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ORIGINAL RESEARCH

Effect of Multivitamin Supplementation on Fatigue in General Practice Patients

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ABSTRACT
Objective: This study aimed to evaluate the effect of multivitamin supplementation on fatigue reduction in general practice patients. **Methodology:** A randomized controlled trial was conducted with 100 participants aged 16–85 years, who were randomly assigned to either an intervention group receiving multivitamin supplements or a control group receiving a placebo. Data were collected through self-reported fatigue, mood, and stress scales at baseline and after 4 weeks of supplementation. Statistical analysis was performed using paired t-tests and multivariate analysis to assess within-group and between-group differences. **Results:** The findings of this study revealed that multivitamin supplementation led to a significant reduction in fatigue levels among participants in the intervention group compared to the control group. After a 4-week period, the intervention group experienced a notable decrease in fatigue, with an average reduction of 30% ($p < 0.05$), whereas the control group showed only a marginal change. In addition to fatigue reduction, the intervention group also exhibited substantial improvements in mood and stress levels. Mood scores increased by an average of 1.7 points ($p < 0.01$), and stress levels decreased by 1.7 points ($p < 0.05$). The most pronounced benefits were observed in participants with deficiencies in vitamin D, iron, and magnesium, suggesting that individuals with specific micronutrient deficiencies may experience greater relief from fatigue. These results strongly indicate that multivitamin supplementation is an effective intervention for alleviating fatigue and enhancing psychological well-being, particularly in individuals with underlying nutritional deficiencies. **Conclusion:** The study demonstrated that multivitamin supplementation effectively reduced fatigue and improved psychological well-being in general practice patients, particularly those with micronutrient deficiencies. The intervention group showed significant improvements in fatigue levels, mood, and stress compared to the control group, highlighting the potential of multivitamins as a practical and accessible solution for managing fatigue. These findings support the use of multivitamin supplementation as a cost-effective strategy to enhance overall health and quality of life, particularly in individuals with nutrient deficiencies. Further studies are needed to investigate the long-term effects and mechanisms underlying these benefits.
Keywords: Multivitamin supplementation, fatigue, general practice, micronutrient deficiencies, psychological well-being

INTRODUCTION
Fatigue is a pervasive and often debilitating condition, frequently encountered in general practice, where it is reported as a primary or secondary complaint by patients across diverse demographic and clinical profiles. Defined by a persistent sense of exhaustion, diminished energy levels, and reduced motivation, fatigue transcends mere physical tiredness, often impacting psychological well-being and overall quality of life(1). Its nonspecific nature complicates diagnosis and management, necessitating a comprehensive approach that accounts for its multifactorial etiology. This complexity underscores the importance of exploring innovative and evidence-based interventions to address fatigue effectively in clinical settings(2).Among the myriad strategies proposed to combat fatigue, nutritional supplementation has emerged as a widely adopted yet scientifically debated option. Multivitamin supplementation holds significant promise due to its potential to address subclinical deficiencies and optimize physiological functions essential for energy production, immune resilience, and neurological health(3). Micronutrients, such as vitamins and

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minerals, are indispensable for cellular metabolism and homeostasis, and their inadequacyeven at subtle levelscan exacerbate fatigue by impairing metabolic pathways. However, despite the widespread reliance on multivitamins, empirical evidence substantiating their efficacy remains inconclusive, necessitating rigorous investigation(2,3).

General practice patients present a unique opportunity for such exploration. Fatigue in this population often stems from a confluence of factors, including chronic illnesses, psychosocial stressors, poor dietary habits, and sleep disturbances(4). These individuals are particularly vulnerable to micronutrient insufficiencies, which may amplify fatigue symptoms and hinder recovery. While prior research has examined the role of specific nutrients in alleviating fatigue, the effectiveness of comprehensive multivitamin regimens in real-world clinical contexts remains underexplored, particularly in the nuanced environment of primary care(5).The physiological mechanisms underpinning fatigue provide a compelling rationale for investigating multivitamin supplementation(6). Vitamins such as B-complex, C, and D, alongside minerals like magnesium and iron, are pivotal in energy metabolism and cellular function. For example, B vitamins serve as coenzymes in ATP production, the body's primary energy currency, while vitamin D deficiencies have been linked to muscle fatigue and reduced physical performance(7). Iron, critical for oxygen transport, and magnesium, essential for enzymatic activity, further underscore the interplay between micronutrient status and fatigue. Addressing these deficiencies through supplementation could offer a targeted and biologically plausible solution to mitigating fatigue symptoms(8).

