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The Effect Of Nutritional Therapy And Supplements On Immune Status And Energy Levels In People Living With Hiv/Aids Undergoing Antiretroviral Therapy

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ABSTRACT

HIV/AIDS remains a global health challenge, particularly in maintaining the quality of life for People Living with HIV/AIDS (PLWHA) undergoing antiretroviral therapy (ARV). Side effects of ARVs, such as fatigue, metabolic disorders, and loss of appetite, often disrupt the nutritional status, immunity, and energy levels of PLWHA. Nutritional therapy and supplements offer a potential solution to improve physical conditions and strengthen the immune system. This study aims to analyze the effect of nutritional therapy and supplements on the immune status and energy levels of PLWHA undergoing ARV therapy. A quantitative experimental study with a pre-test and post-test design was conducted, involving 30 PLWHA who participated in an 8-week intervention of nutritional and supplement therapy. The findings revealed a significant increase in CD4 counts, with an average rise of 65 cells/µL. Additionally , subjective energy levels improved from 2.4 to 3.8, indicating enhanced vitality and daily activity performance. These improvements also supported better adherence to ARV therapy among participants. Nutritional therapy and supplements positively affect the immunity and energy levels of PLWHA, providing a complementary approach that enhances the effectiveness of ARV therapy compared to previous methods focusing solely on medication. Integrating nutritional therapy into HIV/AIDS healthcare services and providing.

Keywords: HIV/AIDS, PLWHA, Antiretroviral Therapy, Nutritional Therapy, Supplements, Immune Status, Energy

1. INTRODUCTION

HIV/AIDS is a global health problem that continues to be a serious concern, especially in maintaining the quality of life of people with HIV/AIDS (PLWHA). Based on the UNAIDS report (2023), more than 39 million people in the world are living with HIV, with more than 1.5 million new infections occurring each year. Antiretroviral therapy (ARV) has become the main solution in the management of HIV/AIDS with high effectiveness in suppressing the development of the virus and extending the life expectancy of PLWHA. However, this therapy also has side effects, such as fatigue, metabolic disorders, and decreased appetite which can interfere with the nutritional status, immunity, and energy of PLWHA. This challenge becomes even more complex when associated with the social stigma and economic constraints often experienced by PLWHA, especially in developing countries like Indonesia.

In Indonesia, ARV therapy has been available in many health services, but there are still gaps in the integration of nutritional approaches. Many health services only focus on ARV distribution without adequate nutritional interventions, although research shows that nutrition and supplements play an important role in supporting immune function and energy in PLWHA. Previous studies have proven the effectiveness of various nutritional interventions. Tang et al. (2015) found that providing protein, vitamin B complex, and zinc can increase CD4 levels and reduce the risk of opportunistic infections. Meanwhile, Molassiotis et al. (2018) reported that omega-3 can reduce fatigue and increase vitality in PLWHA. However, in Indonesia, research integrating nutritional interventions in HIV/AIDS services is still limited.

Kediri City is a relevant location for this study because the prevalence of HIV/AIDS continues to increase in this area, where most PLWHA come from lower-middle economic groups. This study offers a solution in the form of integrating nutritional therapy and supplements into the management of HIV/AIDS, including providing balanced nutritious food and supplements such as vitamin D, B complex, zinc, and probiotics. This intervention is expected to improve the immune and energy status of PLWHA, which can directly improve their quality of life.

This study aims to fill the gap in previous research by providing empirical evidence on the effects of nutritional therapy and supplements on PLWHA undergoing ARV therapy. Different from previous studies that were generally conducted abroad or on a limited scale in Indonesia, this study offers a holistic approach that integrates nutritional interventions with HIV/AIDS medical therapy. With a quantitative experimental design using a pre-test and post-test approach, this study involved 30 PLWHA undergoing ARV therapy for at least six months. The intervention was carried out for eight weeks by monitoring changes in CD4 levels and subjective energy levels before and after the intervention.

The purpose of this study was to analyze the effect of nutritional therapy and supplements on the immune and energy status of PLWHA, evaluate the changes that occur, and provide scientific evidence that can support the development of more integrated HIV/AIDS health services. With this contribution, this study is expected to provide innovative solutions to improve the quality of life of PLWHA, especially in Indonesia, as well as being the basis for more holistic and sustainable health policies.

2. METHODS

This study used a **quantitative experimental design** with a **pre-test and post-test approach** . This design was chosen to measure the effect of nutritional therapy and supplements on the immune and energy status of people with HIV/AIDS (PLWHA) undergoing antiretroviral (ARV) therapy. The pre-test and post-test design allows researchers to evaluate changes in the dependent variable before and after the intervention is carried out.

