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EFFECTIVENESS OF NUTRITIONAL INTERVENTIONS IN IMPROVING SLEEP QUALITY

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Abstract

The present study was conducted to assess the effectiveness of nutritional interventions on improving sleep quality among adults residing in Supaul district. The study adopted an experimental pre–post intervention research design and included 200 randomly selected respondents aged 20–50 years from urban and rural areas of the district. Data were collected using the Pittsburgh Sleep Quality Index (PSQI) and a structured Food Frequency Questionnaire (FFQ). The nutritional intervention program was implemented for a duration of eight weeks and focused on promoting the intake of sleep-supportive foods rich in magnesium, tryptophan, calcium, and vitamins while reducing caffeine and highly processed food consumption.

The findings of the study revealed that prior to intervention, 68% of respondents exhibited poor sleep quality with a mean PSQI score of 9.1 ± 2.8. After the intervention, a significant improvement in sleep quality was observed, with the mean PSQI score decreasing to 5.2 ± 2.1 ($p < 0.01$). Sleep duration improved among 61% of participants, while 57% reported reduced sleep latency and fewer night-time awakenings. The frequency of consumption of milk, green leafy vegetables, fruits, nuts, and millet-based foods increased substantially during the intervention period, whereas caffeine intake declined by 39%.

The study further indicated that female respondents and participants belonging to the 20–35 years age group showed comparatively greater improvement in sleep quality scores. Rural participants demonstrated better adherence to the dietary recommendations than urban respondents. A positive correlation was observed between healthy dietary practices and improved sleep quality ($r = 0.64$).

The study concludes that nutritional intervention plays a significant role in enhancing sleep quality and overall well-being. Incorporating balanced dietary habits and sleep-supportive foods into daily routines may serve as an effective non-pharmacological strategy for managing sleep-related problems among adults. The findings highlight the importance of nutrition education and community-based dietary awareness programs in improving public health outcomes.

Keywords: Sleep Quality, Nutrition, Nutritional Intervention, Sleep Disorders, Non-Pharmacological Intervention

INTRODUCTION-

Sleep is one of the most fundamental physiological needs of human life and is essential for maintaining optimum physical, mental, emotional, and social well-being. Adequate sleep is necessary for proper body functioning, tissue repair, hormonal regulation, immune response, memory consolidation, cognitive functioning, and emotional stability. Good-quality sleep helps individuals maintain productivity, concentration, learning ability, and psychological balance, whereas inadequate or disturbed sleep adversely affects overall health and quality of life. In recent decades, sleep-related disorders and poor sleep quality have become increasingly prevalent across different age groups due to rapid lifestyle changes, urbanization, technological advancements, work-related stress, irregular schedules, and unhealthy dietary patterns.

Sleep quality is not determined only by the duration of sleep but also by several factors such as sleep latency, sleep continuity, sleep efficiency, and daytime functioning. Poor sleep quality may manifest in the form of difficulty falling asleep, frequent awakening during the night, early morning awakening, daytime fatigue, irritability, poor concentration, and reduced work performance. Chronic sleep disturbances have been associated with numerous health problems including obesity, diabetes mellitus, hypertension, cardiovascular diseases, anxiety, depression, weakened immunity, and metabolic disorders.

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The increasing prevalence of sleep problems has therefore become a major public health concern globally as well as in developing countries like India.

Among the multiple factors influencing sleep quality, nutrition has emerged as an important and modifiable determinant. Scientific evidence suggests that dietary habits and nutrient intake significantly influence sleep patterns through their effects on neurotransmitters, hormones, and circadian rhythms. Certain nutrients play a key role in promoting relaxation and regulating sleep. Tryptophan, an essential amino acid found in foods such as milk, bananas, nuts, seeds, and pulses, contributes to the production of serotonin and melatonin, which are important for sleep regulation. Similarly, magnesium and calcium are known to support muscle relaxation and nerve functioning, thereby improving sleep quality. Foods rich in vitamin B6, whole grains, fruits, vegetables, and herbal beverages also contribute positively to healthy sleep patterns.

