

Effectiveness of Honey Supplementation to Overcome Depressive Symptoms in University Students: An Evidence-based Quasi-experimental Study from Indonesia

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ABSTRACT

Background. Depression is a mental health disorder that affects many people, including college students. It can significantly impact a person's quality of life, making concentrating, studying, and performing daily activities difficult. Some studies have shown that honey may have antidepressant properties, but its effectiveness as a treatment for depression in college students has not been fully explored.

Objective. This study aimed to evaluate the effectiveness of daily honey supplementation in reducing depressive symptoms among university students over 10 weeks, compared with a control condition.

Methods. This is a quasi-experimental study. Students (18–25 years) were purposively recruited from the Faculty of Medicine and Health Sciences, Universitas Islam Negeri Alauddin Makassar, Indonesia. A total of 46 students were enrolled and non-randomly allocated to the honey intervention (n=22) or control (n=24). DASS-21 outcomes were assessed pre- and post-intervention. Exclusion criteria included allergy to honey, current antidepressant medication, comorbid psychiatric conditions, and non-compliance during intervention. The intervention group received 2 teaspoons (5 ml) of honey orally once daily for 10 weeks, administered under researcher supervision.

Depression levels were measured before and after the intervention using the validated DASS-21 scale. Data collection also included a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) and a 24-hour recall to control dietary intake. Assessed at baseline and the end of the study using the paired t-test and analysis of variance (ANOVA).

Results. The results showed a significant reduction in depression rates in the honey intervention group compared to the control group. This is evidenced by a decrease in the depression score from 7.22 to 4.45 and a p-value = 0.002. The intervention group showed improvement, with “normal” classification increasing from 81.8% to 95.5%, and no cases of mild depression observed post-intervention.

Conclusion. Honey treatment showed promising effectiveness as a complementary approach in alleviating depression among college students. Future studies with larger randomized samples are recommended to confirm these findings.

Keywords: depression, honey treatment, college students, Indonesia



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INTRODUCTION

Psychological disorders characterized by deviations in individual feelings, cognitions, and behaviours are called depression. Depression is a mental disorder, even one of the most common, that can cause various emotional problems and even lead to the point of suicide.¹ People suffering from depressive disorders often experience sadness and isolation, have a reduced sense of self, and exhibit behaviours that withdraw from their environment. Differences in the level of symptoms, including behavioural deviations and emotional changes, as well as somatic manifestations such as fatigue, sleep disturbances, change in appetite, and various unexplained physical complaints, alongside cognitive symptoms like impaired concentration, indecisiveness, and persistent negative thinking, collectively impact the severity and burden of depression.²

Both the prevalence and incidence of depression continue to increase significantly at an alarming rate. According to a study published in 2015, the rate of people suffering from depression has increased by 18.4 percent in the last ten years.⁴ The number of people suffering from depression is also increasing in Indonesia. The incidence rate was 11.7 percent in 2010.⁵ Christiani et al saw an increase in this number to 15 percent.⁶ In 2018, the percentage reached a new high of 21.8 percent.⁷

Research conducted in 2020 showed that the percentage of people suffering from depression has increased to 43.5 percent.⁸ Anxiety disorder affects 35.8 percent of college students in Greece, and depression affects 51.2 percent of them, according to a survey conducted by those students in 2009.⁹ According to a study conducted in the UK, a third (33 percent) of 461 students suffered from depression.¹⁰ 18.1 percent of students in Bangladesh surveyed experienced severe anxiety, and 15 percent of students in Bangladesh surveyed had moderate to severe depression.¹¹

The COVID-19 pandemic caused by the SARS-CoV-2 virus has made the situation worse. This incident is a problem for public health on a national and international scale.¹² The incidence of moderate depression was found to be about 39 percent, anxiety was found to be 59 percent, and stress was found to be 70 percent, according to a study conducted on 1653 respondents from 63 countries. Young adults (those in their productive years) have an increased risk of developing mental illness due to COVID-19.¹³

Fifty-four percent (54%) of respondents experienced the psychological impact of the COVID-19 outbreak that ranged from moderate to severe, 29 percent were reported to have anxiety symptoms, and 17 percent were reported to have moderate to severe depressive symptoms, according to a study conducted on 1210 respondents from 194 cities in China from January to February 2020.¹⁴