The population in this study were PLWHA undergoing ARV therapy at one of the HIV/AIDS referral clinics in Kediri City. A total of 30 PLWHA were selected as samples using **purposive sampling techniques** based on the inclusion and exclusion criteria that had been set. The inclusion criteria included PLWHA who had undergone ARV therapy for at least six months, aged between 18 and 50 years, and were willing to participate in the intervention program and laboratory examination. Meanwhile, the exclusion criteria included PLWHA who were inconsistent in consuming ARVs or had severe comorbid diseases that could affect the results of the study.

This study was conducted in four main stages, namely participant recruitment, initial measurement (pre-test), intervention implementation, and final measurement (post-test). At the recruitment stage, participants who met the criteria were given information regarding the purpose of the study, intervention methods, and written consent (informed consent). Furthermore, at the pre-test stage, CD4 levels were examined using flow cytometry-based laboratory analysis and a subjective energy questionnaire based on a Likert scale was filled out to assess participants' daily energy levels.

The intervention phase was conducted for eight weeks, involving the provision of a balanced nutritious diet adapted to WHO guidelines for PLWHA, as well as daily supplements including vitamin D (1000 IU), vitamin B complex (50 mg), zinc (20 mg), and probiotics (5 billion CFU). Monitoring was conducted every two weeks to evaluate participant compliance in following the intervention program and to identify potential side effects. Participant compliance was recorded by health workers based on daily reports of food and supplement consumption.

In the post-test stage, re-measurements were performed for CD4 levels and energy levels using the same method as in the pre-test stage. The data obtained were then analyzed using statistical tests to determine the significance of the changes that occurred. Data normality tests were performed using the Shapiro-Wilk Test to ensure data distribution, followed by the **Paired T-Test** for normally distributed data or **the Wilcoxon Signed-Rank Test** for non-normally distributed data.

The success of the study was assessed based on three main indicators: significant increase in CD4 levels, increase in subjective energy scores, and a level of participant compliance reaching at least 80% during the intervention period. In addition, a table of the composition of nutrients and supplements used in the intervention is presented to facilitate future replication of the study.

The method used in this study was designed to produce valid and reliable data, so that it can support the implementation of nutritional therapy and supplements as an integral part of HIV/AIDS management. Thus, this study not only offers scientific contributions but also provides a basis for the development of more holistic and integrated health services for PLWHA.

3. RESULTS

Respondent Description

This study involved 30 PLWHA undergoing ARV therapy at one of the HIV/AIDS referral clinics in Kediri City. Respondent characteristics include:

- **Gender:** 60% male (18 people) and 40% female (12 people).
- **Age:** The majority are aged 25–45 years, with an average age of 36 years.
- **Duration of ARV Therapy:** 70% of respondents have undergone ARV therapy for more than 1 year, and 30% between 6 months to 1 year.
- **Initial Nutritional Status:** 80% of respondents had good nutritional status, while 20% were malnourished.

Pre-Test and Post-Test Results

CD4 Levels Before and After Intervention

CD4 level measurement was conducted to assess the immune status of respondents before and after the eight-week intervention. Table 1 shows the increase in CD4 levels after the intervention.

Table 1. Comparison of CD4 Levels Before and After Intervention

Variables	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	Change	p-Value
CD4 level (cells/µL)	310 ± 25	375 ± 30	+65	< 0.05

The results of the analysis showed a significant increase in CD4 levels with an average increase of 65 cells/µL ($p < 0.05$).

Energy Levels Before and After Intervention

Energy level measurement was conducted using a subjective energy questionnaire based on a Likert scale (1-5). Energy scores increased significantly after the intervention. The pre-test and post-test results are shown in Table 2.

Table 2. Comparison of Subjective Energy Levels Before and After Intervention

Variables	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	Change	p-Value
Subjective Energy Score	2.4 ± 0.6	3.8 ± 0.5	+1.4	< 0.05

Subjective energy scores increased from 2.4 (low category) to 3.8 (moderate category), indicating a significant increase in vitality ($p < 0.05$).

Improving Immune Status through Nutritional Therapy and Supplements

The results showed that the provision of nutritional therapy and supplements for eight weeks resulted in a significant increase in respondents' CD4 levels, with an average increase of 65 cells/µL ($p < 0.05$). CD4 levels are a key indicator in assessing the immune status of PLWHA, where increased CD4 levels indicate improvements in immune function that are important in fighting opportunistic infections.

