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EXTENDED ABSTRACT

Artificial Intelligence-Driven Personalization for Dietary and Physical Activity Interventions: A Systematic Review of Chatbot Efficacy, Design Characteristics, and Methodological Quality

Akhmal Rizal[1], Razif Sazali[1], Yusandra Md Yusoff[1], Muhammad Zulqarnain[1], Amrun Haziq[1], Aizzat Adnan[1], & Adam Linoby[1*]

[1]*Faculty of Sports Science and Recreation, Universiti Teknologi MARA, Negeri Sembilan Branch, Seremban Campus, Negeri Sembilan, MALAYSIA*

**Corresponding author: linoby@uitm.edu.my*

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I. Introduction

Artificial intelligence chatbots promise scalable, personalized lifestyle coaching, yet evidence for their effectiveness and design quality remains fragmented. Existing reviews focus narrowly on activity, overlook diet and weight endpoints, and report heterogeneous methods that thwart synthesis [1]. This systematic review catalogues chatbot platforms, conversational features, and theory use while appraising impacts on physical activity, diet, and weight and critiquing methodological rigor to inform future standardized interventions [2].

II. Methods

PubMed, Scopus, Ovid, and Web of Science were searched from inception to 10 January 2025. Search strings combined chatbot, artificial intelligence, diet, physical activity, and weight keywords. Reference lists of relevant reviews and trial registries were hand-searched, and citation chaining captured additional records. Only full-text English articles were screened [1].

Adults ≥18 years using AI-driven conversational agents delivering at least two-week interventions targeting diet, activity, or weight were eligible. Acceptable designs included RCTs, cluster RCTs, quasi-experimental studies with controls, and single-arm pre-post trials of ≥ 10 participants. Rule-based bots, disease-only apps, one-way messaging, protocols, abstracts, and non-English reports were excluded.

Two independent reviewers screened titles, abstracts, and full texts, resolved conflicts via discussion, and extracted data. RCTs were assessed with Cochrane RoB 2; quasi-experimental studies with the JBI checklist. GRADE judged certainty. Narrative synthesis summarized chatbot features and efficacy; quantitative effect sizes were tabulated, and sensitivity analyses explored the influence of study quality and measurement method [10].

III. Results and Discussion

A. Study Characteristic

Across nine studies, 872 adults (mean age 34.5 years, range 18.8–56.2) had a mean height of 182.0 cm, weight 73.9 kg (range 64.2–83.6), and BMI 24.4 kg/m² (Table 1). Designs included randomized controlled, quasi-experimental, and single-arm trials over 6–12 weeks (Figure 1). Settings spanned outpatient and community contexts.

B. Chatbot Design Landscape

Nine studies mainly deployed chatbots on Facebook Messenger, Kakao Talk, Telegram, SMS, or Slack-style apps [3]. Successful agents paired natural language processing, wearable integration, friendly tone, goal-setting incentives, and optional human escalation [4]. Features reflected Social Cognitive Self-Determination and Fogg theories, underscoring self-monitoring and motivation as central design principles [5].

C. Physical-Activity Outcomes

Seven trials showed moderate to large improvements in device-measured activity, averaging about four hundred additional daily steps and positive Cohen d values near point seven [4,6]. Outcomes based on self-report were more variable. Greater gains aligned with personalized goal tailoring, high reply frequency, and immediate rewards, suggesting engagement and adaptive feedback amplify movement promotion [6].

D. Diet and Weight Findings

Dietary quality improved in most studies. Mediterranean scores rose, red and processed meat intake fell, and sixty-five percent reached fruit and vegetable targets when food tracking was provided [8,1]. Emotion-sensitive personalized chatbots produced larger changes than generic SMS controls [7]. Weight and Body Mass Index outcomes were seldom reported, leaving long-term efficacy uncertain [1].

E. Methodological Quality Effects

Design descriptions, sample details and primary outcomes were generally clear, yet trials faced small cohort's follow-up limited to twelve weeks, scarce blinding and self-reported diet data [9]. Narrative sensitivity checks indicated that lower bias randomised designs produced slightly smaller effects, though benefit direction remained positive, implying that methodological rigour moderates' magnitude rather than existence [1].

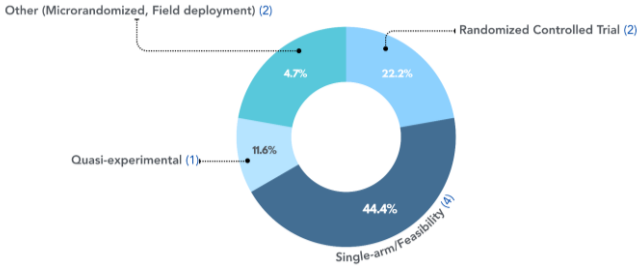

Fig. 1 A donut chart in distinct grey shades that separates Randomized Controlled Trial, Single-arm/Feasibility, and Other designs.

TABLE I
SUBJECT CHARACTERISTICS

Characteristic	Mean	Median	Min	Max
Age (yrs)	34.5	37.8	15.2	56.2
Height (cm)	182.0	182.0	182.0	182.0
Weight (kg)	73.9	83.6	64.2	83.6
BMI (kg/m2)	24.4	24.4	24.4	24.4

Fig. 2 shows an example of an image with country distribution. Check the country distribution to reveal the important detail in the figure.

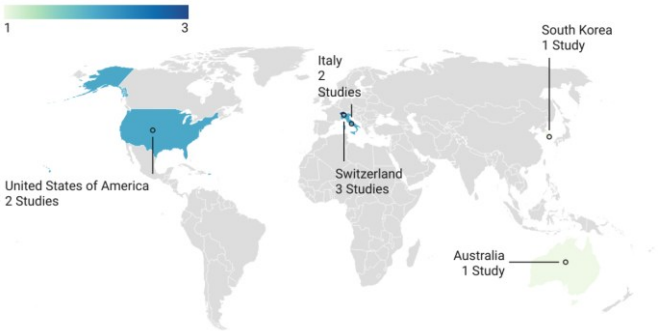

Fig. 2 Map showing the geographic origin of the 9 studies included in this systematic review. Colour intensity reflects the number of studies per country (scale 1–3).

IV. CONCLUSIONS

AI-driven chatbots consistently enhance physical activity and dietary quality via personalized, theory-informed dialogue, yet evidence for sustained weight loss is limited. Standardized reporting and longer, adequately powered trials are required to refine design principles, clarify long-term efficacy, and integrate safety and equity metrics into future lifestyle interventions.

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