



The effect of the 'Stable Sugar Winner' board game on dietary knowledge, attitudes, and behavioral self-efficacy in preventing diabetes among community-dwelling older adults

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ABSTRACT

The purpose of this study was to develop and evaluate the effectiveness of the 'Stable Sugar Winner' board game program in enhancing dietary knowledge, dietary attitudes, and dietary behavioral self-efficacy for diabetes prevention among older adults. This quasi-experimental study involved 49 community-dwelling older adults from two community activity centers. Participants engaged in the 'Stable Sugar Winner' board game program once a week for 90 min, over a 4-week period. The weekly themes were as follows: Week 1 - Types of food and My Healthy Plate; Week 2 - Glycemic index and My Healthy Plate; Week 3 - Dietary calories and My Healthy Plate; Week 4 - My healthy diet pattern. After completing intervention, the older adults had significantly higher mean scores for dietary knowledge, attitudes, and behavioral self-efficacy in preventing diabetes compared to before the intervention. This study can serve as a reference for older adult health promotion.

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Introduction

An estimated 110 million people aged ≥ 70 years had diabetes globally in 2019, with a prevalence of 23.7 % and contributing to 181.9 deaths and 4512.3 disability-adjusted life years (DALYs) per 100,000 population.¹ From 1990 to 2019, the global prevalence of diabetes increased by 39.7 %, while mortality and DALY rates rose by 16.4 % and 22.3 %, respectively. In Taiwan, diabetes is the fifth leading cause of death, with around 2 million individuals currently living with the disease, and the number of people diagnosed with diabetes continues to grow by approximately 25,000 annually.² Older adults with diabetes who do not adhere to a healthy lifestyle have a 2- to 3-fold higher risk of developing physical disabilities compared to their non-diabetic peers. These disabilities are often linked to serious complications such as cardiovascular disease, stroke, chronic kidney disease, retinopathy, and limb amputation. Furthermore, the mortality rate among older adults with diabetes is over 10 % higher than that of the general population.³ Consequently, the prevention of diabetes

and its complications is of paramount importance. While many lifestyle factors such as physical activity and stress management contribute to diabetes control, diet remains the most modifiable and yet most poorly implemented aspect of diabetes care.^{4,5} This study focuses specifically on dietary behavior because it is not only a key determinant of glycemic control, but also an area where older adults often experience significant barriers.

Previous studies have shown that older adults have insufficient dietary knowledge.^{6,7} Knowledge of a healthy diet encompasses understanding various aspects of nutrition and how different types of food, glycemic index (GI), calories, and eating patterns affect one's health.^{8,9} This knowledge is crucial for making informed choices about dietary habits to support overall well-being and prevent chronic diseases.⁵⁻⁸ Increasing a person's knowledge about health can lead to changes in their attitudes towards healthy living, which may ultimately influence their health-related behaviors in a positive way.

In this study, we aimed to design a more effective educational intervention incorporating principles from educational psychology and behavioral science. Specifically, we used Kolb's Experiential Learning Theory (ELT) as the basis for the intervention to promote a deep understanding and practical application of dietary concepts. ELT provides the foundation for engaging older adults in an active,

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experience-based learning cycle, namely concrete experience, reflective observation, abstract conceptualization, and active experimentation.¹⁰ In addition, we applied Keller's ARCS Model (Attention, Relevance, Confidence, and Satisfaction) to guide the development of game content to ensure that it captured the learners' interest, connected with their daily life, built their confidence in dietary choices, and provided satisfaction through successful gameplay.¹¹

Previous educational programs on food types and GI have often been passive, involving lectures, posters, and self-study manuals, lacking interactive fun and discussions on dietary self-efficacy or behavioral impacts. Board games can transform dull knowledge into engaging learning through gamification, integrating messages into long-term memory and boosting behavioral motivation.^{12,13} A comprehensive report of 83 randomized control studies found that traditional board games could improve cognitive impairment and depression, while modern games could enhance healthy eating and smoking cessation behaviors.¹⁴ In addition, a systematic analysis of 43 health education board games showed that they could improve both children's intake of fruits and vegetables as well as knowledge and attitudes towards healthy eating.¹⁵ Similarly, a systematic meta-analysis of 21 randomized and non-randomized control studies found that health-related board games could enhance knowledge, behaviors, and biomarkers.¹⁶ A search of the literature, Taiwan's patent information retrieval system, and online shopping websites revealed a lack of innovative board game designs for educating older adults about diabetes-preventive diets. Hence, we developed the Stable Sugar Winner board game with the aim of educating and enhancing dietary knowledge, attitudes, and behavioral self-efficacy in preventing diabetes among community-dwelling older adults, and offering health professionals an alternative care option.