This increase is in line with the research of **Tang et al. (2015)** which stated that micronutrient supplementation such as zinc and vitamin D contributed significantly to strengthening the immune system. Zinc is known to play a role in the regeneration of immune cells, while vitamin D increases the response of T cells to pathogens. Another study by **Batterham et al. (2016)** also highlighted the role of probiotics in reducing systemic inflammation, which can help improve the immunity of PLWHA. In the context of this study, the combination of macro and micro nutrients, as well as probiotic supplementation, was shown to be effective in increasing immunity, although the duration of the intervention was relatively short.

In addition, these findings demonstrate the importance of nutritional intervention in supporting the success of ARV therapy. ARV therapy is indeed effective in suppressing viral replication, but side effects such as metabolic disorders can reduce immune function if not accompanied

by adequate nutrition. Therefore, nutritional therapy is a very important complement in the management of HIV/AIDS.

Increased Energy Levels and Vitality

Subjective energy scores of respondents increased from 2.4 to 3.8 ($p < 0.05$) after the intervention. This increase indicates that respondents felt more energetic, were better able to carry out daily activities, and experienced a reduction in fatigue which is a common complaint of PLWHA.

This increase in energy is consistent with the results of research **by Molassiotis et al. (2018)** , which states that omega-3 plays an important role in reducing chronic fatigue through anti-inflammatory mechanisms. In addition, the vitamin B complex given in this study supports energy metabolism by converting carbohydrates, proteins, and fats into energy that can be used by the body. Previous studies have also shown that probiotics not only improve digestive health but also increase nutrient absorption, thereby contributing to increased overall energy (**Berger et al., 2017**).

The success of this intervention also reflects the importance of respondent compliance with the nutritional therapy and supplement program. Regular monitoring during the intervention succeeded in ensuring a high level of compliance, reaching 90%, so that the positive effects of the intervention could be realized optimally.

The Relationship between Immunity and Energy

The simultaneous increase in CD4 levels and energy scores suggests a positive relationship between immune status and energy in PLWHA. When immunity increases, the body becomes more effective in fighting inflammation and infection, which are often the main causes of fatigue in PLWHA. **Rahayu et al.'s (2020) study** in Indonesia found a similar pattern, where improvements in immunity were directly proportional to increases in subjective energy.

This suggests that a holistic approach, including immunological management and nutritional support, is essential to improving the quality of life of PLWHA. With better immunity, the body is better able to utilize energy from nutritional intake, thus increasing vitality.

Comparison with Previous Research

The results of this study support the findings of several previous studies, both nationally and internationally. Research by **Tang et al. (2015)** and **Berger et al. (2017)** showed that zinc, vitamin D, and probiotic supplementation contributed to increased immunity and reduced fatigue. However, this study offers a unique contribution in the Indonesian context, especially in Kediri City, by highlighting the importance of integrating nutritional therapy into HIV/AIDS services that have so far focused more on ARV distribution.

This study also showed faster results compared to other studies, with an intervention duration of only eight weeks. This shows the great potential of the combination of macronutrients, micronutrients, and probiotic supplements in supporting the recovery of PLWHA health.

Practical and Clinical Implications

This research has several practical implications:

1. **Integration of Nutrition in HIV/AIDS Services:** These results indicate the need for integration of nutrition and supplement programs in HIV/AIDS management in health facilities, to support the success of ARV therapy.
2. **Community-Based Support:** Community-based approaches can help ensure PLHIV access to nutritious food and supplements, especially in areas with economic constraints.
3. **Nutrition Education:** Health workers need to be trained to provide

appropriate nutritional recommendations for PLHIV, as part of holistic health services.

Research Limitations

This study has several limitations, including:

1. **Limited Intervention Duration:** Eight weeks is sufficient to show significant changes, but a longer duration may be needed to evaluate long-term impact.
2. **Limited Sample:** This study involved 30 respondents, so the results cannot be generalized to a wider population.
3. **External Factors:** Factors such as stress levels and physical activity of respondents were not fully controlled, which may have influenced the results of the study.

This study shows that nutritional therapy and supplements significantly improve the immune and energy status of PLWHA undergoing ARV therapy. These findings support the importance of a holistic approach to HIV/AIDS management, which includes medical, nutritional, and social support. With appropriate interventions, the quality of life of PLWHA can be improved, while supporting the overall success of ARV therapy.

4. DISCUSSION

This study aims to analyze the effect of nutritional therapy and supplements on the immune status and energy in PLWHA (People with HIV/AIDS) undergoing antiretroviral (ARV) therapy. The results showed that the eight-week intervention had a significant impact on increasing CD4 levels and energy levels of respondents. An increase in CD4 levels of an average of 65 cells/μL and subjective energy scores from 2.4 to 3.8 indicated that this study had successfully achieved its intended objectives.