Students are one of the demographics affected by COVID-19, and several studies have shown a link between COVID-19 and clinical depression in college students. A

survey of 876 students in Bangladesh conducted during the COVID-19 pandemic found that forty percent of respondents experienced moderate to severe anxiety, and seventy-two percent experienced depression.¹⁵

Students who are going through stressful situations can receive support from their university. Resilience and support in higher education serve as moderate factors in the relationship between academic stress and depressive symptoms in students. It is essential to help higher education institutions, especially students at higher risk of developing mental disorders such as anxiety and depression.¹⁶

Although other evidence-based treatments such as psychotherapy and pharmacotherapy have been proven effective in reducing depressive symptoms, their actual use among young adults in Indonesia remains low due to stigma, limited access, and low acceptability; therefore, honey needs to be tested as a potential alternative intervention.¹⁷

According to a review of several studies on honey, treating animals and humans with different types of honey can alleviate some of the symptoms of depression.¹⁸

Unfortunately, most studies on the efficacy of honey administration in overcoming depression were conducted in experimental animals. The safety and quality considerations for using honey as a supplement in this study refer to the Indonesian regulatory framework, specifically the Regulation of the Indonesian Food and Drug Authority Number 24 of 2023 on Safety and Quality Requirements for Health Supplements.¹⁹ This study aimed to evaluate the effectiveness of 10 weeks of honey supplementation in reducing depressive symptoms (primary outcome) and anxiety/stress (secondary outcomes) among university students, compared with a control condition.

MATERIALS AND METHODS

Study Design

This study employed a quasi-experimental pre-test-post-test control group design, conducted in the Faculty of Medicine and Health Sciences, Universitas Islam Negeri Alauddin Makassar, Indonesia.

Study Participants

Students were recruited using purposive sampling from the Faculty of Medicine and Health Sciences, Universitas Islam Negeri Alauddin Makassar, Indonesia (aged 18–25 years; meeting the inclusion criteria). The unit of assignment was the individual. Participants were non-randomly allocated to two parallel arms (honey vs control) according to the order of enrollment and session availability without masking; no blocking, stratification, or minimization was used. Outcomes were assessed pre- and post-intervention using the DASS-21. The Depression Anxiety Stress Scales-21 (DASS-21) is a self-report questionnaire designed to quantitatively assess negative emotional states—depression, anxiety, and stress. It consists of 21 items divided into three subscales

(Depression, Anxiety, and Stress), each comprising seven items, and has demonstrated robust psychometric properties, with evidence supporting its validity and reliability as a measurement instrument.²⁰

The number of participants who were sampled was 46; the sample size was calculated using a hypothesis test for two population proportions, the Lemeshow formula with a 95% confidence level and 80% power. A total of 46 participants were selected, then allocated into intervention ($n = 24$) and control ($n = 24$) groups. Inclusion criteria were: (1) aged 18–25 years, (2) mild–moderate depression level based on DASS-21, (3) willing to participate with informed consent. Exclusion criteria were: (1) allergy to honey, (2) undergoing pharmacological or psychotherapy treatment for depression, (3) presence of comorbid psychiatric illness, (4) non-compliance during intervention (at least 80 % or withdrew from the study).

The intervention group received 2 teaspoons (5 ml) of pure honey orally once daily for 10 weeks, administered under the supervision of the research team. The control group did not receive honey but continued with their usual dietary practices. Compliance of the intervention group was attempted by signing an informed consent agreement and conveying the consequences if they did not comply with consuming honey.

Data Collection

Data collection was conducted on-site in the classroom; measurements were carried out at the time of the pre-test and post-test. The time gap between pre and post-test was 10 weeks. Sociodemographic variables, depressive symptoms, dietary habits, and nutritional intake were the focus of measurement. A standard questionnaire (valid and reliable) was used to collect data on sociodemographic factors; DASS-21 (Depression, Anxiety, Stress Scales-21) used the version of the DASS-21 according to the standard manual; the semi-quantitative Food Frequency Questionnaire (FFQ-SQ) was adapted to local dietary items following standard procedures.²¹ The 24-hour food recall followed the multiple-pass method administered by trained assessors; capillary hemoglobin (Hb) was measured following the manufacturer's protocol.

