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Review Article

A comparative review of different diet types to boost innate immunity among HIV-positive children suffering from leukemia

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ABSTRACT

Introduction: HIV impairs the immune system by attacking CD4 cells, a specific type of white blood cell. Most children living with HIV are found in Sub-Saharan Africa, yet this group has a dearth of data on cancer rates. Malignancies are common in children living with HIV, and immunosuppression and oncogenic co-infections are major contributing factors.

Objectives: This review study aims to sort and review the different diet types that may help boost innate immunity among HIV-positive children suffering from leukemia

Research Methods: With the medical topic heading words (MeSH), this review was compiled from articles available without a subscription. HIV-related leukemia, the "inflammatory diet," "immunity-boosting food," and the "HIV diet kinds" were the others. This article only considers publications that have been published and are available online (in open-access databases such as the Directory of Open Access Journals, PubMed, Google Scholar, Semantic Scholar, etc.) between the years 2000 and 2022.

Results: As a result of extensive reviews, some effective diet types have come out to support the article's objective, which is the best dietary approach to prescribe for HIV-induced leukemia. Micronutrient-rich dietary interventions, vitamin A-rich diets, Zinc enriched diet types, Neutropenic diets, Nordic diets, and some traditional Asian diets have been found significant and more effective for long years. The best, most affordable, and most commonly available strategy to maintain good health is to eat more foods that strengthen the immune system.

Conclusions: According to the research, the Indian diet is complete with spices, citrus fruits, certain vegetables, herbal tea, honey, and other traditional foods that can strengthen the immune system. Research into diet and Ayurveda is being prioritized in many countries, including the West, mirroring India's approach.

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1. Introduction

HIV is an infection that weakens the immune system by targeting a subset of white blood cells known as CD4 cells. HIV kills CD4 cells, weakening the immune system against opportunistic diseases like tuberculosis, fungal infections, severe bacterial infections, and certain malignancies like leukemia. Sub-Saharan Africa is where most HIV-positive children worldwide reside; however, there are few cancer statistics for this demographic. Immunosuppression and oncogenic co-infections are associated with many malignancies in children with HIV. Here is Figure 1 shows the epidemic status of children and adolescents below 15 years of age as of 2021, and Figure 2 shows 2.73 million children under 19 years living with HIV globally. [1,2]

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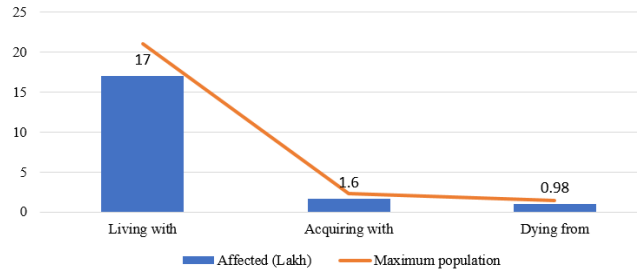

Fig. 1: Summary of the global status of HIV-positive children (below 15 years) as of 2021. (Source: https://www.who.int)

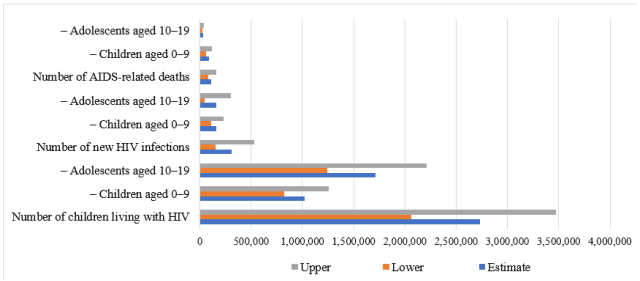

Fig. 2: Children and adolescents living with HIV demonstrated at three levels. (Source: https://data.unicef.org)

2. Research Methods

This review was compiled from a search of open-access literature using medical subject heading words (MeSH) as keywords. These were the "Inflammatory diet," "Immunity boosting food," "HIV diet types," and "HIV-induced leukemia." Only articles were published and are accessible online (in open-access databases like the Directory of Open Access Journals, PubMed, Google Scholar, Semantic Scholar, etc.) between the years 2000 and 2022 considered for this article.

