

Article

Traceable Five-Strain Probiotic-Micronutrient System for Perceived Stress and Emotional Well-Being: Formulation Evaluation and Human Evidence Context

Yassine Jabar¹, Colton Ramirez², Trevor Jenkins³

1. European Life Science Research Association, 61, Bridge Street, Kington, Herefordshire, HR5 3DJ, United Kingdom
2. European Life Science Research Association, 61, Bridge Street, Kington, Herefordshire, HR5 3DJ, United Kingdom
3. European Life Science Research Association, 61, Bridge Street, Kington, Herefordshire, HR5 3DJ, United Kingdom

Abstract: Perceived stress and emotional stability were examined as daily-state outcomes for a traceable five-strain probiotic-micronutrient powder containing *Lactobacillus helveticus*, *Bifidobacterium longum* subsp. *longum*, *Lactiplantibacillus plantarum*, *Lactocaseibacillus paracasei* and *Bifidobacterium breve*. The 3.0 g serving provided 1.0×10^{10} CFU at release and was designed to guarantee at least 5.0×10^9 CFU through shelf life; vitamins B6, B12 and D3, magnesium and zinc were included in the same low-water-activity system. In a four-week randomized parallel non-therapeutic consumer-use evaluation of 60 healthy adults with high learning or work intensity, mean perceived-stress scores changed by -0.8 points with the complete formulation and -0.3 with the matrix control. Work/examination tension changed by -0.7 versus -0.3 points, and emotional stability changed by +0.7 versus +0.2. The observations were descriptive. Randomized human work with *L. helveticus*/*B. longum* combinations, *B. longum* 1714 and *L. plantarum* strains reports stress, cortisol- and emotional-processing outcomes that are useful for endpoint selection, while remaining strain specific. The formulation results place perceived stress and emotional stability among practical outcomes for prospective study of the complete system.

Keywords: psychobiotics; perceived stress; emotional well-being; gut-brain axis; *Lactobacillus helveticus*; *Bifidobacterium longum*; *Lactiplantibacillus plantarum*; magnesium; vitamin B6.

Citation: Jabar, Y., Ramirez, C., & Jenkins, T. Traceable Five-Strain Probiotic-Micronutrient System for Perceived Stress and Emotional Well-Being: Formulation Evaluation and Human Evidence Context. Central Asian Journal of Medical and Natural Science 2026, 7(4), 525-530.

Received: 27th Jun 2026

Revised: 24th Jul 2026

Accepted: 25th Aug 2026

Published: 30th Sep 2026



Copyright: © 2026 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>)

1. Introduction

Stress-focused probiotic research has two immediate constraints: gut-brain biology and strain identity. Neural, endocrine, immune and microbial-metabolite pathways can transmit gut-related signals to the central nervous system [1]. At the product level, probiotic interpretation also depends on a defined microorganism, an adequate viable dose and evidence tied to the intended use [2]. Dinan, Stanton and Cryan introduced the psychobiotic concept to describe microbial interventions with potential relevance to brain and behavior [3]. For a multi-component powder, these points make strain traceability and viable exposure part of the research question rather than a separate manufacturing issue.

The formulation contains five culture-collection-traceable strains together with vitamin B6 (2.0 mg), vitamin B12 (10 µg), vitamin D3 (10 µg), elemental magnesium (26

mg) and elemental zinc (5 mg) per 3.0 g daily serving. Magnesium/B6 trials and meta-analytic work on B-vitamin supplementation provide nutritional context for stress-related outcomes [4], [5]. Their exposure levels and study designs differ from this formulation, so they are used here to define plausible nutritional pathways and suitable measurements rather than to assign an effect to one micronutrient.

Viable-cell preservation was treated as a formulation variable. The BALIMONT system uses a resistant-dextrin/trehalose/microcrystalline-cellulose matrix, low-temperature and low-humidity post-blending, and moisture-resistant packaging. These steps limit prolonged contact between the probiotic fraction and comparatively hygroscopic vitamin/mineral premixes. A stress-related probiotic study is difficult to interpret if the microbial dose at consumption has drifted far from the specified product composition.