In addition to physiological factors, the psychological dimensions of fatigue warrant consideration. Chronic stress, anxiety, and depressive symptoms often co-occur with fatigue, creating a bidirectional relationship that amplifies the burden on patients(9). Nutritional deficiencies can exacerbate these psychological stressors by impairing neurotransmitter synthesis and brain function. Evidence suggests that multivitamins enriched with folate, vitamin B6, and magnesium may enhance mood and reduce stress, offering an ancillary benefit in addressing the psychological underpinnings of fatigue(10). Some studies have demonstrated improvements in energy levels and overall well-being, others have reported negligible effects, raising questions about individual variability, placebo responses, and methodological limitations. These discrepancies underscore the urgent need for robust, well-designed clinical trials to evaluate the real-world impact of multivitamins on fatigue, particularly in populations served by general practitioners(11).

This study aimed to address this gap by investigating the effects of multivitamin supplementation on fatigue levels in general practice patients. By employing a rigorous methodological framework, this research aims to provide evidence-based insights into the role of multivitamins in alleviating fatigue.

Objective

To evaluate the effectiveness of multivitamin supplementation in reducing fatigue levels among general practice patients.

Aim

The aim of this study is to evaluate the effect of multivitamin supplementation on fatigue levels among patients in general practice settings, with the goal of determining its efficacy as a potential therapeutic intervention for alleviating fatigue.

Methodology

This study utilized a randomized controlled trial (RCT) design to assess the impact of multivitamin supplementation on fatigue levels. The target population comprised adult patients who had presented with self-reported fatigue in general practice settings. Participants were recruited based on predefined inclusion criteria, which included adults aged 18–65 years experiencing persistent fatigue for at least four weeks, while individuals with known chronic illnesses or those already using nutritional supplements were excluded. A sample of 100 participantswas stratified into two groups: an intervention group that received daily multivitamin supplementation and a control group that received a placebo. Fatigue levels were measured at baseline and at designated follow-up intervals using validated self-report fatigue scales, ensuring a robust and comprehensive evaluation of the intervention's efficacy.

Inclusion Criteria

Participants were included in the study based on specific criteria designed to ensure the relevance and reliability of the findings. Eligible individuals were adults aged 18 to 85 years who had experienced persistent fatigue for a minimum duration of four weeks prior to enrolment. Participants were required to demonstrate the ability to provide informed consent and to complete self-report fatigue assessments accurately. Only those who were not undergoing any concurrent nutritional supplementation or treatment specifically targeting fatigue were considered. Furthermore, individuals with no history of severe chronic illnesses, such as autoimmune diseases, cancer, or advanced cardiovascular conditions, were included to minimize confounding variables and ensure the focus remained on fatigue within a general practice population.

Exclusion Criteria

The following criteria were used to exclude patients from the study:

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- Individuals diagnosed with severe chronic conditions such as autoimmune disorders, cancer, advanced cardiovascular diseases, or renal failure were excluded to avoid confounding variables.
- Current Supplementation: Participants already taking multivitamins, nutritional supplements, or fatigue-specific treatments at the time of enrolment were not eligible.
- Those with diagnosed psychiatric conditions, including major depressive disorder or generalized anxiety disorder, that could independently contribute to fatigue were excluded.
- Women who were pregnant or breastfeeding were excluded to account for the unique physiological demands during these periods.
- Individuals with a history of alcohol or drug abuse, which could influence fatigue levels, were not included.
- Participants who were unable to provide informed consent or complete self-report assessments due to cognitive or language barriers were excluded.

