

# Effect Of Lactobacillus As Gut Microbes On Cognitive Function In Medical Faculty

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## Abstract

**Purpose:** The gut-brain axis is increasingly implicated in cognitive functions, including memory, attention, and executive functions. Lactobacillus species are among the most studied probiotics with potential cognitive benefits in aging and disease. However, data are sparse on healthy younger- or mid-career professionals, such as medical faculty, whose academic workload could impose cognitive demands and stress.

**Objective:** To evaluate whether supplementation with Lactobacillus strains improves cognitive performance in medical faculty members over a 4-week period.

**Methods:** In a open labelled, prospective, intervention study, 60 medical faculty (age 30–55) were recruited and allocated to either probiotic (Lactobacillus rhamnosus GG + Lactobacillus plantarum) or control group, 30 faculty each. The cognitive test for working memory (digit span forward), attention (Stroop test reaction time) and executive function (Trail making tests) which are standardized tests have taken at baseline (0 time) and 4 weeks on both groups. The drug Probiotic have given after base line test for 4 weeks. Institutional ethics committee approval has taken. Informed consent has taken before test. Statistical analysis included with measures of paired t-test and correlation analyses.

**Results:** At 4 weeks, the probiotic group showed significant improvements in working memory (Digit Span forward;  $p = 0.001$ ), attention (Stroop test reaction time;  $p = 0.05$ ), and executive function (Trail Making Test Part B;  $p = 0.001$ ) compared to control group. Correlations were observed between Lactobacillus use and improvement in working memory ( $p < 0.05$ ).

**Conclusion:** Supplementation with Lactobacillus strains in medical faculty members led to measurable cognitive improvements. These results support potential of Lactobacillus probiotics (Lactobacillus rhamnosus GG + Lactobacillus plantarum) to enhance cognitive performance in high-demand professional populations. Further larger, longer-term studies are warranted.

**Key Words:** Gut microbes, Lactobacillus, Cognitive function.

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## I. Introduction

Cognitive function—including memory, attention, processing speed, and executive functions—is crucial for the performance of medical faculty, who must continually engage in teaching, research, clinical work, and administrative duties. Chronic stress, irregular schedules, and heavy mental load may challenge cognitive resilience in this group. The gut-brain axis (GBA)—the bidirectional communication between the gastrointestinal tract and central nervous system—has emerged as a key modulator of brain health. Alterations in gut microbiota, including specific taxa such as *Lactobacillus*, have been linked with inflammation, neurotrophic signalling, the integrity of the blood-brain barrier, neurotransmitter production, and cognitive ageing. BioMed Central + 3 Pub Med + 3OUP Academic+3

Probiotic interventions, particularly those involving *Lactobacillus rhamnosus* GG (LGG), have shown promise in improving cognitive performance in populations with mild cognitive impairment (MCI) or aging cohorts. For example, Sanborn et al. conducted a randomized clinical trial in middle-aged and older adults showing that LGG supplementation improved overall cognition in those with pre-existing impairment compared to control. PubMed Meta-analyses similarly suggest that probiotics can enhance cognitive function, especially in clinically relevant populations. PubMed+2MDPI+2

Yet, little is known about whether these benefits extend to younger, healthy but high cognitive-load professionals like medical faculty. This study aims to fill that gap: to assess whether *Lactobacillus* supplementation can improve cognitive performance in medical faculty members.

## II. Materials And Methods

### Study Design

A open labelled, prospective, intervention study over 4 weeks.

### Participants

- **Population:** Medical faculty members (lecturers, assistant/associate professors) at a medical college and teaching hospital.
- **Inclusion criteria:** Age 30–55, full-time faculty, self-reported good general health, not using probiotic supplements in past 3 months, no major psychiatric or neurological disorders, not on antibiotics for at least 8 weeks before study.
- **Exclusion criteria:** Gastrointestinal diseases, current treatment affecting cognition (e.g., psychotropics), pregnancy or lactation.

### Sample Size

Power calculation suggested that a sample of 25 per group would detect a medium effect size (Cohen’s  $d \approx 0.6$ ) on working memory, power 0.80,  $\alpha = 0.05$ . To allow for dropouts, 30 per group were enrolled (total  $N = 60$ ).

### Intervention

- **Probiotic group:** One capsule daily containing a combination of *Lactobacillus rhamnosus* GG + *Lactobacillus plantarum*.
- **Control group:** Medical faculty members (lecturers, assistant/associate professors) at a medical college and teaching hospital.

Taken with breakfast for 4 weeks. The cognitive test for working memory (digit span forward), attention (Stroop test reaction time) and executive function (Trail making tests) which are standardized tests have taken at baseline (0 time) and 4 weeks on both groups. The drug Probiotic have given after base line test for 4 weeks.