Table 1. Composition and Functional Roles of the Multistrain Probiotic Formulation

Module	Identity / dose	Role in study framework
Lactobacillus helveticus	DSM 20075 / ATCC 15009	~20% of expiration-guaranteed viable count
Bifidobacterium longum subsp. longum	DSM 20219 / ATCC 15707	~20%
Lactiplantibacillus plantarum	DSM 20174 / ATCC 14917	~20%
Lactocaseibacillus paracasei	DSM 5622 / ATCC 25302	~20%
Bifidobacterium breve	DSM 20213 / ATCC 15700	~20%
Micronutrients	Vitamin B6 2 mg; B12 10 µg; D3 10 µg; Mg 26 mg; Zn 5 mg	Per 3.0 g daily intake
Low-water-activity matrix	Resistant dextrin, trehalose, microcrystalline cellulose, silicon dioxide; optional inulin/maltodextrin	Finished Aw 0.17 in representative formulation

2. Materials and Methods

2.1 Composite formulation and quality framework

Each representative daily serving weighed 3.0 g. The five traceable strains contributed approximately equal shares to an expiration target of 5.0×10^9 CFU/day; the release-added viable count was approximately 1.0×10^{10} CFU/day. The same serving supplied vitamin B6 2.0 mg, vitamin B12 10 µg, vitamin D3 10 µg, elemental magnesium 26 mg and elemental zinc 5 mg. Resistant dextrin, trehalose, microcrystalline cellulose, silicon dioxide and a limited amount of inulin formed the carrier system. Water activity was controlled at $A_w \leq 0.18$ for the nutritional premix and $A_w \leq 0.20$ for the finished powder.

2.2 Non-therapeutic consumer-use evaluation

Sixty healthy adults aged 18-45 years entered a four-week randomized parallel controlled consumer-use evaluation. Participants had relatively high learning or work intensity and noticeable daily perceived stress/fatigue, without diagnosed psychiatric or psychological disease. The test group consumed 3.0 g/day of the complete formulation; the control received the same matrix without probiotics. Seven 10-point self-rating items were recorded: daily perceived stress, work/examination tension, emotional stability, fatigue sensation, sleep quality, abdominal comfort and defecation regularity. The analysis in this

paper uses the first three emotional-state items. The evaluation was non-therapeutic, and only the reported descriptive values were used; no additional P values or inferential statistics were generated.

2.3 Published-evidence synthesis

Published human studies were screened by population, strain, daily dose, intervention duration and outcome type. Randomized work in healthy or stressed adults was prioritized. Trials using other probiotic strains were retained when they measured perceived stress, cortisol responsivity or cognitive-emotional processing, but their outcomes were kept separate from the complete formulation. Meta-analyses were used to show how consistent, or inconsistent, those signals were across studies.

Table 2. Summary of Clinical Evidence on Probiotics and Psychological Stress Outcomes

Study	Population / design	Intervention	Main observation relevant to this paper
Messaoudi et al. 2011 [6]	55 healthy adults; randomized, double-blind, placebo-controlled; 30 d	L. helveticus R0052 + B. longum R0175, 3×10^9 CFU/d	Lower psychological distress on several HSCL-90/HADS domains and lower urinary free cortisol.
Steenbergen et al. 2015 [7]	40 non-depressed participants; triple-blind RCT; 4 wk	Eight-strain probiotic, 2.5×10^9 CFU/d	Reduced cognitive reactivity to sad mood, particularly rumination and aggressive thoughts.
Allen et al. 2016 [8]	22 healthy men; within-participant placebo/psychobiotic design	B. longum 1714	Attenuated cortisol/anxiety response to an acute stressor and reduced daily reported stress.
Chong et al. 2019 [9]	111 stressed adults; randomized, double-blind RCT; 12 wk	L. plantarum DR7, 1×10^9 CFU/d	Reduced stress/anxiety scores and plasma cortisol, with changes in inflammatory and serotonergic markers.
Lew et al. 2019 [10]	103 stressed adults; randomized, double-blind RCT; 12 wk	L. plantarum P8, 10^{10} CFU/d	Lower stress and anxiety scores at early follow-up; cognitive outcomes also assessed.
Ben Fredj et al. 2026 [11]	12 RCTs; 3,350 healthy working adults	Various probiotics	Small but significant pooled improvement in subclinical psychological outcomes and lower cortisol.