Data Collection

Data were collected at two distinct time points: baseline and post-intervention. At the outset of the study, participants completed a comprehensive demographic and health questionnaire to gather relevant background information, including age, medical history, and lifestyle factors. Fatigue levels were assessed using validated self-report scales, such as the Fatigue Severity Scale or the Visual Analog Scale for Fatigue, to ensure reliable and consistent measurement of fatigue severity. Participants in both the intervention and control groups were monitored throughout the study, with follow-up assessments conducted after the intervention period to evaluate any changes in fatigue levels. Additionally, adherence to the multivitamin or placebo regimen was tracked through self-report logs and periodic checks. Data were then analyzed to assess the effectiveness of multivitamin supplementation in reducing fatigue and to explore any potential correlations with demographic or health-related factors.

Data Analysis

Data were analyzed using appropriate statistical methods to evaluate the effectiveness of multivitamin supplementation on fatigue reduction. Descriptive statistics were first employed to summarize demographic characteristics and baseline fatigue scores of participants in both the intervention and control groups. Changes in fatigue levels from baseline to post-intervention were assessed using pairedt-tests for within-group comparisons and independent t-tests for between-group comparisons. To further explore potential confounding factors, multivariate analysis was conducted, adjusting for variables such as age, gender, and baseline health conditions. Additionally, the adherence rate to the supplementation regimen was incorporated into the analysis to assess its potential impact on outcomes. Statistical significance was set at $p < 0.05$, and all analyses were performed using SPSS. The results were interpreted to determine whether multivitamin supplementation had a statistically significant effect on reducing fatigue levels compared to the placebo.

RESULTS

Table 1 presented the demographic characteristics of the study participants, categorized by intervention and control groups. The mean age of participants in the intervention group was 45.2 years (SD = 12.3), while the control group had a mean age of 46.1 years (SD = 11.9), with no significant difference between the two groups. The age range for both groups spanned from 16 to 85 years, ensuring a diverse sample. The gender distribution was relatively balanced, with 60% of the intervention group and 64% of the control group being female. Body mass index (BMI) was also recorded, with the intervention group having a mean BMI of 25.4 (SD = 4.5) and the control group slightly lower at 24.9 (SD = 4.2). The baseline fatigue score, measured using a validated fatigue scale, was similar for both groups, with the intervention group reporting a mean score of 7.4 (SD = 1.2) and the control group a mean score of 7.5 (SD = 1.3), indicating comparable levels of fatigue at the start of the study.

Table 1: Demographic Characteristics of Participants

Characteristic	Intervention Group (n=50)	Control Group (n=50)	Total (n=100)
Age (Mean ± SD)	45.2 ± 12.3	46.1 ± 11.9	45.6 ± 12.1
Gender			
Male	20 (40%)	18 (36%)	38 (38%)
Female	30 (60%)	32 (64%)	62 (62%)
Age Range	16–85	16–85	16–85
BMI (Mean ± SD)	25.4 ± 4.5	24.9 ± 4.2	25.1 ± 4.3
Baseline Fatigue Score (Mean ± SD)	7.4 ± 1.2	7.5 ± 1.3	7.45 ± 1.25

Table 2 displayed the changes in fatigue severity scores from baseline to post-intervention for both the intervention and control groups. At baseline, the mean fatigue score for both groups was high, with the intervention group reporting a mean score of 7.4 (SD = 1.2) and the control group a mean score of 7.5 (SD

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= 1.3). After the intervention period, the intervention group demonstrated a significant reduction in fatigue, with a mean score of 5.2 (SD = 1.1), representing a mean change of -2.2 (SD = 1.3). In contrast, the control group showed only a minimal decrease in fatigue, with a post-intervention score of 7.3 (SD = 1.2) and a mean change of -0.2 (SD = 0.8). Statistical analysis confirmed that the intervention group experienced a significantly greater reduction in fatigue (p = 0.001), while the control group showed no significant change (p = 0.45). These results indicated that multivitamin supplementation had a substantial effect on reducing fatigue levels in the intervention group compared to the placebo.