Adherence Procedures

Participants in the honey arm received pre-measured containers and maintained daily intake logs (paper). Research assistants conducted weekly phone check-ins to verify dosing and address barriers. WhatsApp reminders per day were scheduled during the 10-week intervention. We defined adequate adherence as $\geq 80\%$ of scheduled doses. No financial or material incentives were offered; adherence was encouraged through brief education on the study rationale.

Participants and intervention administrators were unblinded (*open-label*). Outcome assessors were blinded to study arm through de-identified participant codes and separate data-collection stations. Allocation lists and dosing

logs were maintained by a different staff member with no role in outcome assessment.

Data Analysis

SPSS version 23.00 was used for data analysis. The paired t-test and the variance analysis test (ANOVA) determined the presence or absence of differences between the study's beginning and conclusion. The significance level was a p-value less than 0.05 ($p \text{ value} < 0.05$).

Ethical Considerations

This study obtained approval No. B.258/KEPK/FKIK/VI/2022 from the Health Research Ethics Committee within the Faculty of Medicine and Health Sciences, Alauddin State Islamic University Makassar, Indonesia, and all participants provided written informed consent.

Stages of Research

This research began with recruiting samples through social media, be it WhatsApp, Facebook, or Instagram. The screening sample used inclusion criteria—determination of depressive status using DASS 21. The samples were then randomized using a numbering system and distributed to the intervention group. In the baseline, measurements of sociodemographic variables, depressive symptoms, diet, and nutrient intake were carried out. Next, the sample was intervened for ten weeks. Then post-test measurements were carried out on sociodemographic variables, depressive

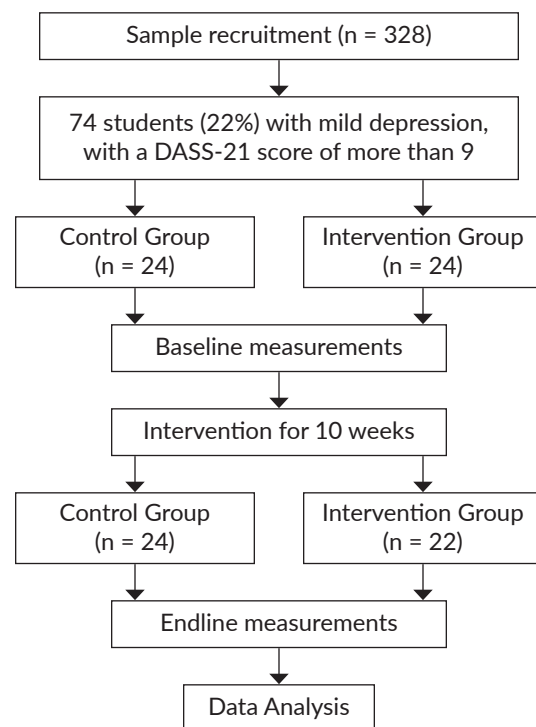


Figure 1. Research flow and number of respondents at research stages.

symptoms, diet, and nutrient intake. The data that had been collected were then processed and analyzed, compiled into research reports and publication drafts.

RESULTS

A total of 75 students were screened for eligibility. Twenty-seven students were excluded (19 did not meet inclusion criteria, 5 declined to participate, 3 reported a honey allergy). Forty-eight participants were enrolled and evenly allocated to the intervention group ($n = 24$) and the control group ($n = 24$). During follow-up, two participants from the control group were absent due to incomplete post-test data and were therefore excluded from the analysis. Baseline demographic characteristics (age, sex, BMI, dietary intake, and baseline DASS-21 scores) were comparable between the two groups, with no significant differences ($p > 0.05$). The participant flow is presented in Figure 1.

Online screening identified 328 prospective respondents. Females predominated (85.4%), reflecting the gender composition of the Faculty of Medicine and Health Sciences at Universitas Islam Negeri Alauddin Makassar and known gendered vulnerabilities to mental health problems. Most prospects were from Public Health (68.6%); Nursing contributed none. Although online recruitment can limit engagement, this distribution was not expected to materially affect findings given the study's experimental design.

First-year students (class of 2021) constituted the largest cohort, with most prospects aged ≤ 20 years (late adolescence), a period marked by transition to adult roles. Among prospective respondents, 34.1% screened positive for depression, 56.5% for anxiety, and 39.9% for stress.

