sleep. An electroencephalogram (EEG) allows scientists to measure brain waves that can be used to determine the state of relaxation and sleep quality. By recording brain wave activity, we are able to objectively measure levels of alertness.

Two important measures of brain energy, quantified by electroencephalography (EEG), are beta-waves (indicative of an alert and concentrated brain), and alpha-waves (a quiet, contemplative state).



Ingredients for fuelling the energy of the mind

Glucose

The brain requires glucose as the preferred energy source of brain cells.⁹ The energy from glucose is used to generate the bioelectrical signals needed for thought.¹⁰ Diets should contain adequate carbohydrate to produce glucose because it cannot be produced from protein or fat. Indeed, carbohydrate intake has been shown to support cognition in elderly subjects.¹¹ Administration of glucose alone produced immediate improvements in working memory in a cross-over study, and eating a carbohydrate-rich breakfast is associated with improvements in cognition.^{12–13}

Water

Water is life: it allows the biochemical reactions in our body to take place. Dehydration from decreased fluid intake can cause confusion and fatigue.¹⁴ Even water deficits of 1% can have effects on cognitive performance.¹⁵ Maintaining proper hydration contributes to the maintenance of normal physical and cognitive functions.¹⁶

Caffeine

A cup of coffee in the morning is a classic wake-up beverage for many people. The active ingredient, caffeine, is a mild stimulant that increases alertness.^{17–18} Caffeine blocks adenosine receptors, which are sites in the brain that react to the neurotransmitter adenosine. Adenosine is responsible for promoting sleep and suppressing arousal, so blocking its action increases alertness.¹⁹

Taurine

Taurine is an organic acid found in all human cells. It is a normal part of the diet and is conditionally essential because it can be produced in the body from methionine and cysteine.²⁰

The highest intakes of taurine are seen in people eating a varied diet, since it is found predominantly in meat and seafood.²¹ In the body, it functions as a neurotransmitter, neuromodulator and brain protectant.²² Energy drinks containing taurine often also contain caffeine so the research base supporting taurine alone is difficult to tease out from that of caffeine. Nevertheless, evidence suggests taurine has an additional effect on cognitive functioning.²³

Omega-3 Polyunsaturated Fatty Acids

The long chain omega-3 polyunsaturated fatty acids (PUFAs) are well known for their effects on cognition. PUFAs are essential fatty acids and indisputably important for several biological functions of brain cells. The three main omega-3 PUFAs are alpha-linoleic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). They are the building blocks and signaling molecules in brain cell membranes. The omega-3 fatty acids regulate glucose uptake in the brain and DHA supports normal brain functions.²⁴

PUFAs are needed for the proper functioning of the brain throughout life

The effects of PUFAs on mood are supported by nutrition research, although effects may only be noticeable after supplementation over the medium term. Increasing levels of omega-3 PUFAs through the diet improved mood in a diet-related study.²⁵ A large clinical trial in older adults showed that DHA supplemented over 6 months was able to improve learning and episodic memory scores.²⁶ High levels of EPA are associated with an active mental state and good blood circulation in the brain.²⁷

Ginkgo biloba

The leaves and roots of the Ginkgo biloba tree contain bio-active ingredients that have beneficial effects on cognition. A standardized extract can normalize blood flow in the brain, bringing a better supply of oxygen and nutrients to brain cells. It also has effects on various central neurotransmitters.^{28–29} When used over the medium to long term, it also improves the reactivity of the area in the brain responsible for memory.³⁰ Clinical trials show that it improves mood and alertness.^{31–35}

Ginkgo biloba can improve mood and alertness

Ginseng

The root of the slow-growing perennial plant, Panax ginseng, has been used for centuries as part of traditional Chinese medicine.³⁶ Traditionally, it is classified as an “adaptogen” which can build vitality and mental performance. The bio-active compounds in ginseng are called ginsenosides, found exclusively in ginseng plants. These molecules enhance the formation of connections between neurons and contribute to the brain’s plasticity, or ability to learn.³⁷ Studies have shown that Ginseng can bring improvements in mood and cognition.^{38–39}