3. Results and Discussion

In this article, theTable 1 shows a complete picture of tentative diet types that are effective for children with HIV and HIV-induced leukemia. The data is insufficient in HIV-induced cancer, particularly HIV-induced leukemia; however, the article tried to show a glimpse of probable dietary approaches already discussed through various published literature.

3.1. HIV transmission (Utero)

Human immunodeficiency virus type 1 does not transmit to most babies born to infected mothers. If a newborn is infected, their infection and response to therapy may progress very differently depending on the infant. HIV infection acquired during pregnancy happens when the immune system matures and is more vulnerable to infection. Transmission of HIV from mother to child (MTCT) occurs most commonly in utero, intrapartum, and through breast milk, accounting for most new pediatric HIV infections. While elevated maternal HIV levels pose the most significant risk of vertical transmission, a rare mutation in the chemokine receptor CCR5 poses the most excellent protection. These findings imply that the relationship between a mother's infectiousness and her child's susceptibility is dynamic and subject to change due to external factors.[3]

3.2. HIV transmission (Intrapartum)

Unfortunately, MTCT through the placenta is the least effective method. Only 5-10% of children become sick despite exposure to the virus for nine months at the maternofetal contact. The blood of HIV-negative babies born to infected mothers contains maternal cells.[4,5]

3.3. HIV transmission (Breast Feeding)

Compared to mixed feeding (i.e., giving infants water, other liquids, and solids), exclusive breastfeeding reduces HIV breast milk transmission by more than 50%. Although it makes sense that HIV exposure would be higher for exclusively breastfed infants, this finding defies logic. It has been known for a long time that in populations not affected by HIV, exclusive breastfeeding results in lower rates of illness and death.[6,7]

The wide variety of components present in breast milk that may either aid or inhibit the spread of HIV is impressive. Most but not all research has found an association between high amounts of pro-inflammatory chemicals and an increased likelihood of transmission. Human milk oligosaccharides, long-chain n-6 polyunsaturated fatty acids, and defensins are also protective in clinical investigations.[8–10]

3.4. HIV-associated malignancies in children

Most children with HIV are found in sub-Saharan Africa, yet there is a lack of information about cancer in this population. Immunosuppression and oncogenic co-infections have been associated with many malignancies in children living with HIV. For this paper, the authors scoured the scientific literature for the latest information on cancer prevention in HIV infection. Vaccinating against Human papillomavirus infection (HPV) strains with a high potential for causing cancer is one way to reduce your chance of developing HPV-related cancer later in life. Questions remain unanswered about the optimal vaccination strategies for children and young women living with HIV before specific guidelines can be developed. Most HIV-infected children in low-income countries begin treatment when immunosuppression is already severe, making it too late to prevent malignancy.[11]

Table 1: The possiblediets applied in HIV-induced leukemia reviewed through various research articles.

S.No.	Types of Diet	Methods	Results	Studies
1	Micronutrient-rich dietary intervention	The purpose of this research was to analyze how well macronutrient intervention works in the treatment of HIV in both children and adults. Selection criteria rated the study quality and extracted data by 3 reviewers—fourteen trials (271 HIV+ children).	Macronutrient formulas were given to ensure energy cum protein and fortification significantly increased energy intake (3 trials; n=131; MD 393 kcal/day; 95%). Protein intake in adults who were losing weight. Clinical, anthropometric, and immunological outcomes in HIV-infected adults and children were not significantly different between the groups who received placebo or amino acid, whey protein concentration, or Spirulina supplementation versus those who received placebo.	Grobler et al 2013 [12]
	Zinc-rich diet	An equivalency trial compares zinc supplementation with a placebo in a randomized, double-blind setting. Each day for six months, 96 children infected with HIV-1 were given either 10 mg of elemental zinc as sulfate or a placebo. The viral load of virus 1 in the plasma was the primary endpoint.	Zinc supplementation reduced the incidence of watery diarrhea in children. Death rates were lower in the zinc supplementation group compared to the placebo group. After zinc supplementation, there was no difference between the groups regarding the mean percentage of CD4+ T cells or the median hemoglobin concentrations.	Bobat et al 2005 [13]
	Vitamin-A supplementation-rich diet	A randomized, double-blind, placebo-controlled clinical trial was done by the study at Mulago Hospital in Kampala, Uganda, which serves the city's urban and semi-urban residents. From the ages of 15 to 36 months, 181 children with HIV were enrolled, and they were randomly assigned to receive vitamin A supplementation, 60 mg of retinol equivalent, or a placebo.	Hospitalizations, bloody stools, fever, and ear discharge were not significantly affected by vitamin A administration. Children administered vitamin A had lower modified point prevalences of chronic diarrhea and a persistent cough. Comparing 94 children (control) to 87 children (vitamin A group), the mortality rates were 20.6% and 32.9%.	Semba et al 2005 [14]
	Mediterranean neutropenic	Protein, fat intake, PG-SGA, and albumin levels were also considered when assessing nutritional status.	The nutritional status of patients in the intervention group improved more after the intervention than in the control group. After the study, the average serum albumin level of the study group was higher than it had been at the beginning of the study.	Jalali, et al 2018 [15]

