LACPRODAN® ALPHA-20
FOR NATURAL WELL-BEING

Arla Foods Ingredients

Discovering the wonders of whey

Introduction

Arla Foods Ingredients has isolated a key protein in bovine milk – alpha-lactalbumin – and carefully refined it to produce Lacprodan® ALPHA-20. Alpha-lactalbumin is among the food proteins with the highest content of the amino acid tryptophan (1). Tryptophan (Trp) is an essential amino acid that has to be obtained from the diet as it cannot be synthesised by the body. Tryptophan is the precursor of serotonin, which is a neurotransmitter and also functions as the precursor to melatonin (hormone involved in the sleep-wake cycle). Serotonin exerts pleiotropic effects and is implicated in the control of the mood, sleep regulation, cognitive performance and the ability to cope with stress (2).
Serotonin is popularly thought to be a main contributor to feelings of well-being and happiness.
A deficit of brain serotonin will increase depressive mood, cause sleep abnormalities, reduce cognitive performance and the ability to cope with stress. The addition of Lacprodan® ALPHA-20 to functional foods, for example, would naturally help boost brain serotonin levels.

BENEFITS OF Lacprodan® ALPHA-20

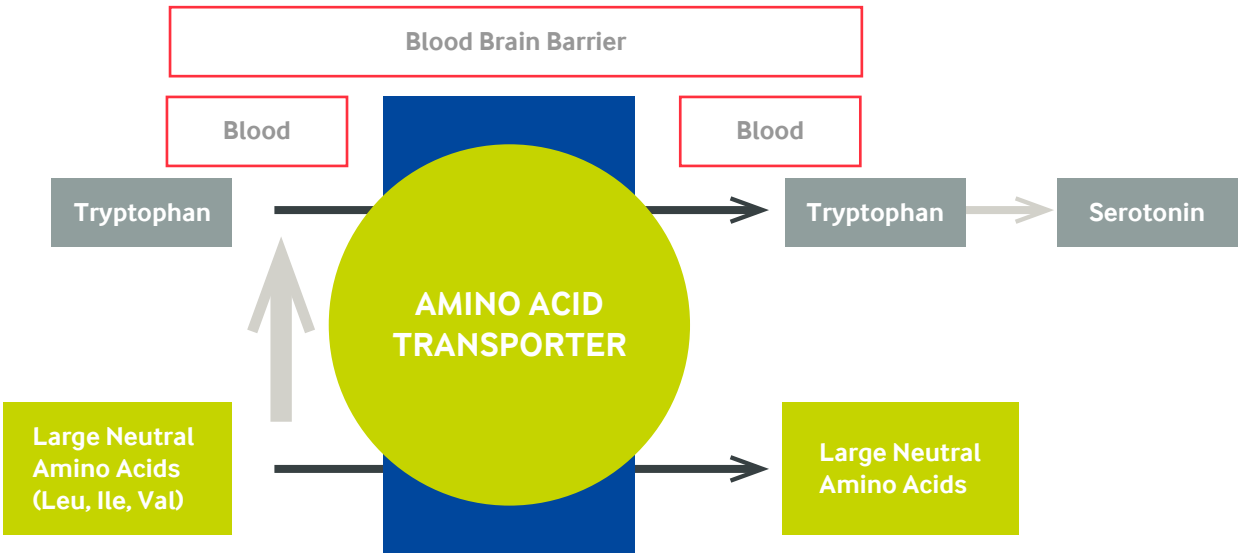
Lacprodan® ALPHA-20 is a highly nutritious native whey protein isolate ideal for naturally formulating functional foods tailored to boost brain serotonin with the following benefits:

- Enhanced mood
- Improved cognitive performance
- Improved sleep pattern

Enhanced mood

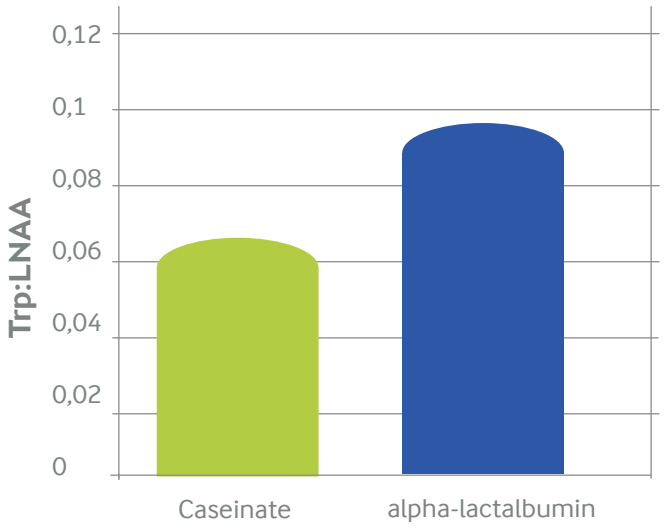
A decline in serotonin activity in the brain is involved in the development of depressive mood, whereas increased brain serotonin may help improve the ability to cope with stress. Serotonin is synthesised from tryptophan, and brain serotonin concentrations rise with tryptophan intake (3). However, it is important that the ratio between tryptophan and large neutral amino acids (LNAA) is high, since the amino acid transporter across the blood brain barrier is used both by tryptophan and large neutral amino acids. Thus, a low ratio will limit the uptake of tryptophan due to competition from LNAA and, thereby, reduce serotonin synthesis. This is illustrated in figure 1.

FIGURE 1
Transport of tryptophan across the blood brain barrier



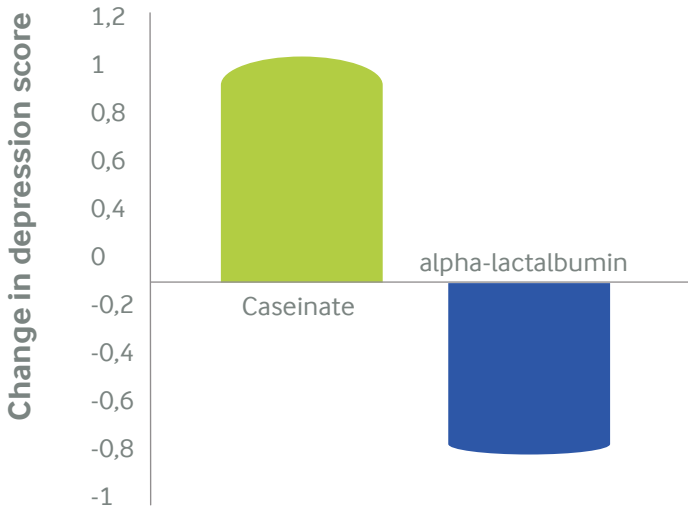
A double-blind, placebo-controlled study was conducted with stress-vulnerable and stress invulnerable subjects (3). The subjects were exposed to experimental stress after ingesting a standardised diet supplemented with two drinks containing either alpha-lactalbumin or sodium caseinate (placebo) as sources to tryptophan. The alpha-lactalbumin drink contained 246 mg tryptophan, and the caseinate drink contained 147 mg tryptophan. The tryptophan LNAA ratio was measured, and a significant 48% increase was found after consumption of the alpha-lactalbumin enriched diet compared to the caseinate diet. This can be seen in figure 2.

FIGURE 2
Plasma tryptophan-LNAA ratio (3)



It was found that, when the subjects consumed the alpha-lactalbumin enriched diet, the depression score was significantly reduced compared to subjects on the caseinate diet, see figure 3.

FIGURE 3
Change in depression scores after exposure to experimental stress (3)



Improved cognitive performance

Cognitive performance often declines during exposure of chronic stress. The negative effect of chronic stress may be mediated by reduced brain serotonin function. Thus, a diet-induced increase in the serotonin precursor tryptophan help increase brain serotonergic activity levels and improve cognitive performance.

This was investigated in a clinical study (4) where highly stress-vulnerable subjects were given standardized diets enriched with two drinks containing either alpha-lactalbumin (246 mg Trp) or sodium caseinate (147 mg Trp) as control, in a double-blind, placebo-controlled, cross-over study.

Measurements of blood samples showed that diet had a significant effect on the plasma tryptophan:LNAA ratio. A significant increase in the ratio, 43% greater, was measured in subjects receiving the alpha-lactalbumin enriched diet compared to subjects on the sodium caseinate diet. The mean plasma tryptophan:LNAA ratio was 0.073±0.012 after the control diet and 0.104±0.013 after the alpha-lactalbumin diet.

The test subjects conducted a computerised Sternberg memory-scanning test after intake of the diets. In the test, 3-6 consonants appear on the screen for the test subjects to memorize. A series of letters then pop up on the screen and test subjects are required to indicate whether they are one of the memorized letters by pressing a "yes" or "no" button. Both the reaction time and the amount of errors are measured to assess the accuracy of cognitive performance. In the memory scanning trials, the reaction time of subjects on the alpha-lactalbumin (758±137 ms) diet was significantly faster than that of subjects on the caseinate diet (800±173 ms).