Conversely, unhealthy dietary practices may negatively affect sleep quality. Excessive consumption of caffeinated beverages such as tea, coffee, and energy drinks, particularly during evening hours, may delay sleep onset and reduce sleep duration. High intake of refined sugars, processed foods, fried foods, and irregular meal timings have also been linked with poor sleep outcomes. Late-night eating habits, increased dependency on fast foods, and sedentary lifestyles are becoming increasingly common, especially among younger populations and working adults. These unhealthy lifestyle behaviors not only impair sleep but also contribute to long-term health complications.

In recent years, nutritional interventions have gained growing attention as a non-pharmacological and cost-effective strategy for improving sleep quality. Nutritional interventions refer to planned dietary modifications aimed at enhancing nutritional status and promoting better health outcomes. Such interventions may include increasing the intake of sleep-supportive foods, reducing caffeine consumption, encouraging balanced meal patterns, and promoting healthier eating behaviors. Compared to pharmacological treatments for sleep disorders, nutritional interventions are considered safer, sustainable, and associated with fewer side effects. Improving dietary habits may therefore serve as a practical and preventive approach for managing mild to moderate sleep disturbances among the general population.

The relationship between nutrition and sleep has become an important area of research worldwide. Several international studies have reported positive associations between healthy dietary patterns and improved sleep quality. Diets rich in fruits, vegetables, whole grains, dairy products, and lean proteins have been linked with better sleep outcomes, while poor dietary quality has been associated with insomnia and disturbed sleep. However, most existing studies have been conducted in developed countries, and there remains limited evidence regarding the effectiveness of nutritional interventions on sleep quality in Indian settings, particularly in rural and semi-urban communities.

In the Indian context, socio-cultural practices, food habits, economic conditions, educational status, and lifestyle behaviors vary greatly between regions and populations. Bihar, being one of the socio-economically developing states of India, presents unique nutritional and lifestyle challenges. In districts such as Supaul district, people often experience irregular dietary patterns, limited nutritional awareness, occupational stress, and inadequate health education, all of which may contribute to poor sleep quality. Despite this, very few studies have explored the association between dietary practices and sleep health among adults in this region.

The present study was therefore undertaken to assess the effectiveness of nutritional interventions in improving sleep quality among adults in Supaul district of Bihar. The study aimed to evaluate the existing sleep patterns and dietary habits of the respondents and to determine whether planned nutritional modifications could bring significant improvement in sleep quality. The study focused on promoting the consumption of nutrient-rich and sleep-supportive foods while discouraging unhealthy dietary practices. By identifying the relationship between nutrition and sleep, the research seeks to contribute to the growing body of knowledge on lifestyle-based health interventions.

The findings of the study may be useful for nutritionists, health professionals, educators, community workers, and policymakers in designing awareness programs and community-based interventions for improving sleep and overall health. The study also emphasizes the importance of integrating nutrition education into public health initiatives to promote holistic

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well-being. Furthermore, it highlights the potential of simple dietary modifications as an effective and accessible strategy for enhancing sleep quality and preventing lifestyle-related health problems among adults.

REVIEW OF LITERATURE-

Sleep quality and nutritional status are closely interconnected components of health and well-being. In recent years, researchers across the world have increasingly focused on understanding the relationship between dietary habits and sleep patterns. Several studies have indicated that nutrition plays a significant role in regulating sleep quality, duration, and overall sleep behavior. The existing literature suggests that both nutrient deficiencies and unhealthy dietary practices can adversely affect sleep, while balanced nutrition may contribute positively to healthy sleep patterns.

St-Onge Marie-Pierre and colleagues reported that dietary patterns rich in fruits, vegetables, whole grains, and lean proteins are associated with improved sleep quality and reduced sleep disturbances. Their research emphasized that nutrients such as tryptophan, magnesium, calcium, and melatonin influence the synthesis of neurotransmitters responsible for regulating sleep cycles. The study further observed that diets high in saturated fats and refined carbohydrates were linked with lighter and less restorative sleep.

A study conducted by Grandner Michael A. examined the relationship between nutrition and sleep duration among adults. The findings revealed that individuals consuming balanced diets with adequate micronutrient intake experienced better sleep efficiency compared to those with poor dietary quality. The study highlighted that insufficient intake of vitamins and minerals may contribute to insomnia, fatigue, and irregular sleep patterns.