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Table 1 continued

Traditional Mediterranean diet	On a scale from 0 (very little) to 9 (very strict), the authors graded how closely subjects followed the classic MD's central tenets to determine their adherence level.	The correlation between a 2-point rise in the score and a 12% percent increase in cancer incidence was found (adjusted hazard ratio, 0.88). This link strengthened in females and increased with exposure. These negative correlations with MD adherence were significantly more robust than those anticipated from correlations between the diet's constituent parts.	Benetou et al. 2008 [16]
Neutropenic Vs. Regular diet	A meta-analysis to see if ND lowered mortality and infection rates among cancer patients. There were four studies totaling 918 patients were found. A random effects model was utilized to determine the total impact.	The ND group had a more significant hazard ratio for the overall composite outcome of infection or fever (relative risk = 1.18, confidence interval: 1.05 to 1.34, P= 0.007). Each group had a similar aggregate outcome when only RCTs were included.	Sonbol et al. 2015 [17]
Diet based on diet diversity score (DDS) and food variety score (FVS).	Dietitians' ability to assess a patient's nutrient needs during chemotherapy treatment was facilitated by a comprehensive understanding of the patient's diet diversity score (DDS) and food variety score (FVS). It could also provide hints that scores helped formulate a healthy eating plan. A total of 63 patients included	After undergoing chemotherapy, all individuals with AML and ALL reported dramatically reduced total calorie intake. Before and after induction, patients had similar daily energy intakes of 1379 and 1411 kcal. The average protein consumption was 63 g/DRI before chemotherapy was induced and then dropped to 46.0 g/DRI after that.	Malihi et al., 2015 [18]
Nordic Diet (ND)	An investigational diet (ND as control diet) cereals with low fiber, milk products, visible fat, and some berries and fish) was given to 88 patients with metabolic syndrome.	TNF-receptor superfamily member 1A was reduced in the intervention group after 18-24 weeks, whereas the expression of the NF-kappaB subunit RELA proto-oncogene was increased.	Ulvenet et al,2019 [19]
Washoku -The traditional Japanese diet	CRP cum IL-6 levels were slightly lower in those who followed a Japanese diet. After two weeks on the Japanese diet, the HbA1c levels of those following the diet were lower than those of the control group.	Reduced inflammation was accompanied by reduced volatile fatty acid (VFA) levels.	Sakane et al., 2019 [20]

Acquired immune deficiency syndrome (AIDS) is the result of an untreated HIV infection, and the severe impairment of the immune system that results in an increased the person's risk of developing cancer. Improvements in these patients' therapeutic regimens, which can include anything from a single course of chemotherapy or antiretroviral medication to a stem cell transplant, are still the subject of active investigation.[21]

3.5. Leukemia links with HIV

Acute myeloid leukemia (AML) is a cancer of the WBC, i.e., white blood cells, and its exact incidence in individuals with HIV infection (PLWH) is unknown. Patients who are newly infected with HIV and are treated with anti-retroviral therapy (ART) have a longer life expectancy than before. Stem cell transplantation and other rigorous chemotherapeutic strategies should now be considered suitable for patients with a well-controlled HIV infection during ART.[22]

