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Integrating Artificial Intelligence into Plant-Based Diet Programs: The Bethsaida Hospital Experience

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Abstract

The convergence of artificial intelligence (AI) and nutritional medicine represents a frontier in the evolution of precision healthcare, offering unprecedented potential to address the global burden of chronic diseases. At Bethsaida Hospital in Indonesia, under the visionary leadership of Prof. Dasaad Mulijono, AI has been seamlessly integrated into a clinically validated Whole Food Plant-Based Diet (WFPBD) program designed not only to prevent but also to reverse prevalent non-communicable diseases such as cardiovascular disease, type 2 diabetes mellitus (T2DM), obesity, hyperlipidaemia, and hypertension. This article delineates the strategic deployment of AI across multiple dimensions of care, including individualized patient education, dynamic menu generation, real-time metabolic monitoring, and intelligent interpretation of laboratory biomarkers. The system enables fully personalized nutritional recommendations tailored to each patient's caloric expenditure, macronutrient balance, micronutrient sufficiency (including protein, omega-3 fatty acids, vitamins, minerals, and fibre), and specific clinical goals. Remarkable clinical improvements have been observed in key biomarkers, including reductions in trimethylamine N-oxide (TMAO), enhanced nitric oxide (NO) bioavailability, and favourable modulation of cholesterol levels, blood glucose, blood pressure, and body mass index (BMI). The integration of AI not only amplifies patient engagement and adherence but also enhances clinical efficiency and scalability. This model illustrates how AI can bridge the gap between scientific knowledge and clinical practice in nutrition, providing a replicable, data-driven framework for sustainable, preventive, and personalized lifestyle medicine globally.

Keywords: Artificial Intelligence; Whole-food plant-based diet; Lifestyle medicine; TMAO; Nitric oxide; Personalized nutrition; Bethsaida Hospital; Prof. Dasaad Mulijono; Metabolic health

Introduction

Chronic non-communicable diseases (NCDs) such as cardiovascular disease, T2DM, obesity, hyperlipidaemia, and hypertension remain the leading causes of morbidity and mortality worldwide [1-6]. These conditions reduce quality of life and place an enormous economic burden on healthcare systems, especially in low- and middle-income countries. Despite decades of pharmacological advancement, the burden of these diseases continues to rise, highlighting the need for more effective, preventive, and sustainable solutions.

A growing body of scientific evidence has established the WFPBD as one

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of the most effective dietary interventions for preventing and reversing chronic diseases [7-82]. WFPBD emphasizes the consumption of unprocessed or minimally processed plant foods including vegetables, fruits, legumes, whole grains, nuts, and seeds—while eliminating or minimizing animal products and ultra-processed foods. This dietary pattern has been associated with reduced systemic inflammation, improved insulin sensitivity, lowered LDL cholesterol, better endothelial function, and favourable gut microbiome modulation. However, despite its robust clinical benefits, the adoption of WFPBD in real-world settings remains limited [83-86].

Implementation challenges include low public awareness, inadequate patient education, lack of individualized nutrition planning, and a medical education system that often underemphasizes nutrition and lifestyle intervention. In addition, clinicians frequently face time constraints, insufficient support tools, and a lack of scalable models for delivering personalized, behaviourally effective nutritional care.

Under Prof. Dasaad Mulijono's leadership, Bethsaida Hospital in Indonesia has pioneered the integration of AI into its dietary and lifestyle medicine programs to address these barriers. The hospital has created a structured, data-driven, and patient-centred ecosystem for delivering WFPBD-based care by leveraging AI's capacity for data processing, behavioural analysis, and predictive modelling. AI tools are employed to automate and personalize patient education, tailor meal plans based on individual metabolic profiles, and continuously monitor and interpret laboratory parameters, including TMAO, NO, blood sugar, and cholesterol levels.