Methods

Study design

This quasi-experimental study was based on a one-group pre- and post-test design. The participants were older people recruited by convenience sampling from two community activity centers in Taiwan. After receiving approval from the Human Research Ethics Committee (NCKU HREC-E-111-105-2), the researchers contacted the directors of the community activity centers in advance of this study to inform them of the purpose of the study, and to ask them to post an announcement. After a 1-month pre-intervention, the announcement was posted on bulletin boards at the community activity centers to provide details of the study, and to invite older people to participate. The study was performed from April 2022 to May 2022. The recruitment activities took place at the two centers on the same day. The inclusion criteria were as follows: (a) age ≥ 65 years, (b) able to communicate in Mandarin or Taiwanese, and (c) having a Short Portable Mental Status Questionnaire (SPMSQ) score ≥ 8 points. Older adults with severe dementia and those who were illiterate were excluded from the study.

The game

The Stable Sugar Winner board game intervention was developed based on a comprehensive literature review and clinical expertise. To ensure a systematic and pedagogically sound development process, we adopted the GAME framework,¹⁷ which consists of four phases:

1. G – Goal Setting and Educational Content Development
Each session focused on a core objective, including understanding food groups, GI, calorie content, and integrating healthy dietary planning for blood sugar control.
2. A – Activity Design and Game Content Creation
The interactive tools included game instructions, player counters, a cloth game board illustrating the food pyramid, diet-

related cards, and an interactive "My Healthy Plate" component (see Fig. 1). The game was originally designed in Mandarin, and the words in the images have been translated into English in publication of this journal.

- (1) Game Instructions: A detailed instruction manual clearly explains the game rules to ensure all players understand the objectives and gameplay procedures.
- (2) Game Counters: Coins are used as betting tools and rewards (Fig. 1a). Players earn coins for correct answers, promoting active participation and friendly competition.
- (3) Cloth Game Board – Food Pyramid: The center of the board features a food pyramid divided into six major categories. The right side has color bands indicating GI levels (high, medium, low), and the left side features calorie zones (high vs. low) (Fig. 1b)
- (4) Diet Game Cards: A total of 123 diet cards are categorized into: whole grains (41), fruits (29), legumes/fish/eggs/meat (22), vegetables (16), dairy (8), and fats (7). The front side of each card features realistic food images with portion indicators; the reverse side shows educational data on food categories, GI values, and caloric content for immediate feedback and knowledge reinforcement (Fig. 1c).
- (5) My Healthy Plate: Printed on A3 paper, the Healthy Pancreas Meal Plate displays daily food group proportions. Portion sizes are illustrated using relatable references—e.g., a fist to represent the portion of fruit, and a palm to represent the portion of fish and meat. A pancreas symbol is embedded in the vegetable section to reinforce the health benefits of vegetable consumption (Fig. 1d).

3. M – Mechanics and Dynamics Implementation

Players bet coins to identify food types, GI levels, and caloric values. These dynamic interactions maintain learner motivation while reinforcing core nutritional knowledge.

4. E – Evaluation of Qualitative and Quantitative Health Outcomes

Post-game debriefings are held after each session to guide the participants in reflecting on their dietary choices, clarify misconceptions, and explore how to apply newly learned strategies in everyday life.

To ensure content validity and practical relevance, the game was reviewed by a panel of six experts with diverse yet complementary backgrounds. This panel included two nursing educators with experience in community health and chronic disease management, two registered dietitians specializing in diabetes care, one researcher in educational board game design, and one geriatric care specialist with clinical experience in older adult health promotion. Their combined expertise ensured that the game content was both pedagogically sound and clinically appropriate for older adults with or at risk of diabetes.

The intervention consisted of four weekly themes, each aligned with the GAME framework. Sessions began with a pre-game briefing, followed by interactive gameplay, and concluded with structured post-game debriefing. The game sessions were led by a team composed of the principal investigator and six assistants. The principal investigator was in charge of setting up the game, while the assistants facilitated playing the game with a group of five to six participants. Their duties included instructing the participants on the game mechanics and overseeing progression of the game. The game was conducted once a week for 90 min over a four-week period, following breakfast. Specific details of the gameplay sessions over these four weeks are provided in Table 1.

1. Week 1 – Types of Food and My Healthy Plate

The participants learned to classify foods into six major groups and construct a balanced meal using My Healthy Plate. During

