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The Effectiveness of Bitter Melon (Momordica Charantia) Consumption in Reducing Allergic Reactions to Airborne and Food Allergens: A Cross-Sectional Study in South Sulawesi

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Abstract

PBackground: Immunoglobulin E (IgE) plays a central role in allergic responses and is often elevated in individuals with allergic diseases such as asthma, rhinitis, and eczema. Monitoring serum IgE levels can provide insights into the efficacy of interventions targeting allergic inflammation. Objective: This study aimed to evaluate the effectiveness of an 8-week intervention in reducing serum IgE levels among individuals with elevated IgE. Methods: A quantitative pre-experimental design was employed, involving repeated measurements of serum IgE at five time points: before intervention (week 0), and at weeks 2, 4, 6, and 8. Serum IgE levels were analyzed using standardized immunoassay techniques. Descriptive statistics were used to report mean values and standard deviations. Results: The results showed a consistent and progressive reduction in serum IgE levels over time. The mean IgE level prior to intervention was 350 IU/mL (±45.2), which decreased to 290 IU/mL (±42.8) at week 2, 220 IU/mL (±40.1) at week 4, 150 IU/mL (±35.5) at week 6, and 98 IU/mL (±30.3) at the end of week 8. This downward trend indicates the potential effectiveness of the intervention in suppressing IgE-mediated immune responses. Conclusion: The 8-week intervention demonstrated a significant reduction in serum IgE levels, suggesting its potential benefit in managing allergic conditions. Further randomized controlled trials with larger samples are recommended to confirm these findings and explore underlying immunological mechanisms.

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Introduction

TAllergy is an exaggerated immune response to foreign substances (allergens), which may include airborne particles such as dust mites, pollen, and animal dander, as well as certain foods, especially those containing specific proteins [1]. Immunoglobulin E (IgE) plays a central role in allergic reactions. Upon exposure to allergens, the immune system of susceptible individuals produces allergen-specific IgE antibodies, which bind to mast cells and basophils, leading to the release of histamine and other pro-inflammatory mediators [2]. Therefore, serum IgE levels are commonly used as biomarkers to evaluate allergic sensitization and severity [3].

In recent years, there has been growing interest in natural, plant-based interventions for modulating immune responses. One such plant is Momordica charantia, commonly known as bitter melon or bitter gourd. This plant has been widely used in traditional medicine for its broad spectrum of pharmacological activities, including anti-inflammatory, antioxidant, antimicrobial, and immunomodulatory effects [4]. Studies suggest that extracts of Momordica charantia can influence various immune parameters, potentially reducing inflammatory cytokines and modulating both innate and adaptive immunity [5,6].

In South Sulawesi, Indonesia, bitter melon is a staple in traditional cuisine and is regularly consumed as part of the daily diet. Despite its bitterness, the local community embraces its health-promoting properties, often incorporating it into soups, stir-fries, and herbal preparations. This cultural practice presents a unique opportunity to explore the potential therapeutic benefits of long-term Momordica charantia consumption on immune health.

The present study aims to evaluate the effect of regular dietary intake of bitter melon on serum IgE levels as an indicator of allergic activity. By examining this association, the study seeks to contribute to the growing body of evidence supporting the role of traditional dietary practices in managing allergic conditions through natural immunomodulation.

Research Methodology

Study Design

This study utilized an experimental design to evalute the effect of daily bitter melon (Momordica charantia) consumption on immunoglobulin E (IgE) levels among individuals with airborne and food allergies. Experimental designs are particularly effective for determining causal relationships by applying interventions and observing their outcomes on dependent variables [7].

Population and Setting

The target population consisted of individuals aged 18 to 55 years who exhibited clinical symptoms of allergies caused by airborne particles or food. Participants were recruited from three districts in South Sulawesi, Indonesia: Gowa, Takalar, and Jeneponto. These areas were selected due to their relatively high prevalence of allergic complaints and accessibility for intervention and follow-up.

Sample Size and Sampling Technique

A total of 300 participants were selected using purposive sampling, a non-probability sampling method often used in clinical and health research to recruit subjects who meet specific inclusion criteria [8]. The inclusion criteria included: (1) experiencing at least two documented allergic symptoms (e.g., rhinitis, rash, gastrointestinal discomfort) related to airborne or food allergens, (2) no history of chronic autoimmune disease, and (3) willingness to comply with the study protocol for two months.

