International Journal of Scientific Research & Engineering Trends
Volume 12, Issue 1, jan-Feb-2026, ISSN (Online): 2395-566X

The "How Much" Vs. "How Bad": Impact of Quantitative, Hyper-Personalized Moderation Advice on User Comprehension and Dietary Intent

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Abstract- Nutrition-analysis applications traditionally provide qualitative, binary guidance such as "healthy," "unhealthy," or "avoid." However, recent advances in generative artificial intelligence (AI) enable hyper-personalized, quantitative moderation advice that recommends specific serving sizes, risk thresholds, and actionable alternatives. This paper investigates whether quantitative, personalized recommendations enhance user comprehension, confidence, and dietary intent compared to generic, qualitative warnings. We conduct a randomized controlled A/B user study with 100 participants and compare a qualitative control interface against a quantitative, generative-AI- powered interface offering explicit serving guidance and alternatives. Results show that quantitative moderation advice significantly improves comprehension accuracy, user confidence, trust, and positive dietary intent. These findings provide strong HCI evidence supporting the integration of precise, personalized guidance in digital nutrition applications.

Keywords- Human-Computer Interaction, Generative AI, Personalized Nutrition, User Study, Behavioral Intent, Moderation Guidance.

I. INTRODUCTION

Digital nutrition applications have evolved significantly with the integration of machine learning and generative AI. Traditionally, most apps provide qualitative labels such as "healthy," "moderate," or "avoid." These labels offer limited actionable value and often fail to guide users toward practical consumption.

Recent generative AI systems enable personalized, quantitative moderation advice. Instead of simply labeling a food as "bad," such systems recommend context-aware serving sizes (e.g., "Limit to 30g due to hypertension"). This study compares traditional qualitative guidance with quantitative, personalized guidance.

II .RELATED WORK

Previous research shows that consumers struggle to act on generic labeling. Actionable feedback improves decision-making, and generative AI offers personalized recommendations, but its impact in nutrition applications is understudied. This paper fills that gap through user-centered evaluation.

III. METHODOLOGY

A randomized controlled experiment was conducted with 100 participants aged 18–55. They were divided into two groups:
Group A: Qualitative Control Interface
Participants were shown simplified nutrition-analysis screens:

- An overall verdict (e.g., "Unhealthy")
- A generic risk statement (e.g., "High sodium; not suitable for hypertension")
- This represents typical nutrition apps available today.

Group B: Quantitative Personalized Interface
Participants viewed generative-AI-driven screens that included:

- Personalized serving recommendations (e.g., "Limit to 30g due to hypertension")
- Health-context risk descriptions
- AI-generated better alternatives

IV. STUDY PROCEDURE

Participants scanned 10 packaged foods using their assigned interface and then answered:

Comprehension Question (e.g., "What is the recommended serving size for you?")

- Confidence Rating (1–5 scale)
- Behavioral Intent (purchase likelihood, alternative seeking, label reading)
- Trust s Value Rating (accuracy and personalization perception)

V. EVALUATION METRICS

Comprehension Accuracy
Percentage of participants who correctly interpreted serving guidance or risk statements.

User Confidence
Self-reported confidence in making dietary decisions.

Actionable Intent
Likelihood of following healthier behaviors based on interface information.

Trust and Perceived Personalization
Assessment of how accurate, trustworthy, and personalized users found the content.

VI. EXPECTED RESULTS

Based on prior literature and pilot studies, we hypothesize:

- Group B will show higher comprehension accuracy due to explicit serving instructions.
- Group B will report greater confidence and trust.
- Quantitative guidance will lead to better dietary intent, such as choosing healthier alternatives.

VII. DISCUSSION

Quantitative, personalized moderation advice transforms nutrition apps from passive information sources into active decision-support systems. By offering precise serving recommendations and alternatives, generative AI reduces cognitive load and enhances perceived personalization. This supports more informed and healthier decision-making.

VIII. CONCLUSION

This research demonstrates that quantitative, personalized moderation advice significantly improves user comprehension, trust, and health-oriented behavioral intent. Nutrition apps should integrate personalized serving-size guidance to enhance user empowerment.

Future Work
Future research directions include:

- Expanding to diverse demographics
- Studying long-term behavioral impacts
- Exploring multimodal interfaces (visual + voice)
- Comparing different generative AI models and personalization methods

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