Table 2: Fatigue Severity Scores at Baseline and Post-Intervention

Group	Baseline Fatigue Score (Mean ± SD)	Post-Intervention Fatigue Score (Mean ± SD)	Change in Fatigue Score (Mean ± SD)	p-value
Intervention Group	7.4 ± 1.2	5.2 ± 1.1	-2.2 ± 1.3	0.001
Control Group	7.5 ± 1.3	7.3 ± 1.2	-0.2 ± 0.8	0.45
Total	7.45 ± 1.25	6.25 ± 1.15	-1.2 ± 1.1	0.001

Table 3 summarized the adherence rates to the supplementation regimen for both the intervention and control groups. The intervention group exhibited a high adherence rate of 92%, with only 8% of participants reporting non-adherence during the study. Similarly, the control group had a 90% adherence rate, with 10% of participants not fully adhering to the placebo regimen. These adherence rates were relatively high, suggesting that the participants in both groups were committed to the study protocol, which is crucial for ensuring the validity of the results. The slight difference in adherence rates between the two groups did not appear to significantly impact the overall findings, as both groups demonstrated similar levels of compliance.

Table 3: Adherence to Supplementation Regimen

Group	Adherence Rate (%)	Non-Adherence Rate (%)
Intervention Group	92%	8%
Control Group	90%	10%
Total	91%	9%

The results revealed that participants in all age groups who received multivitamin supplementation showed a significant reduction in fatigue compared to those in the control group. In the 16–30 age group, the intervention group experienced a mean change of -2.3 (SD = 1.1), while the control group showed only a slight change of -0.1 (SD = 0.6), with a significant difference between the groups (p = 0.001). Similar patterns were observed in the 31–45 and 46–60 age groups, where the intervention group showed a more pronounced reduction in fatigue compared to the control group, with p-values of 0.002 and 0.004, respectively. In the 61–75 age group, the reduction in fatigue was still notable but less pronounced, with a mean change of -1.9 (SD = 1.1) in the intervention group compared to -0.4 (SD = 0.9) in the control group (p = 0.05). In the 76–85 age group, the fatigue reduction was less significant, with a mean change of -1.8 (SD = 1.0) in the intervention group and -0.3 (SD = 0.8) in the control group (p = 0.07). These findings suggested that multivitamin supplementation was effective in reducing fatigue across various age groups, with the greatest effects observed in younger participants.

Table 4: Fatigue Reduction by Age Group

Age Group (Years)	Intervention Group (Mean Change in Fatigue Score)	Control Group (Mean Change in Fatigue Score)	p-value
16–30	-2.3 ± 1.1	-0.1 ± 0.6	0.001
31–45	-2.1 ± 1.3	-0.3 ± 0.7	0.002
46–60	-2.0 ± 1.2	-0.2 ± 0.8	0.004
61–75	-1.9 ± 1.1	-0.4 ± 0.9	0.05
76–85	-1.8 ± 1.0	-0.3 ± 0.8	0.07

Table 5 provided insights into the psychological well-being of participants, specifically mood and stress levels, before and after the intervention. In the intervention group, there was a significant improvement in both mood and stress scores. The baseline mood score was 5.6 (SD = 1.4), which increased to 7.3 (SD = 1.2) post-intervention, representing a significant improvement (p = 0.001). Similarly, the baseline stress score was 6.5 (SD = 1.3), which decreased to 4.8 (SD = 1.1) post-intervention, with a significant reduction in stress (p = 0.002). In contrast, the control group showed minimal changes in both mood and stress levels. The baseline mood score was 5.7 (SD = 1.5), which increased slightly to

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5.9 (SD = 1.4) post-intervention (p = 0.45), and the baseline stress score was 6.6 (SD = 1.4), which only slightly decreased to 6.4 (SD = 1.3) (p = 0.35). These results suggested that multivitamin supplementation not only reduced fatigue but also had a positive impact on mood and stress levels, providing a holistic benefit to participants in the intervention group.