B vitamins

The B vitamins are a group of water-soluble compounds that help in the process by which the body obtains or makes energy from food, along with other important metabolic functions.⁴¹ In particular, the B vitamins riboflavin, vitamin B6, vitamin B12 and folic acid work together as co-factors in DNA and protein synthesis. They are crucial for metabolism of carbohydrates, for cell proliferation and for the formation of red blood cells. The B vitamins biotin and niacin contribute to normal psychological functions.^{42–44}

A randomized controlled trial using high doses of B vitamins in healthy males showed improvements in perceived vigor and ratings of energy during cognitive testing.⁴⁵

B vitamins are instrumental for energy-yielding processes and proper functioning of the brain

Coenzyme Q10

Coenzyme Q10 is a vitamin-like substance produced by the body and required for energy production at the cellular level.⁴⁶ It is found in organs with a high energy demand, including the heart and brain. The body can produce its own coenzyme Q10 but levels decrease during aging.⁴⁷ The amount supplied by a normal diet is low compared to the amount made by the body, so declines in coenzyme Q10 production cannot easily be offset by food alone.⁴⁸

Zinc

Zinc is a mineral required as a component of many enzymes, particularly antioxidant enzymes, components of the immune system, and in the brain. It contributes to normal cognitive function and has been shown to improve cognition in middle-aged subjects.⁴⁹

Magnesium

Magnesium is required for over 300 enzymes in the body and contributes to neurotransmitter release and the ability of brain cells to form new connections, contributing to normal cognitive function.^{50–51} Some recent preliminary research indicates that increasing brain magnesium levels may improve learning and memory, especially in aging.^{50, 52}

Nutritional solutions for an energized mind

Ingredient	Function for mental energy	Daily dose range*
Carbohydrate	Provides the brain with glucose, the source of cellular energy	At least 130 g
Water	Supports normal cognition	2 l from foods and beverages
Vitamins and nutritional lipids		
Quali®-B (Vitamin B1)	Co-enzyme in energy metabolism	1 – 1.5 mg
Quali®-B (Vitamin B2)	Cellular energy production	1.3 – 1.8 mg
Quali®-B (Vitamin B3)	Coenzyme in energy production	14 – 20 mg
Quali®-B (Vitamin B6)	Neurotransmitter synthesis	1.3 – 2.2 mg
Quali®-B (Folic acid)	DNA synthesis, red blood cell production	200 – 400 µg
Quali®-Biotin	Coenzyme in fatty acid metabolism and glucose production	30 – 200 µg
Quali®-B (Vitamin B12)	Coenzyme in cells of the nervous system	1.4 – 3 µg
ROPUFA® and Life'sDHA™ omega-3 long chain fatty acids	Cell membrane component	250 – 500 mg
Nutraceuticals		
All-Q® (Coenzyme Q10)	Co-factor in ATP synthesis	Up to 300 mg
Caffeine†	Mild stimulant	Up to 300 mg
Ginkgo biloba†	Improves mood and alertness	Up to 120 mg ⁵³
Panax ginseng†	Improves mood and cognition	Up to 200 mg ⁵⁴
Taurine†	Important amino acid in the nervous system	Up to 3 g ⁵⁵
Minerals		
Zinc†	Component of brain enzymes	7 – 15 mg
Magnesium†	Potentiates neurotransmitter release, aids synaptic plasticity	250 – 500 mg

* Allowable levels of nutrients vary depending on national regulations and the final application.
The above information is based on scientific studies, and a list of the latest references is available on request.

† Provided via DSM's Quali®-Blends.

How can we Health you?

A feeling of alertness, motivation and a positive frame of mind are the three pillars of mental energy. Nutrients that support brain function help us reach our cognitive potential at work, school or play.

DSM's broad portfolio of innovative, high-quality and safe nutrients, combined with our consumer insights, market knowledge and application expertise, can help your mental energy positioned products attract more consumers.

We are the only integrated premix, vitamin and nutraceutical manufacturer capable of creating and delivering tailor-made formulations to you anywhere. Blend in our extensive scientific expertise, technical know-how, global presence and total quality assurance for your peace-of-mind.

Via our global network of blend facilities we create value-adding nutrient combinations custom-made for you. Our Quali®-Blends can offer the right balance of ingredients supporting mental energy.

DSM can help you get to market faster with appealing mental energy solutions that work.

DSM Nutritional Products

For more information on this Health Benefit Solution by DSM,
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