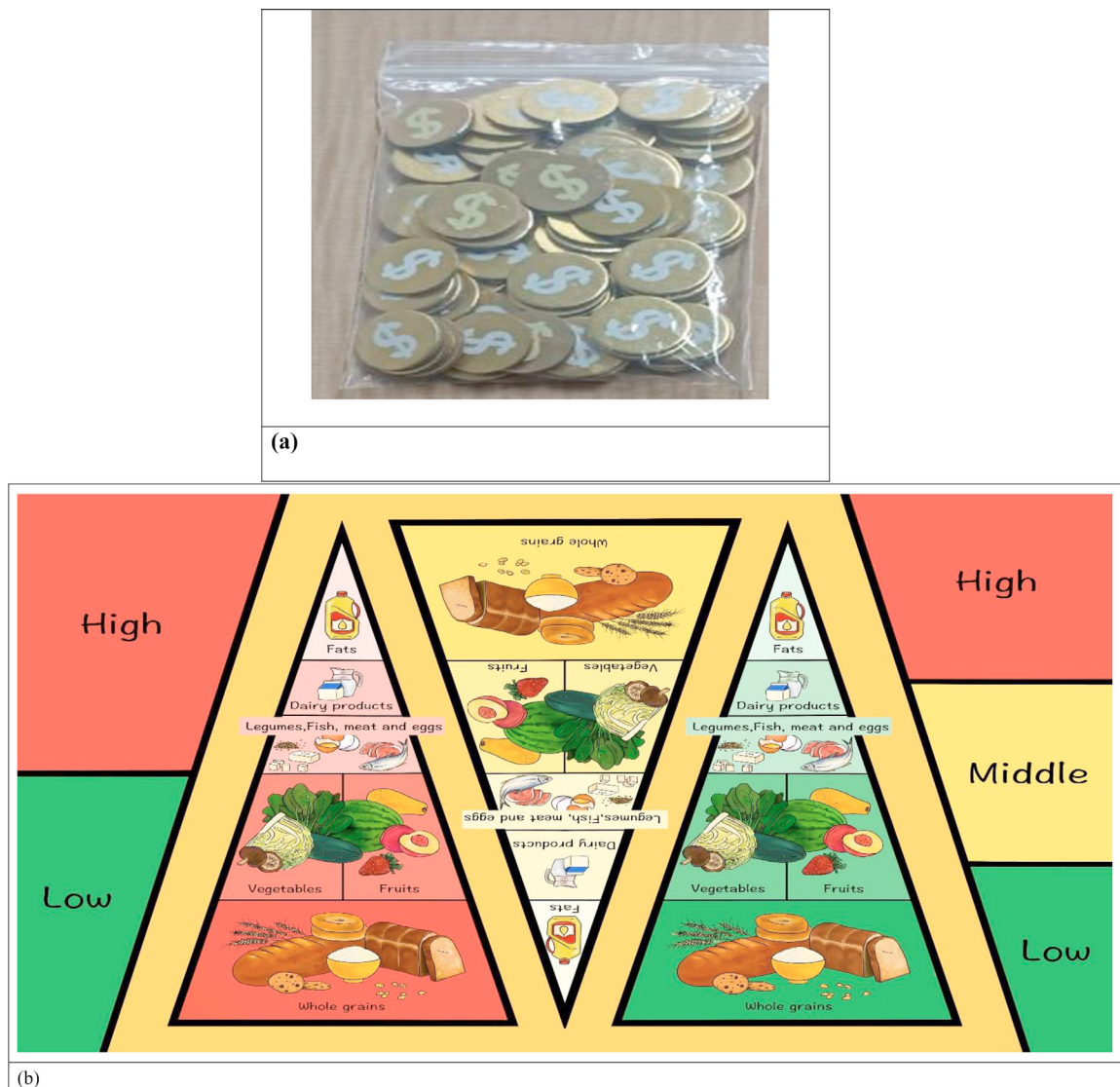


Fig. 1. Contents of the Stable Sugar Winner board game

(a) Game counters (coins) (b) Cloth game board: Food pyramid (c) Diet game cards (d) My Healthy Plate.

gameplay, the players placed bets on food group classification. The debriefing session emphasized portion size calculation and encouraged reflection on personal dietary intake.

2. Week 2 – GI and My Healthy Plate

This session introduced the concept of GI and applied it using color-coded GI cards. The players placed bets based on food group and GI zone (Red >70, Yellow 56–69, Green <55). Post-game discussions highlighted strategies for selecting foods with a lower GI.

3. Week 3 – Dietary Calories and My Healthy Plate

This session focused on understanding calorie content and energy balance. Gameplay involved comparing caloric values between foods and making betting decisions. The debriefing session included personalized calorie need calculations and self-reflection.

4. Week 4 – My Healthy Diet Pattern

The final session integrated all previous knowledge. The players used diet cards to design a 500 kcal breakfast and a 1500 kcal full-day meal. Points were awarded for accuracy and nutritional balance. The debriefing centered on evaluating their meal plans across food groups, GI levels, and calorie intake.

The Stable Sugar Winner board game was systematically designed using the GAME framework to promote dietary health education in an engaging and experiential format. By combining interactive gameplay with structured reflection, the intervention not only improved the participants' understanding of nutritional principles, but also empowered them to apply these concepts to real-life dietary behaviors. The use of validated content, expert review, and participant-centered learning strategies make this approach a promising model for community-based dietary education, particularly for older adults managing blood sugar levels.