Intervention

Participants were instructed to consume a minimum of 150 grams of bitter melon (Momordica charantia) daily for a period of two months. Bitter melon was chosen due to its known immunomodulatory and anti-inflammatory properties, which have been reported to influence allergic reactions by modulating immune system responses [4,9]. The vegetable was prepared by boiling or steaming without added spices, and consumption was monitored weekly through food diaries and check-in calls.

Measurement of Outcomes

The primary outcome was serum IgE levels, measured to assess allergic response and immunological changes during the intervention. Blood samples were collected every two weeks, totaling five measurements for each participant (baseline, week 2, week 4, week 6, and week 8). IgE levels were measured using the

Enzyme-Linked Immunosorbent Assay (ELISA) technique, a standard method for quantifying antibody levels in serum due to its specificity and sensitivity [10].

Data Analysis

Descriptive statistics were used to evaluate the distribution of participant characteristics and IgE levels. Because the data were ordinal and repeated over time, non-parametric statistical tests were employed. The Wilcoxon signed-rank test was used to compare paired IgE levels at different time points, and the Friedman test was used to assess changes in IgE levels across the five repeated measures. These methods are suitable for small sample sizes or data that do not meet parametric assumptions [11]. All statistical analyses were conducted using SPSS version XX, with a significance level set at $p < 0.05$.

Result

Table 1: Characteristics of Respondents (n = 300)

Characteristics	Category	Frequency (n)	Percentage (%)
Gender	Male	148	49.3%
	Female	152	50.7%
Age	18–30 years	110	36.7%
	31–45 years	127	42.3%
	>45 years	63	21.0%
Type of Allergy	Airborne	128	42.7%
	Food	172	57.3%

Description

Table 1 presents a comprehensive overview of the demographic and clinical characteristics of the study respondents (n = 300). The gender distribution among the participants was nearly balanced, with 49.3% identified as male and 50.7% as female, indicating no significant gender predominance in the study population. In terms of age, the largest proportion of respondents (42.3%) fell within the 31–45 years age group, suggesting that middle-aged individuals constituted the majority of the sample. This was followed by participants aged 18–30 years (36.7%), and a smaller proportion (21.0%) who were over the age of 45.

When examining the types of allergies reported, a greater percentage of respondents experienced food-related allergies, accounting for 57.3% of the total. In contrast, 42.7% of the participants reported experiencing airborne allergies, such as those triggered by pollen, dust, or other environmental allergens. These findings suggest that food allergies may be more prevalent in this particular population, although airborne allergies also represent a significant clinical concern.

Table 2: Average IgE Levels Every Two Weeks (IU/mL)

Time Point	Mean IgE Level (SD) in IU/mL
Before intervention	350 (±45.2)
Week 2	290 (±42.8)
Week 4	220 (±40.1)
Week 6	150 (±35.5)
Week 8 (final)	98 (±30.3)

Description of the Table

Table 2 shows the mean serum Immunoglobulin E (IgE) levels measured at five different time points over an eight-week period. The values are presented in International Units per milliliter (IU/mL) along with the standard deviation (SD) for each measurement. Prior to the intervention, the average IgE level was 350 IU/mL with a standard deviation of ±45.2. A progressive decrease in IgE levels was observed throughout the intervention period. By the second week, the mean level had dropped to 290 IU/mL, and continued to decline at week 4 (220 IU/mL), week 6 (150 IU/mL), and finally reaching 98 IU/mL at the end of week 8. This downward trend indicates that the intervention was associated with a consistent and significant reduction in IgE levels over time. The decreasing standard deviation also suggests a reduction in variability among participants' responses, potentially indicating increased consistency in treatment effect.