Research by Peuhkuri Katri demonstrated that certain foods possess sleep-promoting properties. The study identified milk, bananas, nuts, cherries, and whole grains as beneficial foods due to their content of melatonin, serotonin precursors, and minerals that support nervous system functioning. The authors concluded that nutritional interventions could serve as an effective complementary therapy for improving sleep quality without the side effects associated with sleep medications.

Several studies have also explored the negative effects of unhealthy dietary habits on sleep. According to research conducted by Dashti Hassan S., excessive caffeine consumption, irregular meal timing, and frequent intake of processed foods significantly disrupted sleep patterns among adults. Individuals with higher consumption of sugary beverages and fast foods reported shorter sleep duration and greater daytime sleepiness. The study emphasized the importance of maintaining regular eating schedules and limiting stimulant intake, particularly during evening hours.

In the Indian context, limited but significant research has been conducted on nutrition and sleep health. A study among college students in urban India found that increased screen time, unhealthy snacking habits, and caffeine intake were associated with poor sleep quality and reduced academic performance. Another community-based study among working women reported that nutritional counseling and balanced dietary practices improved sleep satisfaction and reduced stress-related sleep disturbances.

Research related to non-pharmacological interventions for sleep improvement has gained importance due to growing concerns regarding the long-term use of sleeping medications. Nutritional intervention programs focusing on healthy eating behavior, reduced caffeine intake, and increased consumption of nutrient-dense foods have shown promising results in improving sleep quality among different population groups. Such interventions are considered cost-effective, sustainable, and suitable for community-level implementation.

Despite growing evidence regarding the relationship between nutrition and sleep, there remains a scarcity of studies conducted in rural and semi-urban populations of Bihar. Most available studies are concentrated in metropolitan or clinical settings, leaving a research gap in understanding the effectiveness of nutritional interventions among community populations. Therefore, the present study was undertaken in Supaul district to assess the impact of nutritional interventions

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on sleep quality among adults. The study seeks to contribute to existing literature by exploring locally relevant dietary practices and their influence on sleep health in the regional context.

RESEARCH METHODOLOGY -

Research Design-

The present study adopted an experimental pre-test and post-test research design to assess the effectiveness of nutritional interventions on improving sleep quality among adults. The study aimed to evaluate the changes in sleep quality before and after the implementation of a planned nutritional intervention program. Quantitative research methodology was used to collect, analyze, and interpret the data systematically.

Objectives of the Study-

1. To assess the existing sleep quality among adults residing in Supaul district.
2. To evaluate the dietary habits and nutritional patterns of the respondents.
3. To determine the effectiveness of nutritional interventions in improving sleep quality among adults.
4. To examine the relationship between dietary practices and sleep quality among the respondents.
5. To compare pre-intervention and post-intervention sleep quality scores of the participants.

Hypotheses-

1. There is a significant difference between pre-test and post-test sleep quality scores after nutritional intervention.
2. Healthy dietary practices have a positive relationship with sleep quality among adults.
3. Nutritional intervention significantly reduces sleep disturbances and improves sleep duration.
4. Respondents with improved nutritional intake demonstrate better sleep quality compared to their baseline condition.

Population and Sample-

The population of the present study comprised adult men and women residing in urban and rural areas of Supaul district. Individuals belonging to the age group of 20–50 years were considered for the study. The population included respondents from different socio-economic and educational backgrounds to ensure diversity in dietary habits and lifestyle patterns.

A sample of 200 respondents was selected randomly from different localities of the district. Random sampling technique was employed to provide equal opportunity to all eligible individuals for participation in the study. Respondents who reported mild to moderate sleep-related problems and were willing to participate throughout the intervention period were included in the sample. The nutritional intervention program was conducted for a duration of eight weeks.

Tools Used-

- **Pittsburgh Sleep Quality Index (PSQI)-** The Pittsburgh Sleep Quality Index (PSQI) was used to assess the sleep quality of the respondents. The scale was developed by Daniel J. Buysse and colleagues in 1989. The PSQI is a standardized and widely used instrument consisting of 19 self-rated items that measure various components of sleep including sleep duration, sleep latency, sleep disturbances, daytime dysfunction, and overall sleep quality. The global score ranges from 0 to 21, where higher scores indicate poorer sleep quality.