Eligible participants were recruited individually. Inclusion criteria were mild depression (DASS-21 score > 9)

and informed consent. Baseline assessments included 24-hour dietary recall, anthropometry, hemoglobin (Hb), and sleep quality to enable monitoring of the honey intervention's effects.

Among enrolled participants, females comprised 85.9% and males 14.1%. Younger age (≤ 20 years) dominated both the control and honey groups. Anemia (by Hb) was present in 34.1% overall; its incidence was lower in the honey group (22.7%) than in controls (33.3%).

Sleep quality was generally poor: 68.2% reported difficulties initiating or maintaining sleep and frequent nocturnal disturbances (temperature discomfort, breathing difficulty, illness, nightmares). Poor sleep was more prevalent in the honey group (78.6%) than in controls (63.6%). By cohort, the class of 2021 also predominated within groups (control 65.9%; honey 72.2%). These baseline characteristics contextualize subsequent analyses of the intervention's effects on mental health, anemia status, and sleep outcomes.

Baseline characteristics did not differ between the control and the honey-treated groups (Table 1). Because matching was not performed, rigorous monitoring and control of dietary intake and hemoglobin levels are required to preserve comparability across groups, thereby allowing any post-intervention changes to be attributed to the intervention itself.

Mental-disorder scores increased from pre- to post-test in the control group (Table 2). A statistically significant rise was observed for stress (mean change = +1.9; $p = 0.017$), indicating deterioration among participants who received no intervention. By contrast, increases in depression (+1.2) and anxiety (+0.9) were not significant ($p > 0.05$).

Participants in the intervention group, who received honey, demonstrated a statistically significant decrease in depression scores from pre-test ($M = 7.22$) to post-test ($M =$

Table 1. Differences in Nutritional Intake and Hb Levels in Respondents Based on Treatment Groups

Intake and Hb	Control Mean	(n = 24) SD	Honey Mean	(n = 22) SD	P*	Interpretation
Energy	1312	± 493	1227	± 402.08	0.702	No difference
Protein	50.6	± 26	47.06	± 2.5	0.714	No difference
Fat	51.77	± 3.14	46.83	± 2.23	0.414	No difference
Carbohydrates	163	± 66.24	156.9	± 58.2	0.949	No difference
Haemoglobin	12.45	± 1.76	12.54	± 1.91	0.661	No difference

*ANOVA Test

Table 2. Changes in Mental Disorder Scores in the Control Group during Pre- and Post-Tests

Mental Disorders Score	Control (n = 24)			P*	Interpretation
	Pre	Post	Change		
Depression	2.67	3.87	1.2	1.22	Insignificant
Stress	4.7	6.6	1.9	0.017	Significant
Anxious	5.2	6.1	0.9	0.271	Insignificant

*Paired t-test

Table 3. Changes in Mental Disorder Scores in the Intervention Group during the Pre- and Post-Tests

Score Kesehatan Mental	Honey (n = 22)			P*	Interpretation
	Pre	Post	Change		
<i>Depression</i>	7.22	4.45	-2.77	0.002	Significant
<i>Stress</i>	7.73	6.9	-0.83	0.327	Insignificant
<i>Anxious</i>	8.04	6.72	-1.32	0.17	Insignificant

*Paired t-test

Table 4. Comparison of Post-intervention Scores between the Intervention and Control Groups

Mental Health	Post Control		Post Intervention		P*	Interpretation
	Score	SD	Score	SD		
<i>Depression</i>	3.87	0.65	4.45	0.60	0.003	Significant
<i>Stress</i>	6.6	1.10	6.9	1.05	0.35	Insignificant
<i>Anxious</i>	6.1	1.15	6.72	1.10	0.069	Insignificant

Table 5. Changes in the Incidence of Mental Disorders in the Control Group and the Intervention Group