This novel approach has not only improved patient adherence and clinical outcomes but also transformed the role of healthcare providers, enabling them to focus on coaching and decision-making. At the same time, AI handles much of the information management and customization. This article details Bethsaida Hospital's experience in using AI to enhance the reach, precision, and impact of a WFPBD program. It explores its potential as a scalable model for global preventive medicine.

AI-Powered Patient Education

Bethsaida Hospital uses AI-driven platforms to deliver structured educational modules to patients and families. These include:

- Healthy Lifestyle Education: Interactive AI interfaces explain the mechanisms of chronic diseases, the role of diet, and behavioural change strategies.
- Plant-Based Food Guidance: AI chatbots and video tools offer real-time guidance on selecting whole, plant-based foods, avoiding processed products, and interpreting food labels.
- Daily Coaching: AI-based mobile apps offer meal reminders, hydration tracking, and motivational messages personalized to users' behaviour and health metrics.

Personalized Menu Planning and Nutritional Tailoring

AI algorithms process patient-specific data (age, weight, lab results, health status, dietary preferences) to generate tailored plant-based meal plans that meet:

- Calorie Requirements: Based on basal metabolic rate (BMR) and physical activity level.
- Protein Needs: AI calculates plant-based protein targets (e.g., lentils, beans, tofu, tempeh, quinoa), ensuring adequacy (~0.8–1.2 g/kg/day).
- Omega-3 Sources: AI recommends flaxseeds, chia seeds, walnuts, and algae-based supplements.
- Micronutrient Sufficiency: AI highlights sources of essential vitamins and minerals, including vitamin B12, vitamin D, iron, zinc, and calcium.
- Fiber Optimization: Ensures >30g/day intake from legumes, whole grains, fruits, and vegetables.

Patients receive visual menu guides, cooking tutorials, and weekly feedback reports to support adherence.

Interpretation of Laboratory Tests with AI

AI-assisted platforms at Bethsaida interpret and track:

- TMAO: Elevated levels are associated with animal protein intake and cardiovascular risk. The AI monitors trends and provides guidance on dietary modifications.
- NO Levels: AI correlates salivary NO test results with endothelial health and recommends nitrate-rich foods (beets, arugula, spinach).
- Cholesterol: AI flags LDL, HDL, triglyceride and Lp(a) levels and offers evidence-based plant-based interventions.
- Blood Sugar: Tracks fasting glucose and HbA1c, adjusting dietary fibre and meal timing accordingly.
- Blood Pressure: Correlates dietary sodium/potassium ratios and recommends DASH-compatible plant foods.

AI integrates lab data into a patient-friendly dashboard with trend visualizations and alerts.

Clinical Outcomes and Metabolic Improvements

Bethsaida's AI-enhanced plant-based program has demonstrated:

- 30–70% reduction in LDL cholesterol within 3 months
- HbA1c improvement of 1–2 points in type 2 diabetes patients

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- Normalization of blood pressure in stage 1-2 hypertensive patients without pharmacotherapy
- 80% of patients reduced TMAO to low levels within 2 months of WFPBD
- Increased NO bioavailability, correlating with improved endothelial function

These outcomes have positioned the hospital as a national leader in AI-integrated lifestyle medicine.

Future Applications of AI in Medical Nutrition

The potential of AI in this domain is vast, including [87-96]:

- Microbiome Integration: AI gut microbiota analysis to tailor prebiotic and fibre intake.
- Genomic-Nutritional Alignment: Nutrigenomic AI to align plant-based prescriptions with genetic markers.
- Predictive Risk Scoring: AI models to anticipate dietary non-adherence, relapse risk, and future disease onset.
- Virtual Reality Education: Immersive environments to simulate meal planning and lifestyle change.
- Clinical Decision Support: Real-time AI alerts clinicians about patients at risk of complications due to poor diet adherence.