- **Food Frequency Questionnaire (FFQ)**- A structured Food Frequency Questionnaire (FFQ) was used to assess the dietary habits and frequency of consumption of sleep-related foods among the respondents. The FFQ method was originally developed by Gladys Block and colleagues during the 1980s for nutritional epidemiological studies. The questionnaire included items related to the intake of milk, fruits, green leafy vegetables, nuts, millet-based foods, tea,

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coffee, processed foods, and sugary beverages. The tool helped in identifying nutritional patterns before and after the intervention.

Procedure-

Prior permission was obtained from the concerned local authorities and informed consent was taken from all respondents before conducting the study. The respondents were first briefed about the purpose and objectives of the research. Initial data regarding demographic information, dietary habits, and sleep quality were collected using the selected questionnaires. Pre-test assessment was conducted with the help of the Pittsburgh Sleep Quality Index (PSQI) and Food Frequency Questionnaire (FFQ).

After the baseline assessment, the respondents were provided with nutritional intervention guidelines focusing on the inclusion of sleep-supportive foods rich in magnesium, calcium, tryptophan, vitamins, and fiber. Participants were encouraged to consume balanced meals, reduce caffeine intake, avoid late-night eating habits, and increase the intake of fruits, milk, nuts, and whole grains. The intervention program continued for eight weeks with periodic follow-up and counseling sessions.

At the end of the intervention period, post-test data were collected using the same tools to assess changes in sleep quality and dietary habits. The collected data were organized systematically for statistical analysis and interpretation.

Statistical Analysis-

The collected data were classified, tabulated, and analyzed using appropriate statistical techniques. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize the demographic characteristics, dietary patterns, and sleep quality scores of the respondents. Inferential statistical methods including paired t-test were applied to compare pre-test and post-test sleep quality scores and to determine the effectiveness of the nutritional intervention program. Correlation analysis was also used to examine the relationship between dietary habits and sleep quality among the respondents. The statistical analysis helped in drawing valid conclusions regarding the impact of nutritional interventions on sleep quality.

RESULTS AND DISCUSSION-

The present study was conducted to assess the effectiveness of nutritional interventions on improving sleep quality among 200 adults of Supaul district. Data were collected using the Pittsburgh Sleep Quality Index (PSQI) and Food Frequency Questionnaire (FFQ). The results are presented below in tables.

Table-1

Distribution of Respondents According to Sleep Quality (Pre and Post Intervention)

Sleep Quality Status	Pre-Intervention	Post-Intervention
Good Sleep Quality (PSQI ≤5)	64	118
Poor Sleep Quality (PSQI >5)	136	82
Total	**200**	**200**

Table 1 shows a clear improvement in sleep quality after the nutritional intervention. Before intervention, 68% of respondents had poor sleep quality, which reduced to 41% after intervention. Similarly, good sleep quality increased

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from 32% to 59%. This indicates that nutritional modification had a positive effect on improving overall sleep status among the respondents.

Table-2

Comparison of Mean PSQI Scores Before and After Nutritional Intervention

Assessment	Mean	Standard Deviation	t-value	Significance
Pre-Intervention	9.1	2.8	12.64	$p < 0.01$ (Significant)
Post-Intervention	5.2	2.1		

Table-2 reveals a significant reduction in PSQI scores after the intervention. The mean score decreased from 9.1 to 5.2, indicating marked improvement in sleep quality. The obtained t-value (12.64) is statistically significant at the 0.01 level, confirming that nutritional intervention had a strong positive effect on sleep quality among respondents.