Mental Disorders	Control Group				Honey/Intervention Group			
	Pre		Post		Pre		Post	
	n	%	n	%	n	%	n	%
<i>Depression</i>								
Normal	23	95.8	22	92	18	81.8	21	95.5
Mild	0	0	2	8.3	3	13.6	0	0
Moderate	1	4.2	0	0	1	4.5	1	4.5
Severe	0	0	0	0	0	0	0	0
<i>Stress</i>								
Normal	24	100	22	92	22	100	22	100
Mild	0	0	2	8.3	0	0	0	0
Moderate	0	0	0	0	0	0	0	0
Severe	0	0	0	0	0	0	0	0
<i>Anxious</i>								
Normal	21	87.5	18	75	9	40.9	15	68.2
Mild	2	8.3	2	8.3	5	22.7	2	9.1
Moderate	1	4.2	4	17	7	31.8	5	22.7
Severe	0	0	0	0	1	4.5	0	0
Very Severe	0	0	0	0	0	0	0	0

4.45), with a mean reduction of -2.77 ($p = 0.002$) (Table 3). Although reductions were also observed in stress (-0.83) and anxiety (-1.32) scores, these changes were not statistically significant ($p = 0.327$ and $p = 0.17$, respectively).

The post-intervention analysis showed a **significant improvement in depression scores** among participants who received the honey intervention compared to the control group ($p = 0.003$) (Table 4). This indicates that honey consumption may have a positive effect on depressive symptoms. In contrast, changes in **stress** ($p = 0.350$) and **anxiety** ($p = 0.069$) levels were **not statistically significant**, suggesting that the intervention did not substantially affect these two domains within the observed period.

These findings imply that while the honey intervention may contribute to alleviating depressive tendencies, its impact on stress and anxiety requires further investigation,

possibly involving a longer intervention duration or larger sample size to capture more subtle psychological effects.

Table 5 presents the categorical changes in both groups.

For Depression—the control group exhibited a slight decline in the “normal” category (95.8% to 92.0%) with the emergence of mild depression (8.3%), whereas the intervention group improved from 81.8% to 95.5% “normal,” with no mild cases after the intervention. For Stress—all intervention participants were “normal” at both assessments; the control group decreased from 100% to 92.0% “normal,” with 8.3% classified as mild post-test. For Anxiety—the control group’s “normal” proportion fell (87.5% to 75.0%) alongside a rise in moderate anxiety (4.2% to 17.0%). Conversely, the intervention group’s “normal” category increased substantially (40.9% to 68.2%), and no “severe” cases remained post-intervention.

DISCUSSION

The findings of this study demonstrate that daily honey supplementation for 10 weeks significantly reduced depression scores among college students compared to the control group. The moderate effect size suggests that honey may serve as a promising complementary approach for managing depressive symptoms. External validity is supported by the pragmatic, on-site implementation in a university setting, high completion (100%), and routine-feasible adherence procedures without incentives. However, generalizability may be constrained by the single-site context (Faculty of Medicine and Health Sciences, UIN Alauddin Makassar), the 10-week follow-up, and non-probability sampling of 18–25-year-old students. Replication in multi-site cohorts, longer follow-up, and more diverse student populations is warranted.

In the control group, mental-disorder scores increased from pre- to post-test across domains. Anxiety rose from 5.2 to 6.1 ($p = 0.271$), depression from 2.67 to 3.87 ($p = 0.122$), and stress increased significantly from 4.7 to 6.6 ($p = 0.017$). These results suggest emerging stress problems among participants who received no intervention, although overall mental health remained generally within normal limits. The observed deterioration in the control group—most notably the significant rise in stress despite generally normal baseline profiles—is consistent with longitudinal evidence showing that university students often experience worsening psychological distress across an academic term in the absence of targeted intervention.^{20,21} Large multi-country surveys likewise document high and persistent burdens of depression and anxiety in college populations, with stress-related symptoms commonly intensifying around assessment periods.²² Methodologically, our reliance on the DASS-21 to index depression, anxiety, and stress is aligned with its validated psychometric performance in student samples and its sensitivity to within-semester change.²³ Together, these findings suggest that the increases we observed in the control arm likely reflect the typical trajectory of student stress under routine academic demands rather than measurement artefact.