Table 5: Psychological Well-Being (Mood and Stress) Pre- and Post-Intervention

Group	Baseline Mood Score (Mean ± SD)	Post-Intervention Mood Score (Mean ± SD)	Baseline Stress Score (Mean ± SD)	Post-Intervention Stress Score (Mean ± SD)	p-value (Mood)	p-value (Stress)
Intervention Group	5.6 ± 1.4	7.3 ± 1.2	6.5 ± 1.3	4.8 ± 1.1	0.001	0.002
Control Group	5.7 ± 1.5	5.9 ± 1.4	6.6 ± 1.4	6.4 ± 1.3	0.45	0.35

Table 6 explored the relationship between specific micronutrient deficiencies and fatigue reduction in both the intervention and control groups. The results indicated that participants with micronutrient deficiencies, particularly in vitamin D, iron, and magnesium, experienced more significant reductions in fatigue when receiving multivitamin supplementation. In the intervention group, those with vitamin D deficiency showed a mean change in fatigue of -2.4 (SD = 1.2), compared to -0.1 (SD = 0.6) in the control group (p = 0.001). Similarly, participants with iron and magnesium deficiencies in the intervention group showed greater reductions in fatigue (-2.2 ± 1.3 and -2.1 ± 1.1, respectively) compared to the control group (-0.3 ± 0.8 and -0.2 ± 0.7, respectively), with p-values of 0.002 and 0.003. Participants without any micronutrient deficiencies in the intervention group experienced a smaller reduction in fatigue (-1.8 ± 1.0), although still greater than the control group (-0.4 ± 0.8), with a p-value of 0.05. These findings suggested that multivitamin supplementation was particularly effective in reducing fatigue among participants with specific micronutrient deficiencies, highlighting the importance of addressing nutritional gaps in fatigue management.

Table 6: Relationship Between Fatigue Reduction and Micronutrient Deficiencies

Micronutrient Deficiency	Fatigue Reduction in Intervention Group (Mean ± SD)	Fatigue Reduction in Control Group (Mean ± SD)	p-value
Vitamin D Deficiency	-2.4 ± 1.2	-0.1 ± 0.6	0.001
Iron Deficiency	-2.2 ± 1.3	-0.3 ± 0.8	0.002
Magnesium Deficiency	-2.1 ± 1.1	-0.2 ± 0.7	0.003
No Deficiency	-1.8 ± 1.0	-0.4 ± 0.8	0.05

DISCUSSION

The findings of this study underscore the potential of multivitamin supplementation as a viable intervention for alleviating fatigue among general practice patients. A significant reduction in fatigue levels was observed in the intervention group, which was supplemented with multivitamins, compared to the control group that received a placebo. At baseline, both groups exhibited comparable fatigue scores, indicating no pre-existing differences in fatigue severity. However, post-intervention results revealed a marked decrease in fatigue within the intervention group, with minimal change in the control group. This highlights the efficacy of multivitamin supplementation in managing fatigue, particularly in individuals with underlying micronutrient deficiencies. These findings align with previous researchby Tielsch et al., which has also demonstrated that micronutrient supplementation can lead to improvements in fatigue and overall energy levels (12).

The study sample was diverse, encompassing participants aged 16 to 85 years, with a balanced gender distribution. This diversity is critical for enhancing the external validity of the findings, as it ensures that the results are applicable across a broad demographic spectrum. Age-related analysis revealed that the reduction in fatigue was more pronounced in younger participants, particularly those aged 16–30 years, which mirrors findings from similar studies. For example, a study by Soofi et al., found that younger individuals tend to experience more significant improvements in fatigue following supplementation due to their higher metabolic rates and better nutrient absorption(13). Nevertheless, even older participants (aged 76–85 years) in the intervention group experienced a meaningful reduction in fatigue, albeit to a lesser extent. This suggests that multivitamin supplementation can benefit individuals across the lifespan, albeit with varying degrees of effectiveness.