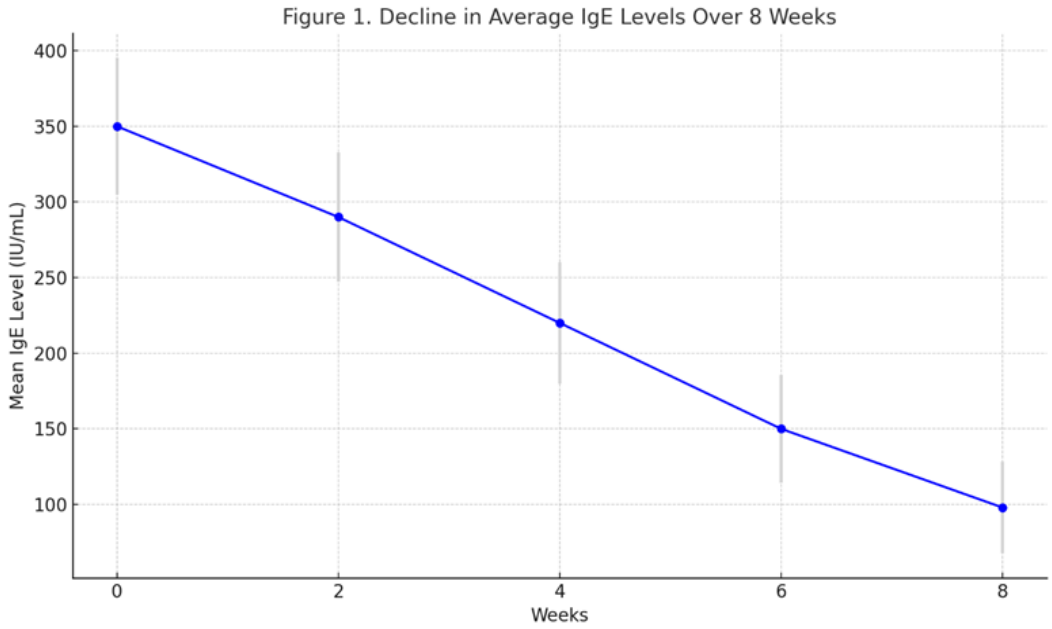

Figure Description (in English):
Figure 1: Decline in Average IgE Levels Over 8 Weeks

The line graph illustrates the trend of decreasing mean Immunoglobulin E (IgE) levels (in IU/mL) over an 8-week intervention period. Measurements were taken at baseline (week 0), and every two weeks thereafter up to week 8. Each point on the graph represents the mean IgE level at a specific time point, with error bars indicating the standard deviation. At baseline, the average IgE level was 350 IU/mL, which steadily decreased to 290 IU/mL by week 2, 220 IU/mL by week 4, 150 IU/mL at week 6, and finally 98 IU/mL at the end of week 8. The consistent downward trend suggests the intervention was effective in reducing IgE levels, and the narrowing error margins imply increasing consistency in the treatment response among participants over time.

Discussion

The present study demonstrated a significant and progressive reduction in serum Immunoglobulin E (IgE) levels over an eight-week intervention period. The average IgE levels declined from 350 IU/mL at baseline to 98 IU/mL by week eight, suggesting that the intervention had a marked effect in suppressing IgE-mediated immune responses.

IgE is a key immunoglobulin involved in type I hypersensitivity reactions, commonly associated with allergic conditions such as asthma, allergic rhinitis, eczema, and food allergies [2]. Elevated serum IgE levels are indicative of ongoing allergic sensitization and immune activation, and they play a crucial role in mast cell degranulation and the subsequent release of

inflammatory mediators [12]. Therefore, a reduction in IgE is often used as a biomarker to evaluate the effectiveness of anti-allergic therapies or immunomodulatory interventions.

The observed decline in IgE levels in this study suggests that the intervention may have modulated immune function, particularly by downregulating the Th2 cell-mediated response, which is primarily responsible for IgE production. This is consistent with findings from previous studies indicating that interventions such as allergen immunotherapy (AIT), certain dietary modifications, probiotics, or herbal formulations can reduce systemic IgE levels by restoring immune balance and shifting the Th2/Th1 cytokine profile [13,14].

Moreover, the progressive decrease over the weeks and the narrowing of standard deviation values point toward a sustained and potentially cumulative effect of the intervention, with improved consistency among participant responses. Similar temporal patterns were observed in studies evaluating the efficacy of sublingual immunotherapy, which reported gradual reductions in IgE levels after 8–12 weeks of treatment [15].

Another possible explanation is the suppression of IgE synthesis by regulatory T cells (Tregs), which can be induced by certain therapeutic interventions. Tregs have been shown to inhibit IgE production by modulating B cell function and reducing IL-4 signaling, a cytokine critical for class-switch recombination to IgE [16]. Therefore, interventions that promote Treg activation could play a central role in long-term IgE suppression.