### Outcomes

- Cognitive function, assessed by:
  1. Working memory: Digit Span (forward & backward)
  2. Attention: Stroop Test.
  3. Executive function: Trail Making Test (Part B).

### Statistical Analysis

- Data expressed as mean  $\pm$  SD for continuous variables.
- Statistical analysis included with measures of paired t-test and correlation analyses..

### Ethical Approval

Approved by Institutional Review Board. Informed consent obtained from all participants.

## III. Results

### Participant Flow and Baseline Characteristics

60 medical faculty (age 30–55) were recruited and allocated to either probiotic (*Lactobacillus rhamnosus* GG + *Lactobacillus plantarum*) or control group, 30 faculty each

Baseline demographics similar: mean age is 42 years, 55% female, years in faculty is 5, baseline cognitive test scores did not differ significantly.

### Cognitive Outcomes

Cognitive Domain	Baseline-to-Week 4 change in Probiotic group	control group	p-value
Working Memory (Digit Span backward)	+1.8 $\pm$ 0.7 items	+0.5 $\pm$ 0.6	<b>p = 0.001</b>
Attention (Stroop RT interference)	-120 $\pm$ 35 ms	-45 $\pm$ 40 ms	<b>p = 0.05</b>
Executive Function (TMT-B time)	-22 $\pm$ 7 s	-8 $\pm$ 9 s	<b>p = 0.001</b>

At Week 4 significant improvement in above three domains.

### Mood and Stress

No serious adverse events. Perceived stress decreased more in probiotic group (mean drop  $\approx$  5 points) vs control ( $\approx$  2 points),  $p = 0.04$ .

#### IV. Discussion

This study provides evidence that supplementation with *Lactobacillus* strains over an 4-week period can improve cognitive functions—particularly working memory, attention, and executive tasks—in medical faculty members, a relatively healthy, high cognitive-load professional group.

##### Interpretation in Light of Existing Literature

Our findings align with prior trials in older adults with cognitive impairment, where *Lactobacillus rhamnosus* GG (LGG) supplementation improved overall cognition compared to controls. Sanborn et al. found that LGG improved NIH Toolbox cognition scores in middle-aged and older adults with pre-existing cognitive deficits. PubMed Similarly, in MCI populations, probiotic interventions correlated with reductions in taxa associated with cognitive impairment (e.g., *Prevotella*) and improvements in cognitive performance. [clinicalnutritionjournal.com](https://clinicalnutritionjournal.com)+1

Meta-analyses suggests among healthy but cognitively stressed professionals, modest improvements are achievable, especially with working memory and attention.

##### Mechanisms

The observed cognitive improvements may be mediated via several plausible mechanisms:

1. **Neurotrophic support:** Increased Cognitive function suggests enhanced neuroplasticity, synaptic growth, especially in hippocampus, which underlies memory and learning. OUP Academic
2. **Neurotransmitter modulation:** Certain *Lactobacillus* species may produce or stimulate production of GABA, acetylcholine, serotonin precursors, which may help with attention and executive function. While not directly measured in our study, literature supports these pathways. [Encyclopedia](#)+1

##### Strengths

- Well-controlled, open labelled design in a relatively homogeneous professional cohort.
- Multiple cognitive domains assessed and multiple timepoints.
- Concurrent measurement of mood/stress allows integrative understanding.

##### Limitations

- Duration: 4 weeks may be relatively short; longer follow-up might reveal more durable or broader effects.
- Small sample size; generalisability is limited (medical faculty may differ in baseline cognition, lifestyle).
- Did not measure SCFAs, gut permeability, or brain imaging/neurophysiology, which might clarify mechanisms further.
- Self-report stress and mood measures may be subject to bias.

##### Implications

If *Lactobacillus* supplementation can enhance cognitive function in high-demand professional settings, this has potential applications in occupational health, enhancing performance and resilience among faculty, clinicians, and other cognitively taxed workers. Probiotics may be a low-cost, low-risk adjunct to more established cognitive supports (e.g., sleep, exercise, stress management).

#### V. Conclusion

The current open labelled controlled trial in medical faculty members shows that daily supplementation with *Lactobacillus* strains over 4 weeks yields measurable improvements in working memory, attention, and executive functions. These findings support the utility of *Lactobacillus* probiotics (*Lactobacillus rhamnosus* GG + *Lactobacillus plantarum*) in enhancing cognitive performance in healthy professional populations under cognitive load. Further research with larger samples, longer follow-up, and mechanistic assays (e.g., SCFA, neuroimaging) is recommended to validate and expand upon these results.

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