Measurements

The Dietary Knowledge Scale for Preventing Diabetes

Referencing the literature^{18,19} and clinical experience, we developed the 36-item Dietary Knowledge Scale for Preventing Diabetes in collaboration with dietitians. This scale includes three sub-scales: dietary nutrition (10 items), balanced diet (13 items), and glycemic load diet (13 items). The scale uses a format of question and answer

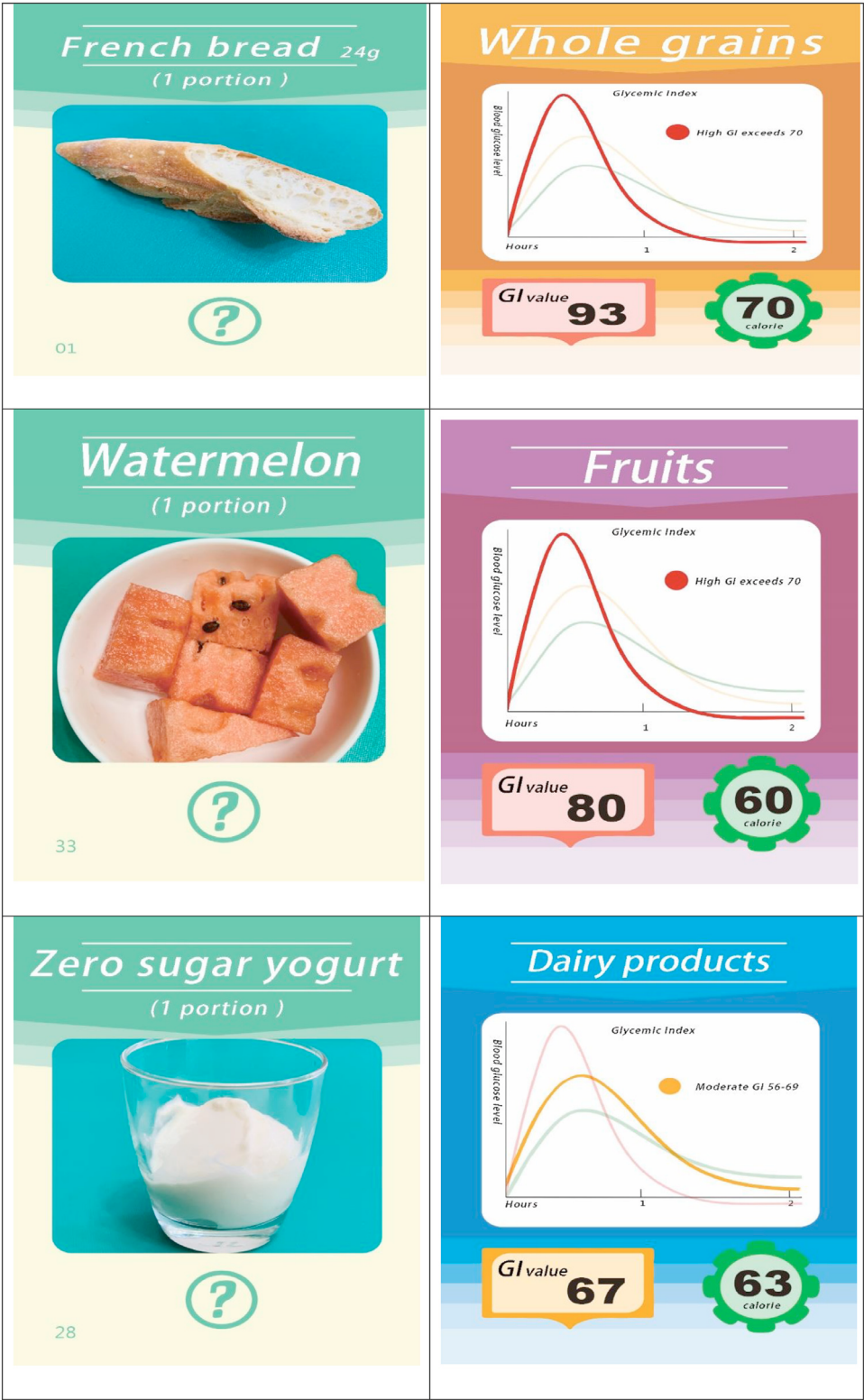


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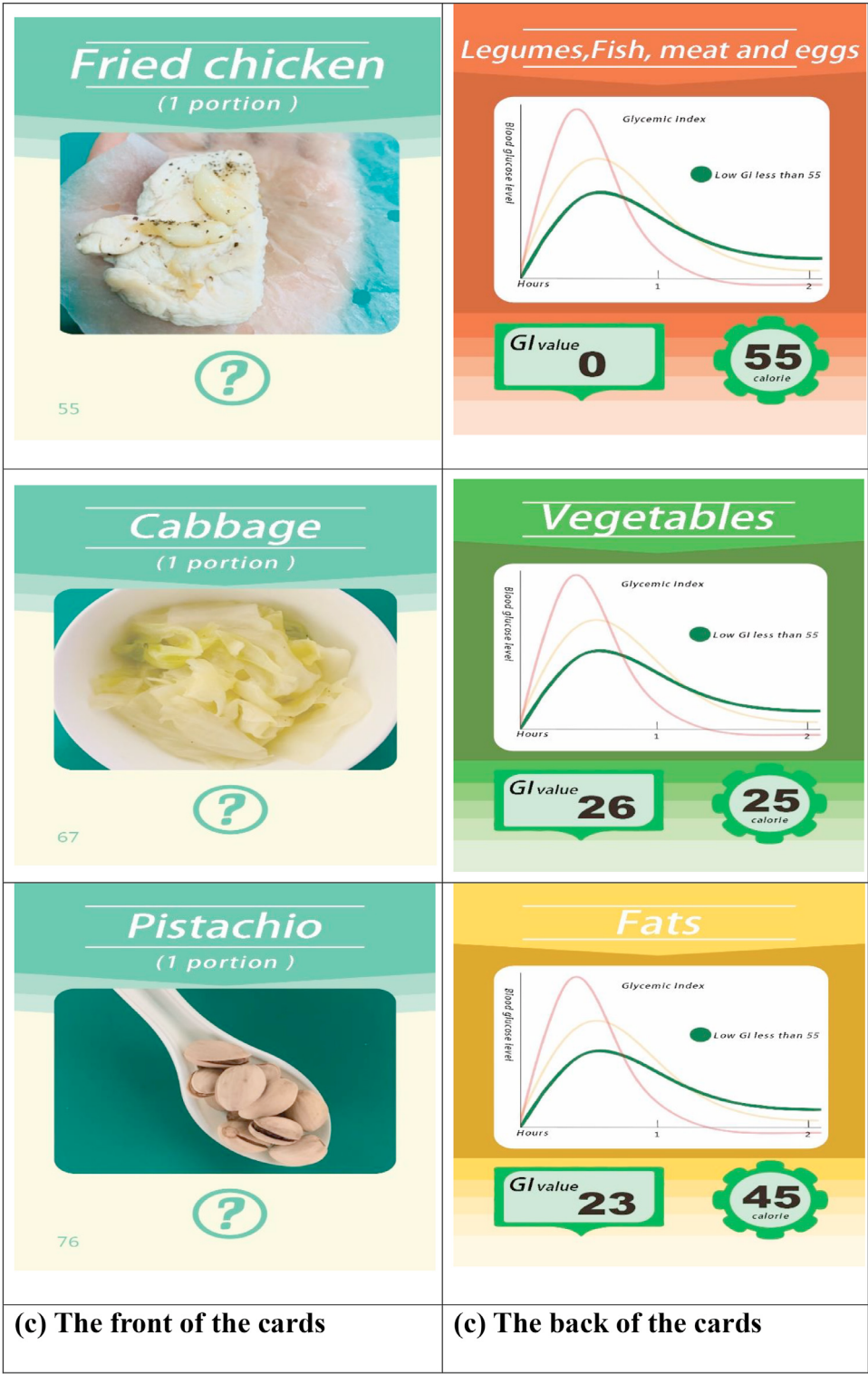