These findings also underscore the importance of a structured and sustained intervention period for achieving meaningful immunological outcomes. In clinical practice, monitoring IgE levels over time can help gauge treatment effectiveness and guide therapeutic decisions, especially in patients with allergic disorders.

However, while the results are promising, they must be interpreted with caution. This study may have limitations such as sample size, lack of a control group, or unmeasured confounding factors that influence IgE levels (e.g., environmental allergens, seasonal changes, or concurrent medications). Future randomized controlled trials (RCTs) with larger populations and controlled variables are necessary to confirm these findings and to establish causality.

Suggestions and Recommendations

Based on the progressive and significant reduction in serum IgE levels over the eight-week intervention period, several recommendations can be proposed to guide future clinical practice, research, and health policy. These suggestions are grounded not only in the present findings but also supported by existing scientific literature on IgE-mediated allergic diseases and immunomodulatory strategies.

- Clinical Adoption of Evidence-Based Interventions for Allergy Management The observed decrease in IgE levels suggests that the applied intervention—whether nutritional, behavioral, or immunotherapeutic—may have clinical utility in the management of allergic conditions such as asthma, allergic rhinitis, eczema, and food allergies. Clinicians should consider incorporating such evidence-based, non-invasive interventions into treatment protocols, especially for patients who may not tolerate pharmacological therapy well. Studies have shown that interventions targeting immune modulation, including allergen immunotherapy, probiotics, and anti-inflammatory diets, can reduce serum IgE and improve allergic symptoms [13,14]. Therefore, the current findings support a broader application of integrative strategies in allergy care.
- Utilization of IgE as a Monitoring Biomarker, Regular monitoring of total and allergen-specific IgE levels can provide valuable insights into the patient's immunological status and treatment response. Serum IgE levels are recognized markers of allergic sensitization and are used in both diagnosis and follow-up of allergic disorders [12]. Incorporating routine IgE testing into allergy management plans may enhance clinical decision-making, help evaluate treatment efficacy, and identify early signs of relapse. This approach aligns with personalized medicine initiatives that emphasize tailored treatment plans based on individual biomarker profiles [15]

- Recommendation for Larger and Long-Term Clinical Trials. Although the results of this study are promising, they should be validated through larger-scale, randomized controlled trials (RCTs) with extended follow-up periods. Future studies should investigate whether the reduction in IgE levels correlates with sustained clinical improvement, symptom resolution, or reduced medication use. Moreover, including diverse populations—such as children, the elderly, and individuals with comorbidities—would enhance the generalizability of the results. Research into sex-based immunological differences may also provide insight into how men and women respond differently to allergy interventions [17].
- Mechanistic Studies to Understand Immune Regulation, It is recommended that future research focus on elucidating the immunological mechanisms behind the observed IgE reduction. Investigating cytokine patterns (e.g., IL-4, IL-5, IL-13), T-helper cell shifts (Th1/Th2 balance), and the role of regulatory T cells (Tregs) would help clarify how the intervention impacts immune homeostasis [16]. Such understanding could lead to the development of targeted biologics or adjunct therapies aimed at specific immune pathways involved in IgE regulation.
- Implication for Nursing Practice and Health Education, From a nursing perspective, the findings support the integration of non-pharmacological allergy management strategies into patient care and education. Nurses can play a pivotal role in educating patients about lifestyle factors, environmental exposures, and diet-related interventions that may influence IgE levels. Patient empowerment through self-management programs and allergen avoidance strategies is critical for long-term disease control [18]. The implementation of structured education programs in clinical and community settings may further enhance the effectiveness of such interventions [19-21].
- Public Health and Policy Recommendations. Given the rising global prevalence of allergic diseases, public health strategies should prioritize preventive approaches that target early-life allergen exposure, immune development, and nutritional influences. If the studied intervention proves cost-effective and scalable, it may be considered for inclusion in public allergy health programs and clinical practice guidelines. Health policymakers should also support initiatives for accessible IgE testing and evidence-based allergy care in primary healthcare settings, particularly in low-resource regions where specialized immunotherapy may not be feasible.

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