Adherence to the supplementation regimen was remarkably high, with 92% of the intervention group and 90% of the control group maintaining full compliance throughout the study. This level of adherence is noteworthy, as it ensures that the observed effects were not confounded by non-

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compliance, thereby enhancing the reliability of the study's conclusions. High adherence rates have been linked to more robust outcomes in clinical trials, as noted by Zlotkin et al.,emphasized the importance of participant commitment in clinical nutrition research. The high adherence in both groups suggests that participants were motivated to follow the study protocol, further validating the observed results(14).

In addition to the reduction in fatigue, the study also found significant improvements in psychological well-being, specifically in mood and stress, among participants in the intervention group. Post-intervention, the intervention group exhibited substantial improvements in both mood and stress scores, while the control group showed negligible changes. These findings are consistent with the literature, which suggests that micronutrient supplementation can have a positive impact on psychological health. A study by Varma et al., found that individuals with low micronutrient intake, particularly vitamins B12 and D, experienced heightened levels of anxiety and depression, which were alleviated following supplementation(15). The improvements in mood and stress in the current study may be attributed to the broader physiological benefits of multivitamins, including enhanced immune function and better regulation of energy metabolism, which could mitigate the psychological burden of fatigue.

The relationship between micronutrient deficiencies and fatigue reduction was a particularly compelling aspect of the study. Participants with deficiencies in vitamin D, iron, and magnesium demonstrated the most significant improvements in fatigue following supplementation. This finding aligns with research that has highlighted the role of specific micronutrients in the regulation of energy levels. For instance, a study by Machado et al., demonstrated that vitamin D deficiency was strongly correlated with fatigue, and supplementation led to marked improvements in energy levels(16). Similarly, iron deficiency has long been associated with fatigue, and studies such as that by Gill et al., have shown that iron supplementation can significantly reduce fatigue in individuals with low iron stores(17). The results of this study further emphasize the importance of addressing micronutrient deficiencies in the management of fatigue, suggesting that targeted supplementation may be particularly beneficial for individuals with specific nutrient gaps.

Despite the strengths of this study, several limitations should be acknowledged. The use of self-reported measures for fatigue, mood, and stress introduces the potential for bias, as participants may be influenced by their expectations or social desirability in reporting outcomes. Future studies could benefit from incorporating objective measures of fatigue, such as biomarkers or performance-based assessments, to validate the self-reported data. Additionally, the study did not account for other lifestyle factors, such as physical activity levels, sleep quality, or underlying medical conditions, which could also contribute to fatigue. For example, previous research by Fernald et al., has demonstrated that physical activity plays a crucial role in fatigue management, and future studies could explore the interaction between physical activity, nutrition, and fatigue(18).

The intervention group showed substantial improvements in fatigue, mood, and stress compared to the control group, highlighting the potential of multivitamins as a cost-effective and accessible intervention for managing fatigue. These findings are consistent with previous studies that have reported the benefits of micronutrient supplementation in alleviating fatigue and improving mental health(2,4,13). Future research should investigate the long-term effects of multivitamin supplementation, explore the mechanisms underlying these benefits, and assess the impact of supplementation on other health outcomes, such as immune function and cognitive performance.

CONCLUSION

The findings of this study demonstrated that multivitamin supplementation significantly reduced fatigue and improved psychological well-being in general practice patients, particularly those with micronutrient deficiencies. The intervention group experienced a marked reduction in fatigue, mood improvement, and decreased stress levels compared to the control group, highlighting the effectiveness of multivitamins as a practical and accessible intervention for managing fatigue. These results corroborated previous research that suggested the beneficial role of micronutrient supplementation in alleviating fatigue and enhancing mental health. Despite certain limitations, such as reliance on self-reported measures, the study's outcomes underscored the potential of multivitamin supplementation as a cost-effective strategy to improve quality of life, particularly for individuals with nutritional deficiencies. Further research is needed to explore the long-term effects and underlying mechanisms of multivitamin supplementation on fatigue and other health outcomes.

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