The success of this study was supported by several key factors. First, the pre-test and post-test study design ensured that the changes measured could be directly attributed to the intervention. Second, the combination of macro and micro nutrients, including protein, vitamin D, B complex, zinc, and probiotics, was shown to be effective in supporting immune function and improving energy metabolism. Regular monitoring conducted during the intervention also contributed to the high level of participant compliance, reaching 90%, so that the results of the intervention could be maximized.

The results of this study are consistent with previous findings, as reported by Tang et al. (2015), which showed that zinc and vitamin D supplementation supported increased CD4 levels in PLWHA. Another study by Molassiotis et al. (2018) showed that omega-3 supplementation contributed to reducing chronic fatigue in PLWHA. However, this study has advantages in the local context, namely focusing on PLWHA in Kediri City, which has economic constraints and limited access to nutrition. The methods applied also integrate a holistic approach, including providing balanced nutrition and probiotic supplements, which is rarely done in similar studies in Indonesia.

Despite the success of this study, there are some challenges that need to be noted. Not all participants showed significant increases in CD4 counts. This could be due to external factors such as stress levels, sleep quality, or uncontrolled comorbid conditions. Additionally, the eight-week intervention duration may have been too short to show significant changes in some participants, especially those who had very low CD4 counts prior to the intervention.

The work that has not been successfully done is the evaluation of the long-term impact of this nutritional therapy and supplementation. In

addition, this study has not explored the relationship between changes in immune status and energy levels with psychological aspects such as stress or anxiety. These psychological factors are important to consider, considering that mental conditions can affect the physical health of PLWHA.

For further research, several things can be followed up. First, a longer intervention duration is needed to evaluate the long-term impact on immunity and energy of PLWHA. Second, the addition of psychological variables such as stress, anxiety, and quality of life can provide a more comprehensive understanding of the relationship between physical and mental health. Third, research with a larger sample size needs to be conducted to increase the external validity of the results of this study. In addition, the implementation of community-based programs can be a strategic step to expand the impact of this program, especially in areas with limited resources.

5. CONCLUSION

This study successfully demonstrated that nutritional therapy and supplements have a positive effect on improving the immune status and energy in PLWHA undergoing ARV therapy. The findings showed an increase in average CD4 levels of 65 cells/µL and an increase in subjective energy scores from 2.4 to 3.8 after eight weeks of intervention. These results support the importance of integrating nutritional interventions in the management of HIV/AIDS to strengthen the immune system and improve the quality of life of PLWHA.

The success of this study can be attributed to the comprehensively designed method, including balanced nutrition, vitamin D, B complex, zinc, and probiotic supplementation, and regular monitoring to ensure participant compliance. This approach produced significant results in a relatively short period of time. However, the eight-week intervention duration limits the evaluation of the long-term impact of this program. In addition, although the results showed significant improvements, some participants showed lower than average increases in CD4 levels, possibly due to external factors such as stress, sleep patterns, or comorbid conditions that were not measured in this study.

This study has several limitations. First, the limited duration of the intervention makes this study unable to evaluate the long-term impact of nutritional therapy and supplements. Second, the sample size of only 30 people is insufficient to generate generalizable results to a wider population of PLWHA. Third, this study did not measure external variables such as stress or anxiety that could affect the results. Fourth, the focus of the study on physical aspects has not included psychological aspects which are also important in managing HIV/AIDS.

To address these limitations, further research is needed with a longer intervention duration to evaluate the long-term impact of nutritional therapy. Future studies should also include psychological variables such as stress levels, anxiety, and quality of life to gain a more holistic understanding. In addition, research with a larger sample size is needed to increase external validity and provide more representative results. The development of a community-based model that involves social support and education for PLWHA can also help improve the effectiveness and sustainability of the program.

The implications of this study are significant, both in clinical, social, and policy contexts. Clinically, this study shows that the integration of nutritional

therapy and supplements into HIV/AIDS health services can improve the effectiveness of ARV therapy and the quality of life of PLWHA. From a social perspective, education about the importance of nutrition can help reduce the stigma faced by PLWHA and improve their adherence to care. At the policy level, the results of this study support the need to develop nutrition-based programs in holistic and sustainable HIV/AIDS management strategies.

Overall, this study provides an important contribution to understanding the role of nutrition in the management of HIV/AIDS. With appropriate follow-up, these findings could form the basis for the development of more inclusive and patient-centered health services. A combination of medical, nutritional, and social approaches is key to improving the quality of life of PLWHA and ensuring the success of long-term HIV/AIDS management.

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