Implementing AI in Clinical Nutrition: Lessons from Bethsaida's WFPBD Model

Bethsaida Hospital's experience under the leadership of Prof. Dasaad Mulijono offers a pioneering model of how AI can bridge the longstanding gap between nutrition science and its practical application in clinical settings. While decades of research have established the preventive and therapeutic value of WFPBD, real-world implementation has been limited by patient adherence, clinician time constraints, and a lack of personalized dietary tools. AI helps overcome these barriers by functioning as a 24/7 virtual assistant scalable, consistent, and evidence-based.

AI empowers patients through continuous, interactive education tailored to their needs, cultural preferences, health status, and learning styles. At Bethsaida, AI tools break down complex nutritional concepts into engaging modules, reducing dependency on scarce human resources. Real-time chatbot support, automated nudges, and visual dashboards enhance patient engagement, enabling sustained behavioural change a critical component in lifestyle medicine.

For clinicians, AI provides valuable decision support. It automates the labour-intensive tasks of calculating caloric needs, protein distribution, and micronutrient adequacy while integrating laboratory data, such as TMAO, NO, cholesterol, glucose, and blood pressure, into actionable insights. This saves time and improves diagnostic precision, particularly in complex cases requiring multidisciplinary input.

A WFPBD is especially well-suited to AI personalization due to its diversity in ingredients, meal combinations, and functional roles (e.g., anti-inflammatory, gut microbiota-enhancing, vasodilatory). AI can identify which plant foods best meet a patient's nutritional goals, balancing macronutrients and optimizing phytochemical intake. This granular level of personalization enhances both effectiveness and patient satisfaction.

However, several challenges must be addressed to ensure the safe, equitable, and ethical expansion of AI in nutrition care. Ensuring data privacy is paramount, particularly as sensitive health information is shared across digital platforms. AI bias remains another concern; algorithms must be trained on diverse, representative datasets to avoid inequitable recommendations. Additionally, clinician training is essential—not to replace human expertise, but to augment it. Healthcare providers must understand how to interpret AI outputs, question its assumptions, and integrate these insights into holistic care plans.

Ultimately, interdisciplinary research and robust policy frameworks are essential to validate AI tools, establish regulatory standards, and support the development of infrastructure. Bethsaida Hospital's model demonstrates what is possible, but its replication at scale requires cooperation between government, academia, private sector innovators, and healthcare institutions.

The Bethsaida model paves the way for a paradigm shift in preventive and therapeutic healthcare by aligning AI capabilities with the science of plant-based nutrition. It represents a leap toward personalized, proactive, and precision medicine that treats the root causes of chronic disease rather than just managing symptoms.

Conclusion

The integration of AI into plant-based dietary interventions at Bethsaida Hospital under the direction of Prof. Dasaad Mulijono has fundamentally reshaped

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how nutrition care is delivered. The hospital has achieved measurable improvements in patient engagement, clinical outcomes, and operational efficiency by leveraging AI to educate patients, personalize dietary planning, and interpret dynamic metabolic biomarkers. These include reduced LDL cholesterol, blood sugar, TMAO levels, blood pressure, and improved NO bioavailability, as well as sustained adherence to WFPBD.

This model is not only effective it is replicable. It provides a framework for other institutions seeking to implement lifestyle medicine in a scalable, resource-efficient manner. Combining AI and WFPBD uniquely enables a data-driven, individualized, and holistic approach to disease prevention and reversal, moving beyond reactive, pharmacological strategies toward proactive and root-cause-based care.

As digital health technologies evolve, AI will become an indispensable ally in delivering sustainable, evidence-based, personalized nutrition therapy. The future holds enormous promise, from real-time risk assessment to genomic-based dietary recommendations. However, success will depend on strategic investment, clinician education, and the establishment of ethical and regulatory guardrails to ensure safety, equity, and trust.

Bethsaida Hospital's initiative exemplifies the future of medicine: one where artificial intelligence and plant-based nutrition converge to empower patients, restore health, and redefine what is possible in chronic disease management.

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