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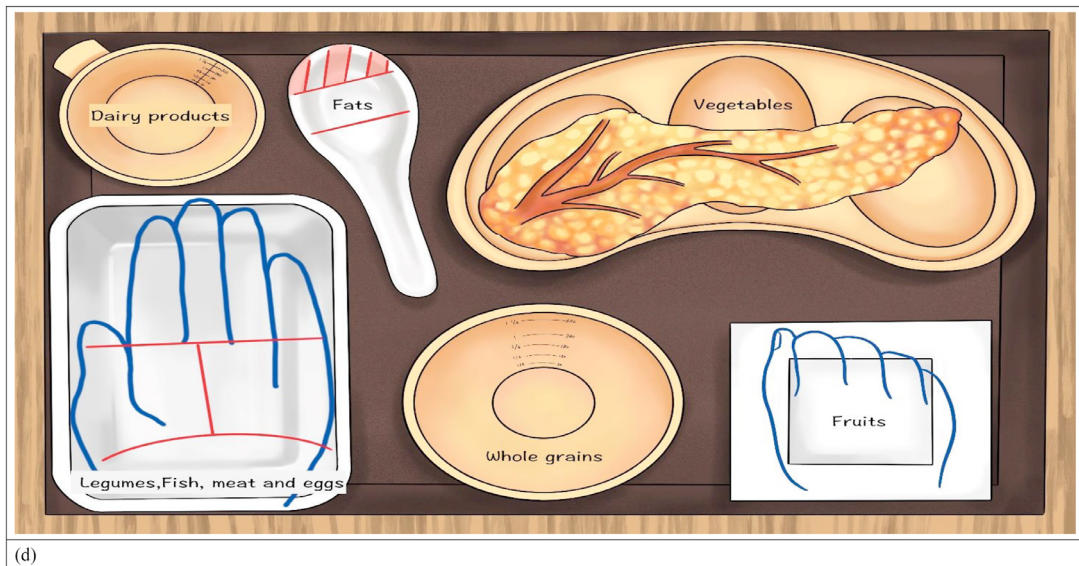


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as well as true/false statements, where responses are marked as 'correct', 'incorrect', or 'don't know'. Correct responses are scored 1 point, while incorrect or 'don't know' responses score 0 points. A higher score indicates a more accurate understanding of diabetes nutritional knowledge. The content validity index (CVI) was 0.92, and the KR-20 was 0.72.