3. Results

3.1 Formulation-specific emotional-state observations

After four weeks, mean daily perceived stress changed by -0.8 points in the formulation group and -0.3 in the matrix-control group. Work/examination tension changed by -0.7 and -0.3 points, respectively. Emotional stability increased by +0.7 with the formulation and +0.2 with control. These values are descriptive group changes from the consumer-use evaluation.

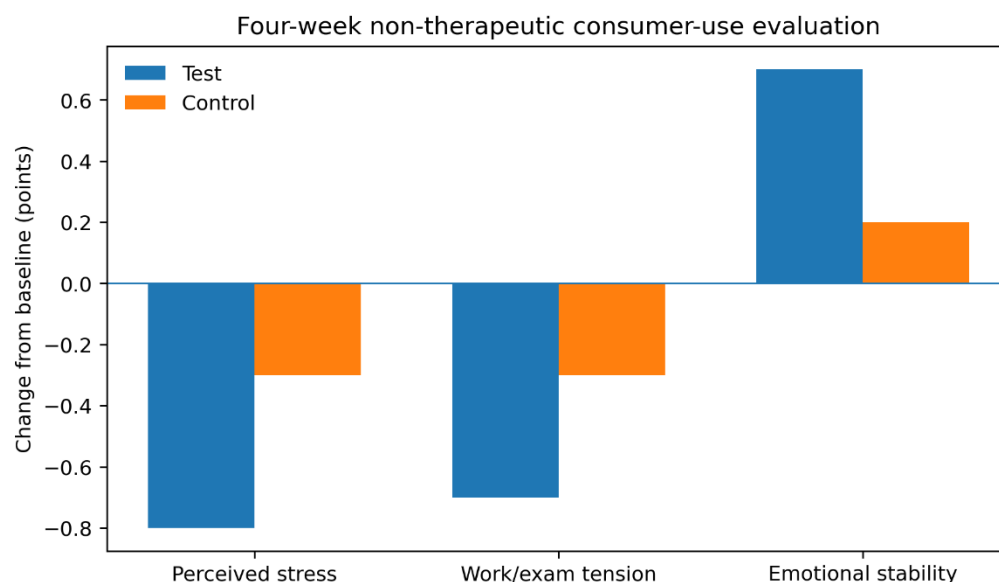


Figure 1. Descriptive change in perceived-stress and emotional-state self-ratings after four weeks.

3.2 Relationship to human psychobiotic evidence

Messaoudi et al. reported lower scores on several psychological-distress domains and lower urinary free cortisol after 30 days of *L. helveticus* R0052 plus *B. longum* R0175 in healthy adults [6]. Steenbergen et al. found reduced cognitive reactivity to sad mood after a four-week multispecies intervention [7]. *B. longum* 1714 attenuated acute stress-related cortisol and subjective anxiety in healthy volunteers in the study by Allen et al. [8]. In stressed adults, *L. plantarum* DR7 and *L. plantarum* P8 were each associated with lower stress- or anxiety-related scores; DR7 also changed cortisol and inflammatory/serotonergic markers [9], [10].

The larger syntheses are not uniform. Ben Fredj et al. pooled 12 randomized trials in 3,350 healthy working adults and reported a modest improvement in subclinical psychological outcomes together with lower cortisol [11]. Zhang et al., using seven RCTs and 1,146 healthy volunteers, also found a reduction in subjective stress, with heterogeneity across subgroup analyses [12]. The practical implication for the present formulation is that strain, dose, baseline stress and the instrument used to measure response should remain explicit in study design.