3.6. Asian diet types

Chinese and Japanese traditional diets have been popular due to their anti-inflammatory effect since ancient ages. Obesity, diabetes, cardiovascular disease, and cancer are just some chronic NCDs on the rise. The prevalence of obesity and metabolic syndrome is higher in the north of China but lower in the south. Dietary differences between the two regions have been linked to this distinction.[23] The Japanese diet and lifestyle are among the healthiest and longest-living in the world. The traditional Japanese diet (Washoku) emphasizes a wide variety of fish over red meat and other animal fats. Steaming, boiling, and stewing are the significant cooking ways, and the resulting meals are high in water content and low in fat.[24] Since the industrial revolution, which began 150 years ago, people in developed nations have had unrestricted access to a high-calorie diet. This western diet is pro-inflammatory because the eating pattern is based on excess consumption of red meat or other animal food, refined cereals, sugars, poultry products, dairy products, and artificial drinks. The diet also increases the consumption of salt and low consumption of green vegetables, fresh fruits, grains, fish, dry fruits, and legumes.[25] However,the Indian traditional diet and versatile nature of food are already attractive globally due to their easy availability and interest in acceptability.

3.7. Technology application in lifestyles disorders

As per the latest data from WHO and CDC, children worldwide are remarkably affected by type -I diabetes, apart from viral diseases like Cancer and HIV. Diabetes is a chronic, non-communicable illness that has been a significant public health concern on a global scale for decades. In type-1 diabetes, the pancreas does not create enough insulin; in type-2 diabetes, the body cannot absorb the insulin produced. One study described that despite variable blood sugar records, several machine-learning techniques are typically used for classification, prediction, and detection.[26] Data scientists and epidemiologists are also using machine learning cum deep learning for severe viral diseases like Cancer, HIV/AIDS, etc.

3.8. The right food for innate immunity

Most importantly, diet and nutrition are essential to living happily through sound innate immune systems. The immune system protects the body from pathogens and foreign substances that can invade the body through the skin, tissues, and the fluids (like blood). The immune system is divided into the innate (i.e., general) and adaptive (particular) branches. The innate immune system is the body's primary defense against foreign pathogens. People in underdeveloped nations worry about getting the vital nutrients they need from their daily average main meals, typically funded on a considerably smaller budget than usual due to financial difficulties. The only way to stay healthy is to increase our intake of foods that enhance our immune systems, which are top-in-class, affordable, and widely accessible. The study shows that spices, citrus fruits, some vegetables, herbal tea, honey, and other traditional meals are all that Indian people can boost their immunity.[27] As in India, other countries also focus on food as a medical approach by doing more research on diet and Ayurveda.

3.9. Better ways of survival

Most HIV-related tumors are brought on by oncogenic viruses or other exogenous agents, making them avoidable. Vaccination against human papillomavirus helps protect against malignancies caused by HPV. Due to the high rate of salivary transmission of Kaposi's sarcoma-associated herpesvirus (KSHV), it is possible that behavioral interventions could help lower the virus's prevalence. The danger of infection increases when saliva is used for any sexual activity, even as lubrication. Although ART has helped to increase overall survival and decrease the incidence of AIDS-defining cancers, other cancers have emerged as significant causes of complications and death among those living with HIV infection. However, many issues are still unclear. Answers to these questions will pave the way for innovative strategies in the fight against cancer, affecting over 35 million people worldwide.[28,29] Despite extensive training, education, and expertise in the field, the opinions of dietitians and other medical professionals are routinely disregarded. Based on clinical data, dietitians should be especially vigilant about monitoring to ensure the most significant potential outcome from dietary interventions in HIV/AIDS-associated Cancers.[30]

4. Conclusions

Selective foods that improve the innate immune system are the best, cheapest, and most accessible way to keep society healthy. Dietary therapies rich in micronutrients, such as the Neutropenic, Nordic, and several traditional Asian diets, have been significant and more effective for several years against HIV-induced cancers. Many nations, including the West, prioritize studying the relationship between diet and Ayurveda in this topic, just like India has done.

5. Source of Funding

None

6. Conflict of Interest

None

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