The dietary attitude scale

Referencing the literature¹⁸⁻²⁰ and clinical experience, we also developed the Dietary Attitude Scale. This scale includes the perceived likelihood of contracting a disease, the severity of disease, the importance of preventing a disease, and the importance of implementing preventive behaviors. This questionnaire uses a Likert 5-point scale, ranging from 'strongly agree' to 'strongly disagree', with a total of 15 questions. Higher scores indicate a more positive attitude. The CVI was 0.96, and the Cronbach's alpha was 0.89.

The dietary behavioral self-efficacy scale

The Dietary Behavioral Self-efficacy Scale consists of 10 items from the Chinese-translated version of the Cardiac Diet Self-Efficacy Scale,²¹ 5 items from the Chinese version of the Diabetes Management Self-Efficacy Scale²² and 1 item from the literature,²³ making a total of 16 items. The scale uses a 5-point scoring method, ranging from 1 point for 'not at all confident' to 5 points for 'very confident.' A higher score indicates greater confidence in executing a healthy diet. The scale was previously used to measure health-related eating behaviors among 21 community-dwelling older adults, and showed a consistency reliability of 0.74.²¹ To adapt the scale for the purposes of this study, the diet items related to cholesterol and fats were changed to a GI diet. The CVI was 0.96, and the Cronbach's alpha was 0.87.

Personal basic attributes and disease characteristics

This questionnaire includes variables such as gender, age, education level, religious beliefs, marital status, lifestyle habits, history of receiving dietary education, and medical history.

Data collection and analysis

Prior to participation in the study, each individual was required to read and sign a consent form acknowledging their informed consent.

Subsequently, the participants were asked to fill out questionnaires designed to assess their status before initiating the board game intervention (T0) and immediately after its conclusion (T1). To gather data on the outcomes at both T0 and T1, structured surveys were utilized. A research assistant who had undergone specific training was responsible for administering these questionnaires. The administration of the questionnaires took approximately 13 to 17 min, depending on the participant's reading ability and familiarity with the topic. Information on personal characteristics was only obtained at the initial time point, T0.

Results

Personal basic attributes and disease characteristics

Of the 49 participants, one was excluded due to incomplete data. Of the remaining participants, the mean age was 73.7 years. Most of the participants were female, had a sedentary lifestyle, and had previously received dietary education (Table 2).

Dietary knowledge, attitudes, and behavioral self-efficacy before and after the participants completed the board game intervention

The mean score for dietary knowledge significantly increased from 18.51 before the board game intervention to 29.53 after the board game intervention ($p < .001$). The mean score for dietary attitude significantly increased from 53.41 before the board game intervention to 65.23 after the board game intervention ($p < .001$). The mean score for dietary behavioral self-efficacy significantly increased from 54.88 before the board game intervention to 67.33 after the board game intervention ($p < .001$) (Table 3).

Discussion

The findings of this study indicated that the board game intervention significantly enhanced older adults' dietary knowledge, attitudes, and behavioral self-efficacy. This aligns with the principles of experiential learning theory, which posits that learning through experience significantly impacts behavioral change, positive attitude and knowledge acquisition.^{16,24} The

Table 1

The learning objectives, implications, and game contents.