Another clinical study demonstrated improved memory after consumption of an alpha-lactalbumin diet compared to a caseinate diet (5). The study found that alpha-lactalbumin improved abstract visual memory in both recovered depression patients and healthy subjects.

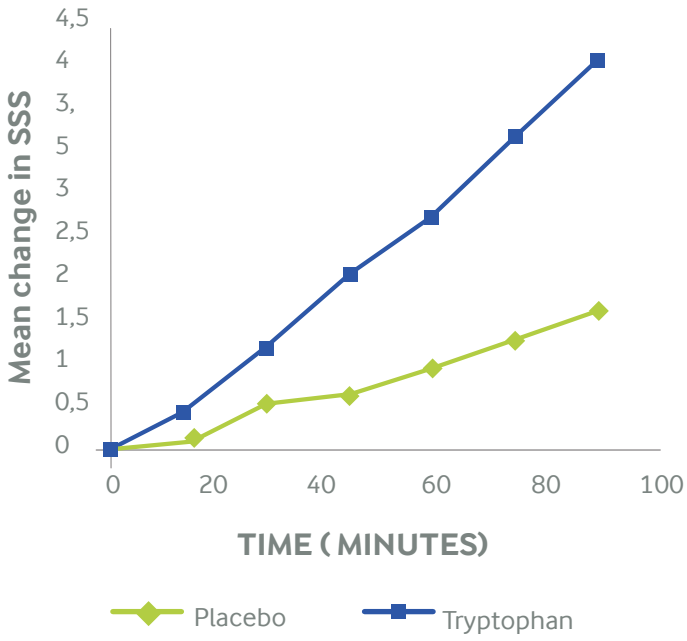
Improved sleep pattern

The tryptophan in Lacprodan® ALPHA-20 helps improve the sleep pattern by increasing sleepiness, reducing the time taken to fall asleep (sleep latency) and improving morning alertness due to a more efficient sleep.

Increased sleepiness

In a clinical study (6), 12 healthy, young, male and female subjects were given either 4g tryptophan or 4g placebo before their usual bedtime. All subjects were given both treatments separated by a one-week washout period. Measurements were taken at 15-minute intervals using the Stanford Sleepiness Scale. It was found that tryptophan produced significantly more sleepiness than the placebo 45-90 minutes after, see figure 4.

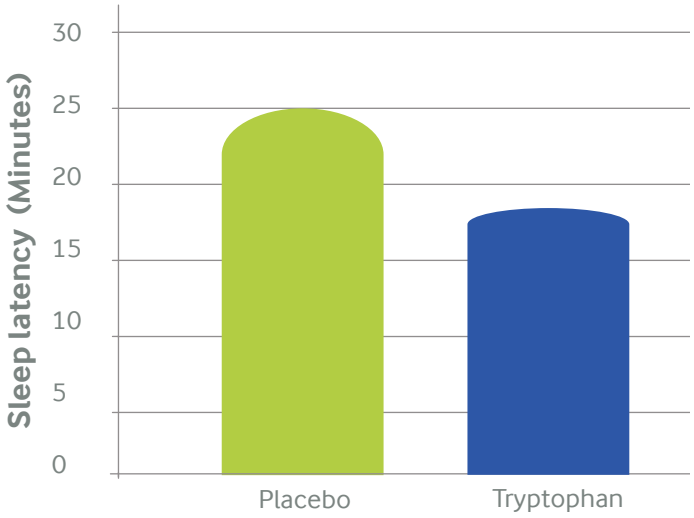
FIGURE 4
Mean change in Stanford Sleepiness Scale, SSS (6)



Decreased sleep latency

Fifteen healthy male subjects who reported sleep latencies above 30 minutes, participated in a clinical study (7). Sleep recordings were registered on five occasions, each one week apart. The subjects took tryptophan 20 minutes prior to bedtime. A dose of 1 g tryptophan produced a significantly shorter sleep latency compared to the placebo group, see figure 5.