4. Discussion

The consumer-use data are easiest to read as a set of three related descriptive outcomes. Stress and work/examination tension moved downward, whereas emotional stability moved upward. No single ingredient needs to account for all three changes. The product combines a defined microbial exposure with a micronutrient module and a storage strategy intended to keep that exposure recognizable through shelf life; those are separate design features that can be measured independently in a confirmatory trial.

Species overlap with published psychobiotic work is informative, but strain substitution is not. The strongest *B. longum* stress data in the current evidence set involve 1714 or R0175, not the *B. longum* subsp. *longum* strain used here. The same applies to the published *L. plantarum* P8 and DR7 trials. A separate randomized proof-of-concept study using *L. helveticus*, *B. longum* and *L. plantarum* found altered brain responses during an arithmetic stress task in healthy subjects [13]. Such work helps identify candidate neural and psychometric endpoints without treating different strains as equivalent.

The micronutrient module has a different evidentiary role. Pouteau et al. used 300 mg magnesium with or without 30 mg vitamin B6 in adults with low magnesemia and

substantial stress [4], doses well above the 26 mg magnesium and 2 mg B6 supplied here. Young et al. found a pooled effect of multi-B-vitamin supplementation on perceived stress in healthy or at-risk groups [5]. These studies make stress-related nutritional measurements reasonable in a composite trial, while the present daily amounts remain the defined formulation exposures.

Storage quality remains relevant because the biological input is the product that is actually consumed, not only its theoretical recipe. The representative finished powder had Aw 0.17 and the broader stability program retained viable counts through extended storage. Outside probiotic trials also show why background exposure should be recorded: a high-prebiotic/fermented-food diet altered microbial stability and perceived stress in healthy adults [14], and an eight-week NVP-1704 trial measured mental-health, sleep, inflammatory and microbiota outcomes together [15]. Diet, sleep and baseline stress are therefore useful covariates rather than afterthoughts.

4.1 Research Scope and Future Directions

A confirmatory study can be kept simple. One validated stress scale should be prespecified as the primary outcome, with work/examination tension or emotional stability as secondary measures. Randomization, adherence and strain-specific viable exposure at the point of consumption should be documented. Salivary cortisol or heart-rate variability can add an objective stress measure, and a limited stool panel can test whether changes in microbial abundance track with the psychometric data. A longer observation period would show whether the four-week directional pattern is sustained.

5. Conclusion

During four weeks of non-therapeutic use, the five-strain probiotic-micronutrient formulation showed descriptive changes of -0.8 points in perceived stress, -0.7 in work/examination tension and +0.7 in emotional stability; the matrix-control changes were -0.3, -0.3 and +0.2. Human psychobiotic trials and meta-analyses report strain-dependent effects on stress-related ratings, cortisol and emotional processing. The formulation also maintains a defined viable-cell and micronutrient exposure through a low-water-activity design. These elements justify a prospectively powered study of everyday stress and emotional well-being using prespecified validated endpoints.