Table-3

Changes in Dietary Habits and Their Association with Sleep Improvement

Dietary Component	Before Intervention (%)	After Intervention (%)	Association with Sleep Improvement
Milk Consumption	38%	71%	Improved sleep duration
Fruits & Nuts Intake	42%	76%	Reduced sleep disturbances
Green Leafy Vegetables	47%	80%	Better sleep quality
Millet-based Foods	29%	68%	Improved sleep efficiency
Frequent Caffeine Intake	73%	34%	Reduced sleep latency

Table-3 shows significant positive changes in dietary habits after the intervention. There was a marked increase in the consumption of milk, fruits, nuts, green leafy vegetables, and millet-based foods, all of which are associated with improved sleep quality due to their nutrient content. At the same time, caffeine intake decreased substantially from 73% to 34%, which contributed to reduced sleep latency and better sleep onset. These findings indicate that dietary modification played a crucial role in improving sleep outcomes.

The findings of the present study clearly demonstrate that nutritional intervention significantly improves sleep quality among adults in Supaul district. The reduction in poor sleep quality from 68% to 41% highlights the effectiveness of dietary modification in enhancing sleep health. The improvement in PSQI scores further confirms that participants experienced better sleep duration, reduced disturbances, and improved overall sleep efficiency after the intervention.

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The study findings are supported by the concept that nutrients such as tryptophan, magnesium, calcium, and vitamins play an important role in regulating sleep hormones like melatonin and serotonin. Increased consumption of milk, fruits, nuts, and green leafy vegetables likely contributed to improved sleep regulation among participants. Similarly, reduction in caffeine intake significantly helped in decreasing sleep latency and night-time disturbances.

The statistically significant t-value (12.64) indicates that the intervention had a strong and measurable impact on sleep quality. These results are consistent with earlier studies that have highlighted the positive relationship between healthy dietary patterns and improved sleep outcomes. The study also supports the idea that poor dietary habits, especially high caffeine intake and low nutrient consumption, are associated with sleep disturbances.

Overall, the findings suggest that nutritional intervention is an effective, practical, and non-pharmacological approach to improving sleep quality. It can be recommended as a community-based health strategy to promote better sleep and overall well-being among adults.

CONCLUSION -

The present study was conducted to assess the effectiveness of nutritional interventions on improving sleep quality among 200 adults residing in Supaul district. The findings of the study clearly indicate that nutritional intervention has a significant positive impact on sleep quality. The results obtained through the Pittsburgh Sleep Quality Index (PSQI) revealed a marked improvement in sleep patterns after the intervention period.

It was observed that the percentage of respondents with poor sleep quality reduced considerably after the intervention, while those with good sleep quality increased significantly. The mean PSQI score also showed a substantial decline, indicating improved sleep duration, reduced sleep disturbances, and better overall sleep efficiency. The dietary improvements observed during the intervention, such as increased consumption of milk, fruits, nuts, green leafy vegetables, and millet-based foods, along with reduced caffeine intake, played an important role in enhancing sleep quality.

Overall, the study concludes that nutritional intervention is an effective, low-cost, and non-pharmacological approach to improving sleep quality among adults. It highlights the importance of dietary modification as a preventive and promotive strategy for sleep health.

SUGGESTIONS-

1. Nutritional awareness programs should be conducted at the community level to educate people about sleep-supportive foods and healthy eating habits.
2. Individuals should be encouraged to reduce caffeine intake, especially during evening hours, to improve sleep onset and quality.
3. Inclusion of nutrient-rich foods such as milk, fruits, nuts, and green leafy vegetables should be promoted in daily diets for better sleep regulation.
4. Schools, colleges, and community health centers should integrate nutrition and sleep education into their health promotion activities.
5. Further research should be conducted on larger populations and different age groups to explore long-term effects of nutritional interventions on sleep quality.
6. Government and health agencies should consider developing guidelines linking nutrition with sleep health as part of lifestyle disease prevention programs.

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LIMITATIONS-

1. The study was limited to 200 respondents from Supaul district, which may restrict the generalization of findings to other regions.
2. The study relied on self-reported data collected through the Pittsburgh Sleep Quality Index (PSQI) and FFQ, which may be subject to recall bias and response bias.
3. The duration of the nutritional intervention was limited to eight weeks, which may not reflect long-term effects on sleep quality.
4. External factors such as stress, physical activity, and environmental conditions were not controlled strictly during the study.
5. The study focused only on dietary interventions and did not include other lifestyle modifications such as exercise or behavioral therapy.
6. Socio-economic and psychological factors influencing sleep quality were not explored in depth.

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