Week	Theme	G – Goal (Educational Objectives)	A – Activity (Game Content)	M – Mechanics (Game Play)	E – Evaluation (Debrief & Outcome Reflection)
1	Types of food and My Healthy Plate	1. Understand the six major food groups and the classification of each food within these groups. 2. Achieving a balanced diet with the six major food groups.	1. Game counters 2. Food pyramid game board 3. Diet game cards 4. My Healthy Plate	Game play- Game counters (coins), food pyramid game board, and diet game cards (60 min) (1) Select one dealer from each group, the rest are players; each person has 5 coins. (2) The dealer randomly puts down a diet game card face up. (3) Players place (bet) their coins in the middle of the large pyramid according to which of the six major food groups they think the card belongs to. (4) The dealer turns the card over. If the answer is correct, the dealer gives the player double the amount of money they bet; if wrong, they lose the money they bet.	Winning and educational conclusion- Diet game cards and My Healthy Plate (30 min) (1) Teach the players to calculate their food portions based on their workload and ideal weight. (2) From the diet game cards, pick out the food the player ate yesterday. (3) Put the diet game cards on My Healthy Plate and let the players examine whether their diet is balanced on their own. (4) Those with a balanced diet are the winners. Winners need to share how to be a balanced dieter, and losers share why they were not.
2	GI and My Healthy Plate	1. Understand the GI. 2. Be able to understand the GI of one's own food intake.		Game play- Game counters (coins), food pyramid game board, and diet game cards (60 min) (1)(2) The same as in week 1 (1)(2) (3) GI value > 70 = Red, GI value 56–69 = Yellow, GI value < 55 = Green in the food pyramid. Players bet their coins in the large pyramid according to which of the six major food groups and GI they think the card belongs to. (4) The dealer turns the card over. If the answer is correct, the dealer gives the player double the amount of money they bet; if wrong, they lose the money they bet.	Winning and educational conclusion- Diet game cards and My Healthy Plate (30 min) (1) From the diet game cards, pick out the food the player ate yesterday. (2) Put the diet game cards on My Healthy Plate and let the players examine whether their diet has a high, middle, or low GI. (3) Those with a lower GI diet are the winners. Winners need to share how to be a low GI dieter, and the losers share why they were not.
3	Dietary calories and my healthy plate	1. Understand dietary calories. 2. Be able to understand the calorie content of one's own food intake.		Game play- Game counters (coins), food pyramid game board, and diet game cards (60 min) (1) The dealer takes two cards, one as the main card and the other as the subsidiary card. (2) Players judge the calorie content of the subsidiary card. If it is lower than the main card, they place their bet on the green 'High-Low' area on the left; if the calorie content is higher, they place it on the red area. (3) If the answer is correct, the dealer gives the player double the amount of money they bet; if wrong, they lose the money they bet.	Winning and educational conclusion- Diet game cards and My Healthy Plate (30 min) (1) Teach the players to calculate their food calories based on their workload and ideal weight. (2) From the diet game cards, pick out the food the player ate yesterday. (3) Put the diet game cards on My Healthy Plate and let the players examine whether their diet calories meet their own needs. (4) Those with a balanced calorie diet are the winners. Winners need to share how to be a balanced calorie dieter, and losers share why they were not.
4	My healthy diet pattern	Arrange my healthy dietary pattern.	1. Diet game cards 2. My Healthy Plate	Game play- Diet game cards and My Healthy Plate (60 min) (1) Everyone has a set of diet game cards. The challenges are: (a) aim for a breakfast of 500 calories, and (2) aim for a daily total of 1500 calories. The players pick their own cards, and the closest to the calorie target of the challenge scores points.	Winning and educational conclusion- Diet game cards and My Healthy Plate (30 min) (1) From the diet game cards, pick out the food the player ate yesterday. (2) Put the diet game cards on My Healthy Plate and let the players examine whether their diet type, GI, and calorie content meet their own needs. (3) Those with a balanced food, calorie and lower GI diet are the winners. Winners share their strategies for maintaining a balanced diet in terms of food groups, calorie intake, and GI, while losers reflect on the reasons they were not able to do so.

Abbreviation: GI, glycemic index.

board game simulation and practice activities in this study acted as an experiential learning tool, facilitating the engagement and active participation of the older adults, which in turn led to better retention and application of dietary information. In addition, the board game, as an interactive learning tool, allowed the participants to actively engage in the learning process through

actions such as placing bets, arranging, and making decisions during the game. This participatory learning approach, compared to traditional lecture-based or reading methods, is more effective in capturing the attention of older adults, enhancing their motivation and interest in learning, and thereby leading to behavior implementation.

Table 2
Personal basic attributes and disease characteristics.

Variables	N	%
Sex		
Male	12	24.5
Female	37	75.5
Age (years) mean±SD	73.7 ± 8.0	
70 and below	20	40.8
Above 70	29	59.2
Education level		
Elementary school and no formal education	18	36.7
Junior high school or higher	17	34.7
University and above	14	28.6
Religion		
Buddhism	29	59.2
Taoism	19	38.8
Christianity	1	2.0
Marital status		
Single	7	14.3
Married	28	57.1
Widowed	14	28.6
Lifestyle habits		
Primarily sedentary	4	8.2
Mostly sedentary	30	61.2
Half sedentary, half active	13	26.5
Mostly active	2	4.1
History of receiving dietary education		
Yes	44	89.8
No	5	10.2
Disease history		
None	14	28.6
Hypertension and heart disease	10	20.4
Diabetes	6	12.2
Diabetes and hypertension	5	10.2
Diabetes and osteoporosis	14	28.6

In this study, the older adult participants had significantly improved overall scores on dietary knowledge after the intervention. The results of this study are consistent with other studies.^{24,25} The board game used three key mechanisms to enhance the participants' understanding of dietary concepts. First, the practice-and-feedback mechanism: during weekly gameplay sessions, the participants were prompted to make dietary choices based on specific nutritional themes and received immediate feedback. For example, when selecting low-GI foods or calculating meal calories, the participants could instantly grasp the consequences of their decisions. This continuous feedback loop of action, feedback, adjustment, and reaction reinforced the learning process, promoted the internalization of knowledge, and facilitated the correction and refinement of behavioral strategies. Second, visual learning: the incorporation of food photographs, portion sizes, calorie values, and GI information helped transform abstract nutritional principles into tangible and engaging learning content. This visual approach enhanced the memorability of information. In addition, the use of easy-to-understand text and images allowed for individuals proficient in either Mandarin or Taiwanese to actively participate in the gameplay experience. Third, conceptual scaffolding through visual models: the food pyramid

offered a hierarchical representation of food groups and their recommended proportions, providing an intuitive framework for understanding healthy eating habits. Similarly, the My Healthy Plate model visually depicted the ideal balance of food groups in a meal, further reinforcing the participants' ability to comprehend and recall dietary guidelines.