REFERENCES

- [1] J. F. Cryan, K. J. O'Riordan, C. S. M. Cowan, et al., "The microbiota-gut-brain axis," *Physiol. Rev.*, vol. 99, no. 4, pp. 1877-2013, 2019, doi: 10.1152/physrev.00018.2018.
- [2] C. Hill, F. Guarner, G. Reid, et al., "The International Scientific Association for Probiotics and Prebiotics consensus statement on the scope and appropriate use of the term probiotic," *Nat. Rev. Gastroenterol. Hepatol.*, vol. 11, no. 8, pp. 506-514, 2014, doi: 10.1038/nrgastro.2014.66.
- [3] T. G. Dinan, C. Stanton, and J. F. Cryan, "Psychobiotics: a novel class of psychotropic," *Biol. Psychiatry*, vol. 74, no. 10, pp. 720-726, 2013, doi: 10.1016/j.biopsych.2013.05.001.
- [4] E. Pouteau, M. Kabir-Ahmadi, L. Noah, et al., "Superiority of magnesium and vitamin B6 over magnesium alone on severe stress in healthy adults with low magnesemia: a randomized, single-blind clinical trial," *PLoS One*, vol. 13, no. 12, p. e0208454, 2018, doi: 10.1371/journal.pone.0208454.
- [5] L. M. Young, A. Pipingas, D. J. White, S. Gauci, and A. Scholey, "A systematic review and meta-analysis of B vitamin supplementation on depressive symptoms, anxiety, and stress: effects on healthy and at-risk individuals," *Nutrients*, vol. 11, no. 9, p. 2232, 2019, doi: 10.3390/nu11092232.
- [6] M. Messaoudi, R. Lalonde, N. Violle, et al., "Assessment of psychotropic-like properties of a probiotic formulation (*Lactobacillus helveticus* R0052 and *Bifidobacterium longum* R0175) in rats and human subjects," *Br. J. Nutr.*, vol. 105, no. 5, pp. 755-764, 2011, doi: 10.1017/S0007114510004319.
- [7] L. Steenbergen, R. Sellaro, S. van Hemert, J. A. Bosch, and L. S. Colzato, "A randomized controlled trial to test the effect of multispecies probiotics on cognitive reactivity to sad mood," *Brain Behav. Immun.*, vol. 48, pp. 258-264, 2015, doi: 10.1016/j.bbi.2015.04.003.

- [8] A. P. Allen, W. Hutch, Y. E. Borre, et al., "Bifidobacterium longum 1714 as a translational psychobiotic: modulation of stress, electrophysiology and neurocognition in healthy volunteers," *Transl. Psychiatry*, vol. 6, p. e939, 2016, doi: 10.1038/tp.2016.191.
- [9] H. X. Chong, N. A. A. Yusoff, Y. Y. Hor, et al., "Lactobacillus plantarum DR7 alleviates stress and anxiety in adults: a randomised, double-blind, placebo-controlled study," *Benef. Microbes*, vol. 10, no. 4, pp. 355-373, 2019, doi: 10.3920/BM2018.0135.
- [10] L. C. Lew, Y. Y. Hor, N. A. A. A. Yusoff, et al., "Probiotic Lactobacillus plantarum P8 alleviated stress and anxiety while enhancing memory and cognition in stressed adults: a randomised, double-blind, placebo-controlled study," *Clin. Nutr.*, vol. 38, no. 5, pp. 2053-2064, 2019, doi: 10.1016/j.clnu.2018.09.010.
- [11] S. Ben Fredj, H. Kechiche, A. Chouchen, et al., "Probiotic intake and mental health in healthy working adults: a systematic review and meta-analysis of randomized controlled trials," *BMC Psychol.*, vol. 14, no. 1, p. 175, 2026, doi: 10.1186/s40359-025-03885-5.
- [12] N. Zhang, Y. Zhang, M. Li, et al., "Efficacy of probiotics on stress in healthy volunteers: a systematic review and meta-analysis based on randomized controlled trials," *Brain Behav.*, vol. 10, no. 9, p. e01699, 2020, doi: 10.1002/brb3.1699.
- [13] H. M. T. Edebol Carlman, J. Rode, J. König, et al., "Probiotic mixture containing Lactobacillus helveticus, Bifidobacterium longum and Lactiplantibacillus plantarum affects brain responses to an arithmetic stress task in healthy subjects: a randomised clinical trial and proof-of-concept study," *Nutrients*, vol. 14, no. 7, p. 1329, 2022, doi: 10.3390/nu14071329.
- [14] K. Berding, T. F. S. Bastiaanssen, G. M. Moloney, et al., "Feed your microbes to deal with stress: a psychobiotic diet impacts microbial stability and perceived stress in a healthy adult population," *Mol. Psychiatry*, vol. 28, no. 2, pp. 601-610, 2023, doi: 10.1038/s41380-022-01817-y.
- [15] H. J. Lee, J. K. Hong, J.-K. Kim, et al., "Effects of probiotic NVP-1704 on mental health and sleep in healthy adults: an 8-week randomized, double-blind, placebo-controlled trial," *Nutrients*, vol. 13, no. 8, p. 2660, 2021, doi: 10.3390/nu13082660.