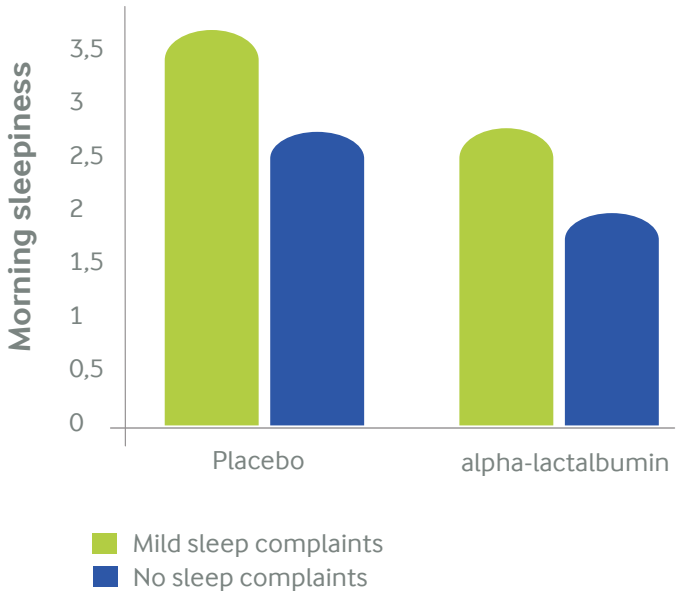
FIGURE 5
Sleep latency of placebo and 1g trytophan (7)



Reduced morning sleepiness

In a clinical study (1), healthy subjects with and without mild sleep complaints participated in a double-blind, placebo-controlled study. The subjects slept at the laboratory for two separate nights so that morning performance could be evaluated after an evening diet enriched with drinks containing either alpha-lactalbumin (960 mg tryptophan) or sodium caseinate (280 mg tryptophan) as placebo. The results demonstrated that both poor and good sleepers felt significantly less sleepy and more alert in the morning after consuming the alpha-lactalbumin enriched drinks compared to the placebo, see figure 6. The observed improvement in morning alertness is believed to be caused by a better sleep quality and reduced sleep loss.

FIGURE 6
Mean change in sleepiness scores after an overnight sleep, following evening intake of an alpha-lactalbumin or placebo drink in healthy subjects with and without mild sleep complaints (1)



Conclusion

Lacprodan® ALPHA-20 is a high quality native whey protein concentrate rich in alpha-lactalbumin which naturally contains high amounts of the serotonin precursor tryptophan. Increased dietary intake of tryptophan has documented beneficial effects on brain serotonin synthesis and activity with positive effects on mood, cognitive performance and improved sleep pattern. Clinical trials have demonstrated significant reductions in depressed moods after intake of alpha-lactalbumin. Other trials have shown improved cognitive performance by improving reaction time and visual memory. In addition, trials have shown improved sleep patterns by increasing sleepiness, reducing sleep latency and improving morning alertness after ingestion of an alpha-lactalbumin enriched diet.

- Lacprodan®ALPHA-20 offers the possibility to naturally formulate high tryptophan containing foods and beverage with beneficial effects on sleep, mood, and cognitive performance
- Lacprodan®ALPHA-20 is an optimal natural well-being ingredient for UHT stable high protein beverages and healthy foods
- A dosage of 17 g Lacprodan® ALPHA-20 provides 500 mg tryptophan

References

1. Markus Cr; Jonkman Lm; Lammers Jh; Deutz Ne; Messer Mh; Rigtering N. Evening intake of {alpha}-lactalbumin increases plasma tryptophan availability and improves morning alertness and brain measures of attention. Departments of Experimental Psychology and the Biomedical Center, University of Maastricht, Maastricht, Netherlands, and TNO Quality of Life, Zeist, Netherlands. Am J Clin Nutr 2005 May;81(5):1026-33.

2. Pollet P, Leathwood PD. The influence of Tryptophan on sleep in man. Research notes. Nestlé Products Technical Assistance Co. Ltd., Research Dept. PO box 88, CH-1814 La Tour-de-Peilz, Switzerland

3. Markus CR, Olivier B, Panhuysen GE, Van Der Gugten J, Alles MS, Tuiten A, Westenberg HG, Fekkes D, Koppeschaar HF and De Haan EE. The bovine protein alpha-lactalbumin increases the plasma ratio of tryptophan to the other large neutral amino acids, and in vulnerable subjects raises brain serotonin activity, reduces cortisol concentration, and improves mood under stress. Am J Clin Nutr 2000 Jun;71(6):1536-44

WHY CHOOSE ARLA FOODS INGREDIENTS?

R&D in our DNA
- More than 16% of our employees work with research, innovation and application development
- Collaboration with top universities worldwide
- Clinical and scientific documentation

Superior quality
- Premium quality ingredients
- Kosher and Halal certification

Your trusted business partner
- Application support
- Business development support
- In-depth nutrition research and formulation support

Security of supply
- Producing whey proteins since 1980
- Leading supplier of whey proteins, whey protein hydrolysates, whey fractions and lactose
- Continuous investment in production capacity to meet the growing volume needs of global customers
- Reliable supplies from three production sites

Arla Foods Ingredients
Discovering the wonders of whey

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