The overall scores for dietary attitude were significantly improved after the intervention. This finding is in concordance with existing literature, as demonstrated by a systematic review and other empirical studies, suggesting that board games effectively promote the flow state among older adults.^{15,26,27} The concept of 'flow'—a highly focused mental state conducive to productivity—supports the notion that engaging activities can enhance cognitive engagement and motivation, leading to improved learning outcomes. The mechanism for inducing a state of flow in the older adults in this study was as follows: (1) In line with attention in the ARCS model, engage players right from the start with colorful, realistic food images and interactive game pieces. Introduce challenges or missions based on creating balanced meals or managing dietary needs under different scenarios. This kept the players interested and focused on the task at hand, making learning about nutrition fun and engaging. (2) Reward system: while playing the game the players bet on answers using coins, as winning or losing money can easily induce a state of flow. Rewards obtained from winning the game not only increased the enjoyment of learning, but also acted as positive reinforcement, encouraging the continued practice of healthy dietary behaviors.

The overall scores for dietary behavioral self-efficacy were significantly improved after the intervention. This result is consistent with a study indicating that board games can change management behaviors.^{25,28} The board game in this study used four mechanisms to increase behavioral self-efficacy. (1) Increase learning confidence: the game guided the players to gradually build knowledge and skills related to diet and nutrition, starting with simpler tasks such as the classification of each food, GI, dietary and calories, and then progressing to more complex challenges such as creating a meal plan for a day that meets specific nutritional goals. Positive feedback and hints were given during the game to encourage the players and build their confidence in making healthy dietary choices. (2) Goal setting and achievement: the challenges and goals in the game (such as reaching a certain caloric goal) provided clear behavioral objectives. Through the decision-making process in the game, the participants learned how to control and manage their dietary choices. The participants enhanced their sense of control and self-efficacy in practicing healthy eating behaviors by achieving these smaller goals throughout the game. (3) The design of the game involved using cards marked with red, yellow, and green to represent the GI levels in a betting game format based on the colors of the food pyramid, distinguishing high, medium, and low GI levels instead of traditional numerical values. This approach made learning easier to remember and more accessible for the older adults, increasing self-efficacy and boosting confidence in learning. (4) In line with relevance in the ARCS model, the game's objectives were connected to the players' daily lives by using real-life food choices and situations. For example, the players were

Table 3
Dietary knowledge, attitudes, and behaviors of the older adults before and after the board game intervention (*n* = 49).

Variables	Pre-test mean score (SD)	Post-test mean score (SD)	T value	p-value
Dietary Knowledge	18.51(9.52)	29.53(7.85)	−7.43	<0.001
Diet nutrition (10)	4.61(2.20)	7.23(2.99)	−5.69	<0.001
Balanced diet (13)	6.78(3.45)	10.51(2.83)	−6.29	<0.001
Glycemic load diet (13)	8.04(4.27)	11.80(2.68)	−6.40	<0.001
Dietary Attitude (15)	53.41(7.22)	65.23(8.08)	−10.51	<0.001
Dietary Behavioral Self-efficacy (16)	54.88(11.38)	67.33(10.71)	−5.76	<0.001

tasked with assembling a healthy meal using the healthy eating plate model, considering their own dietary restrictions or preferences. This made the contents of the game directly applicable to their personal health and dietary choices, enhancing the motivation to learn and apply the information. Moreover, the game incorporated reflection periods where the players could discuss what they learned and how they can apply this knowledge to their daily lives, thereby reinforcing the connection between the game and real-life dietary habits.

This study has several limitations that should be addressed in future research.

First, the limited scope of the game board. The current game board does not encompass all food types and is specifically designed for diabetes prevention. Future iterations could broaden the scope to include dietary considerations for various diseases and a more comprehensive range of foods. Second, the small sample size, which may have restricted the generalizability of the findings and increased the risk of type II errors. Future studies should conduct a power analysis during the design phase to determine the appropriate sample size needed to achieve the desired level of statistical power. Third, the absence of a control group, which makes it challenging to attribute observed changes solely to the intervention. Including a control group in future studies would enhance the ability to draw causal inferences about the effectiveness of the intervention. Fourth, longitudinal studies are necessary to confirm the results obtained in this study and evaluate the potential use of such a board game among older adults in different countries.

Conclusion

Our results showed that the 'Stable Sugar Winner' board game intervention, by integrating principles of educational psychology and behavioral science, effectively promoted knowledge acquisition, positive attitude formation, and self-efficacy enhancement in dietary management among older adults. This project not only demonstrates the potential application of gamified learning in the field of health education, but also provides a valuable reference for future health promotion strategies targeting older adults.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Chun-Chin Tsai: Conceptualization, Methodology, Formal analysis. **Huei-Lih Hwang:** Conceptualization. **Pin-Yu Chen:** Resources, Conceptualization. **Mei-Fang Chen:** Writing – review & editing, Writing – original draft, Project administration, Conceptualization.

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