In the intervention (honey) group, mental-disorder scores decreased from pre- to post-test. The reduction was significant for depression (7.22 $\rightarrow$ 4.45; $p = 0.002$), and larger than the changes observed in other domains, indicating a targeted effect on depressive symptoms. Stress (7.73 $\rightarrow$ 6.90; $p = 0.327$) and anxiety (8.04 $\rightarrow$ 6.72; $p = 0.170$) also declined, but these changes were not statistically significant. The greater reduction observed for depression relative to stress and anxiety mirrors prior evidence that polyphenol-rich interventions yield clearer improvements in depressive symptoms than in other affective domains, plausibly via antioxidant and anti-inflammatory pathways.^{24,25} Findings with Tualang honey similarly suggest mood-modulating effects, with more consistent signals on depressive outcomes.²⁶ Although our stress and anxiety changes were not statistically significant, the downward trends are compatible with meta-

analytic estimates showing small effects for these domains.^{22,23} Additionally, trials reporting sleep benefits from milk–honey mixtures provide a plausible indirect route to mood improvement that may contribute to the observed pattern.²⁷ Potential hematinic effects of honey reported in human studies could also support affect regulation through improved iron status.²⁸ Overall, our results align with this literature, extending it to a young adult cohort assessed with DASS-21.

For depression categories, the control group shifted from 4.2% moderate depression at pre-test to 8.3% mild depression at post-test. In the intervention group, 13.6% had mild and 4.5% had moderate depression at pre-test; at post-test, no participants remained in the mild category, and 4.5% had moderate depression. For stress, no control participants were classified as stressed at pre-test, whereas 8.3% exhibited mild stress at post-test. The directional shifts observed here—emergence of mild stress in the control group and stabilization of stress in the intervention group, alongside improvement in depression categories after honey—are broadly consistent with prior evidence on polyphenol-rich honey and dietary polyphenols.^{24–26} Trials using milk–honey mixtures have also shown improvements in sleep quality, suggesting an indirect pathway to mood regulation that may help explain the favorable post-intervention distributions we observed for depression and the absence of stress cases in the intervention arm.²⁷ Use of the DASS-21 to categorize depression and stress is methodologically consistent with validated applications in intervention research.²⁹

For anxiety categories, the control group moved from 8.3% mild and 4.2% moderate anxiety at pre-test to 17.0% moderate anxiety at post-test. In the intervention group, pre-test distributions were 22.7% mild, 31.8% moderate, and 4.5% severe; at post-test, these improved to 9.1% mild, 22.7% moderate, and 0% severe. Overall, categorical shifts favored the intervention group and were consistent with the continuous-score trends. The pattern is coherent with evidence that honey and broader polyphenol exposures may exert mood-modulating effects—with clearer signals on depressive symptomatology than on anxiety or stress—while still yielding small, often non-significant changes in the latter domains.^{24–26} Improvements in sleep associated with milk–honey mixtures offer a plausible complementary pathway for anxiety reduction and overall affect regulation.²⁷ Our categorization approach using the DASS-21 aligns with validated practice for monitoring intervention-related change.²⁹

Honey treatment is an effective method for overcoming depression in the respondents. These findings reinforce the conclusions of previously conducted studies on honey treatments that helped treat depression. This study found novelty regarding the effectiveness of honey treatment in college students, in contrast to previous research that found the effectiveness of honey treatment in overcoming depression in experimental animals. and in the elderly.^{30–37}

The Depression Anxiety Stress Scale (DASS-21) was employed in this study because it is a standardized instrument with proven validity and reliability across diverse populations. One of its main strengths is its ability to assess depression, anxiety, and stress simultaneously within a single framework. Nevertheless, it should be noted that the DASS-21 is not a clinical diagnostic tool, and further validation on larger samples is recommended to strengthen the generalizability of the findings.

Limitations of the Study

While the results are promising, several limitations—including the small sample size, absence of blinding, and short duration of intervention—restrict the generalizability of the findings. Nonetheless, this research contributes valuable preliminary evidence for the role of natural dietary supplementation in mental health interventions.

CONCLUSION

This study demonstrates the potential of honey as an intervention to reduce depressive symptoms among university students with mild to moderate depression. This quasi-experimental study demonstrated that daily oral administration of honey (10 ml) for 10 weeks significantly reduced depression levels among college students compared with the control group. The intervention showed a moderate effect size, supporting honey as a potential complementary approach in managing depressive symptoms within this population.

In practical terms, honey may be integrated as part of student wellness initiatives to provide affordable and accessible support for depression management. However, further randomized controlled trials with larger samples, extended follow-up, and biomarker assessment are necessary to confirm effectiveness, establish long-term benefits, and explore underlying biological mechanisms.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

All authors declared no conflicts of interest.

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